Appendix A: Reading Comprehension Guidelines

Dear Students,

Thank you very much for your help with this research, which aims to investigate how students study reading comprehension skill.

Questionnaire for Reading Comprehension

Name……………………………………………………………… Class………..No………

Week ………. Date……………………………

Topic 1………………………………………

2……………………………………….

3……………………………………….

Source: www……………………………………………………………………………..

www……………………………………………………………………………..

www……………………………………………………………………………..

Pre-reading Phase

Cognitive strategies	Always	Usually	Sometimes	Rarely	Never
1. Previewing headings					
2. Surveying illustration/pictures					
3. Reading introductions and summaries					
4. Creating questions that might need to be answered					
5. Thinking about previous knowledge on the topic of the text					

While-reading Phase

Cognitive strategies	Always	Usually	Sometimes	Rarely	Never
6. Thinking aloud during the reading					
7. Guessing the meaning of a word from the context					
8. Skipping some of unknown words					
9. Having a picture of the events in the text in mind					
10. Comparing what is read to what is known					
11. Rereading a sentence or a paragraph					
12. Taking notes on the important points of the text					
13. Using a dictionary for the unknown words					
14. Predicting what will come next based on the information in the text					

Post-reading Phase

Cognitive strategies	Always	Usually	Sometimes	Rarely	Never
15. Summarizing the main ideas					
16. Rereading the text to remedy comprehension failures					
17. Rereading the text to remember the important points					

Sources: Ozek. Y. and Civelek, M., 2006.

Appendix B: Attitude Questionnaire

Name……………………………………………………Class………………No………….

Instruction After finishing your assignments 5 times in SALLC, please put a tick √ to indicate your opinion how much these factors affect your reading comprehension and then show your attitudes towards your learning reading comprehension on Web

1. **Factors affecting students' reading comprehension**

	The Most	Medium-High	Moderate	Less	The least
1. I have knowledge of the topic					
2. I have knowledge of language. structure(e.g. grammar, structure, sound, lexical)					
3. I have knowledge of text structure. (e.g. comparison/contrast, time/order, description)					
4. I have knowledge of genres. (e. g. fiction, science fiction, biography, mystery)					
5. I have motivation. (e.g. marks, goal, purpose, interest)					
6. I have knowledge of cognitive and metacognitive strategies.					
7. I have reading ability.					

2. Students' attitudes towards Web reading comprehension

Attitude Measurement	5	means	Strongly Agree
	4	means	Agree
	3	means	Neutral
	2	means	Disagree
	1	means	Strongly Disagree

The questionnaire for Web reading Comprehension

	Attitudes				
	5	4	3	2	**1**
1. I understand the instructions & purposes on the guided sheets for learning reading comprehension on Web.					
2. The letters and pictures of reading passages are interesting.					
3. The reading contents are interesting.					
4. The reading passages are not difficult to understand.					
5. I understand questions and exercises in instruction sheets.					
6. I understand Self-Assessment.					
7. I learned how to be a self-directed learner.					
8. I gained knowledge from reading .					
9. I learned how to read for comprehension.					
10. I think my reading comprehension skill after learning reading 5 times in SALLC has improved.					
11. I want to study Web reading comprehension in the SALLC in the future.					

Appendix C: Samples of Instruction Sheets

France

Title: France

Skill Area: Reading & Writing

Level: Pre-Intermediate

Time: 10 minutes

Aim: Practice skimming & scanning techniques

Process: Write down the information that you find.

Link: en.wikipedia.org/wiki/France

Country information

Full name:...

Meaning of France:..........................

Population:..

Capital:..

Official language:.............................

Currency:..

Continent:..

The answers shown at the back of the sheet

It's better to be unlucky

Title: It's better to be unlucky

Skill Area: Reading

Level: Intermediate

Time: 20 minutes

Aim: 1. Learn about vocabulary in this story.

2. Practice answer the questions.

Process:

1. Read the story.

2. Go to "Open Questions"

Link: www.rong-chang.com/qa2/stories/story007.htm

The Rule of the Road

Title: The Rule of the Road

Skill Area: Reading

Level: Intermediate

Time: 10 minutes

Aim:

1. **Understand the author's purposes.**
2. **Understand the text.**

Process:

1. **Read the story.**
2. **Answer the questions by clicking on the best answers.**

Link: http://www.majortests.com/sat/reading-comprehension-test05

Ubiquitous Teaching Assistant for Location-based Learning

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0251

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The Asian Conference on Technology in the Classroom 2012

Official Conference Proceedings 2012

Abstract:

Using software agents to assist students in virtual learning environments has become increasingly common for many experimental programs. Therefore, this work proposes a framework to establish ubiquitous teaching assistant (u-TA). The proposed u-TA framework provides several system modules for different virtual learning environments and also supports the multi-modal user interfaces, such as Web-based and instant messenger-based interfaces. With the development of ubiquitous learning, u-TA should also consist of good mobility for guiding students and answering students' questions on mobile handheld devices. Therefore, this work uses the u-TA framework to construct a location-based service (LBS) learning system to introduce the essence of courses to students and help them browse the content of the course resources on campus. We gave a case study for using the proposed system to promote the Service-Learning courses in Feng Chia University, Taiwan. The experimental results show that the proposed u-TA system can enhance the understanding of Service-Learning courses for students and encourage them to participate in these curricula.

1. Introduction

To increase the quality of instruction and address the limitations of traditional learning to enable learners to learn at any time and from anywhere, e-Learning studies and applications have become increasingly popular. Researchers have designed and implemented various learning platforms (Acampora *et al*.,2010, and Lang *et al*., 2006) that serve as interfaces for students to access e-Learning systems. Virtual learning environments can be applied to distance education, and also enrich course activities. Using software agents (Blázquez *et al*., 2008, Dow *et al*., 2006, and Jong *et al*., 2007) to assist students in virtual learning environments has become increasingly common for many experimental programs. In a traditional learning environment, students can ask teacher/teaching assistant questions directly. In a virtual learning environment, students need a software agent, such as a virtual teacher/teaching assistant, for asking questions or solving problems. Therefore, we provide a ubiquitous teaching assistant (u-TA) framework to construct a virtual teaching assistant. The u-TA framework integrates different agents' advantages and let the software agents provide their functions in a heterogeneous environment, such as Web pages or smartphones, to get more learning benefits from software agents for users. Thus, how to use agent techniques to construct u-TA for assisting students in solving problems in virtual learning environments becomes an important issue.

2. Related Work

Virtual learning environment integrates learning materials by using computers through software tools and creates an online learning environment. With the virtual learning environment, users can learn some teaching materials conveniently at any time. Virtual classroom is a common virtual learning environment that combines with the information technology and specific courses for learners, such as Computer Assisted Instruction (CAI) tools. Li *et al*., 2009 proposed a systematic framework of virtual laboratories that consists of software agent execution environment, software agent and learning platform. They used wrappers as the middleware in virtual laboratories. Many agents are designed to cooperate between instructor and learner or between learner and learner in the virtual laboratory. Recently, mobile devices, such as smartphones, iPads, tablet PCs, etc, are flourishing development. Users can study using mobile hand terminal at anytime and anywhere.

Agent technology has been an issue in the discipline of computer science and provides new options for designing and delivering educational content. The agents applied in education are called TA agents (Graesser *et al*., 2005, and Huang *et al*., 2010) and they can act as a teacher/tutor to teach or provide assistance for students. A virtual TA may have many additional capabilities, such as the coordination of knowledge building and collecting wisdom advancement (Gan *et al*., 2007), monitoring of student actions (Blázquez *et al*., 2008), chatting with users, and application of constructivist learning theories. Some proposed TA agents can adapt their behaviors to the environment and the students. They offer instruction or hints, and support the processes of collaborative learning (Zhou *et al*., 2005).

3. Ubiquitous Teaching Assistant (u-TA) Framework

A good design of u-TA needs to consider that system can adapt heterogeneous environments and learning activities. The learning ability and friendly user interfaces are also under consideration. Different virtual environments, such as the virtual classroom and virtual laboratory, may need to connect with different hardware devices. For making implementation more easily, u-TA must have the flexibility to adapt to different virtual environments. u-TA must be able to learn and accumulate knowledge in order to reduce the burden on teachers/teaching assistants. The u-TA system provides appropriate user interfaces can allow the users to select preferred interface to operate and to get learning effectiveness. Therefore, a well-designed u-TA should have the knowledge retrieval, adaptive learning technique, LBS learning, and multi-modal user interfaces for users.

We proposed a u-TA framework that consists of multi-modal user interfaces, agent system modules, learning activity observation, and virtual learning environment, as shown in Figure 1. In order to allow the users to complete online learning successfully, we design different adaptive system modules, including fundamentals, knowledge retrieval module, and positioning module, and provide appropriate content to the users. The fundamentals contain modules, including event module, guiding module, learning module, and feedback recording, used in foundation construction of u-TA. The event module promotes students' learning efficiency by observing the behaviors of their event logs, such as Web browser and IM dialogue logs. The guiding module leads users by course guideline. The learning module allows agents to exchange knowledge with other software agents and also provides interface for consultants to give course knowledge. The feedback recording module can correct the answers with feedback at regular periods. Virtual learning environments provide the online learning environment for the users. The knowledge retrieval module provides an appropriate answer, and the learning module is responsible for obtaining new knowledge. The positioning module can be used to access the user's location information through GPS. Learning activity observation are events and behaviors between teachers and students.

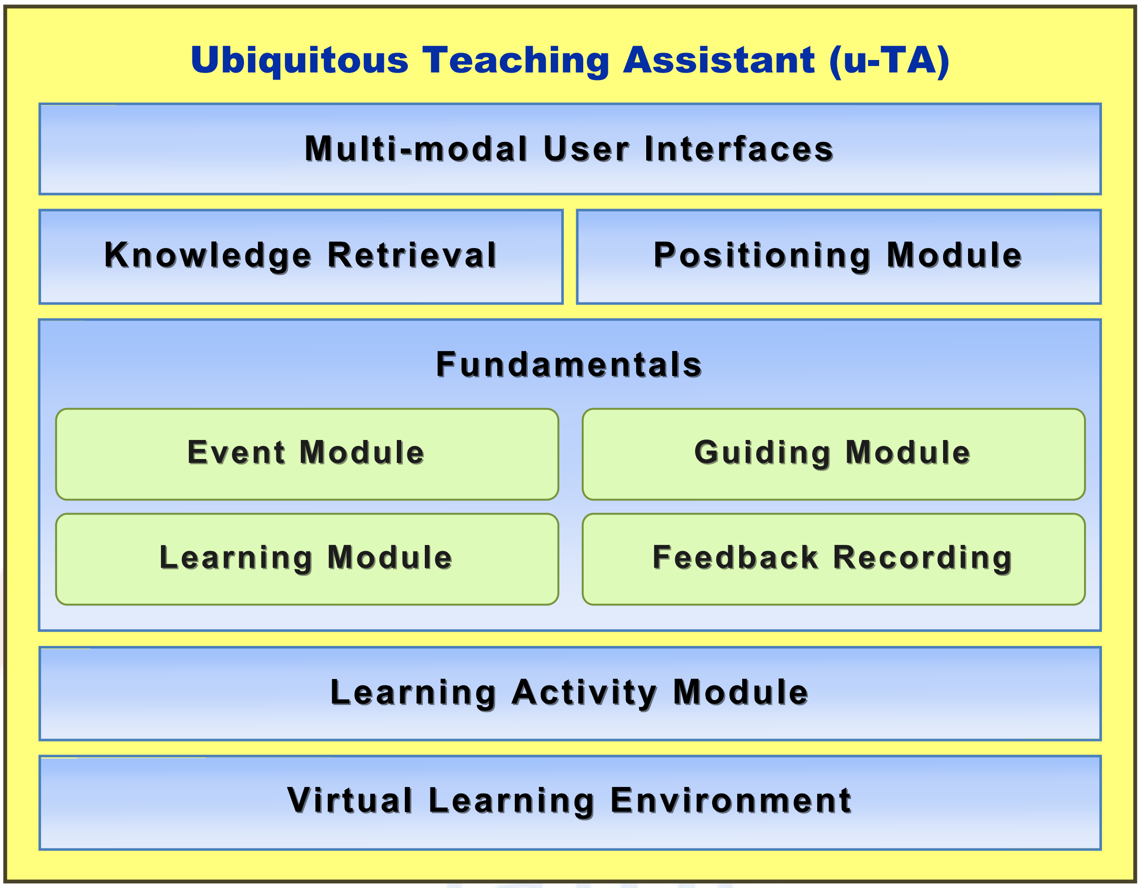

Figure 1 The Proposed u-TA Framework

The proposed u-TA is designed and implemented to improve users learning efficiency and reduce the burden of teaching assistant. The proposed u-TA system is constructed using multi-tier architecture and created a flexible and reusable application. Multi-tier architecture is a client-server architecture in which the data management, the application processing, and the presentation are logically separate processes. Developers can modify or add a specific layer, rather than have to rewrite the entire application over. As shown in Figure 2, the proposed u-TA system can be separated into three layers, including data server, application server, and client.

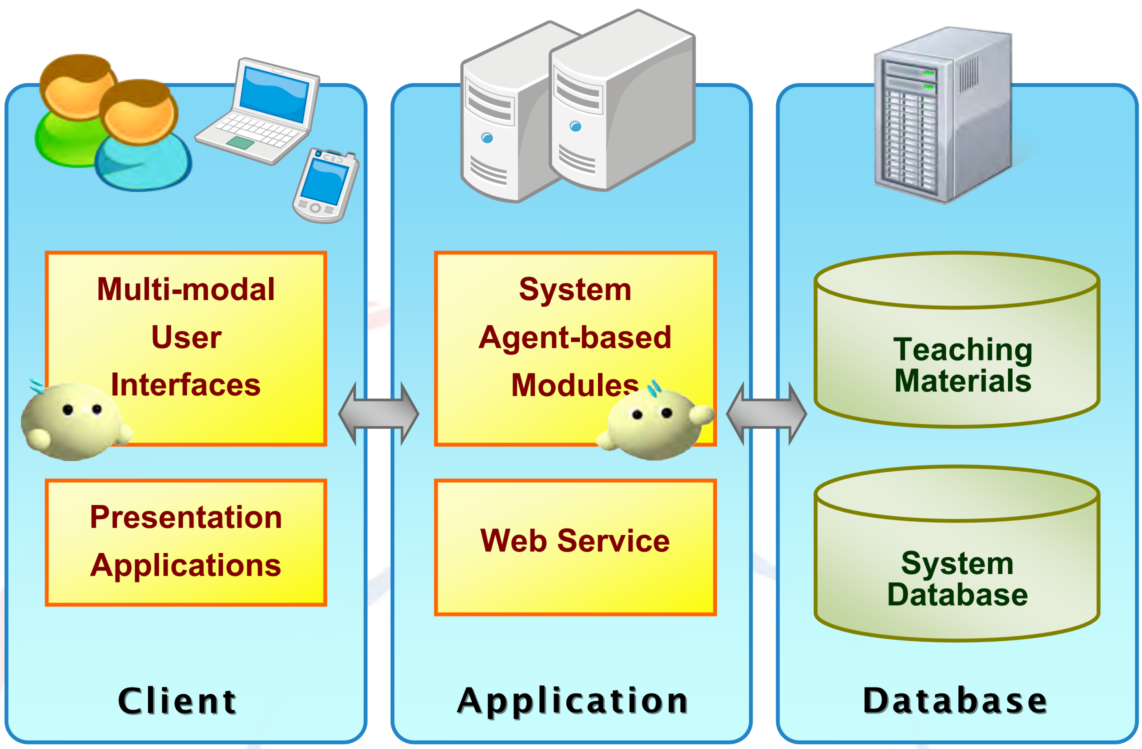

Figure 2 u-TA System Environment

The data server has two databases which contain teaching materials and system data, respectively. Teaching materials database includes course information and other teaching materials, such as custom maps information. System database provide effective run-time execution and support u-TA system's need. The application server includes system agent-based modules. System agent-based modules present u-TA functions, and each agent-based module plays an important role in the proposed system. The Web service is also provided in this tier. When data needs to exchange crossing different platform, Web service can communicate between two platforms over the web. The Client consists of multi-modal user interfaces and presentation applications. Multi-modal user interfaces provide different user interfaces for users to choose. For example, students can interact with u-TA through Web browsing, and u-TA can guide students to solve problems on Web pages.

4. Mobile Learning System with u-TA

In order to proceed mobile learning smoothly, we construct the LBS learning system with u-TA. Characteristics of LBS learning are added value to users' location information to provide users related knowledge. Therefore, users not only can experience by themselves in some places, but can also get the knowledge behind what they see. The proposed LBS u-TA system also provides mobile learning assistance. The proposed system consists of two parts: user interfaces and system modules, as shown in Figure 3. Students can interact with u-TA through two kinds of user interfaces: the website and smartphone. The proposed system consists of positioning module and fundamental system modules. The functions of system components are described as follows.

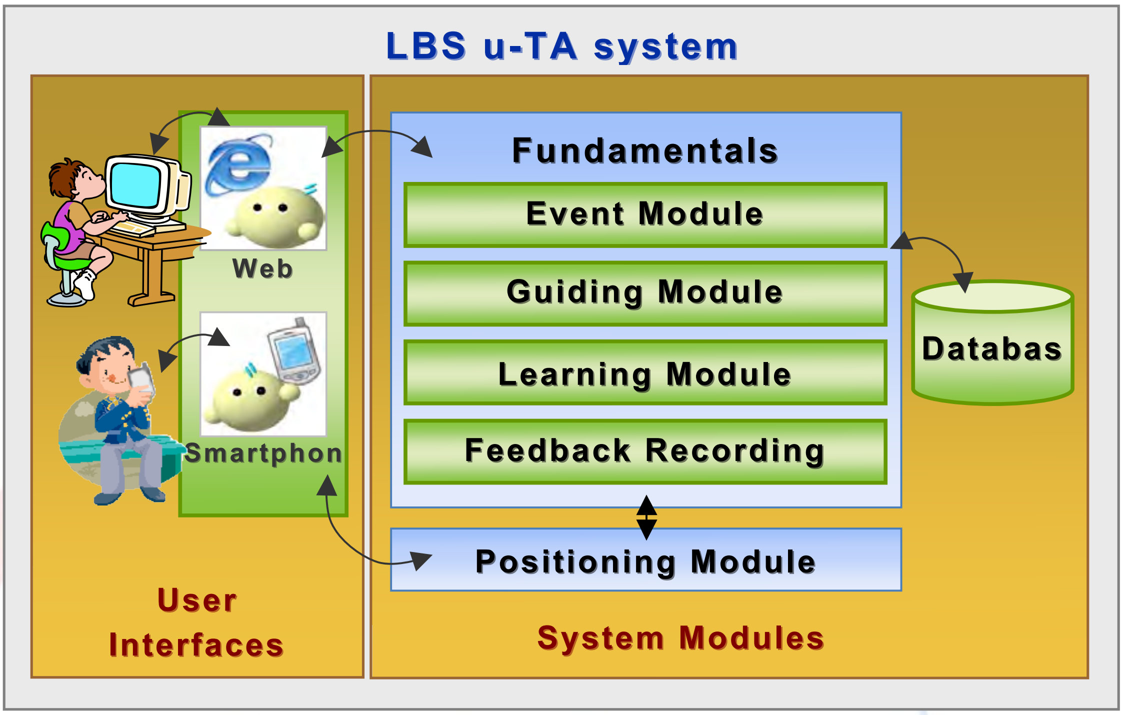

Figure 3 LBS u-TA Architecture

(1) Fundamental Modules

The fundamentals include basic system modules and can be used not only to gather a student's personal data, but also to analyze the data. When students use the proposed system, they take a short time to fill in the questionnaire, which is used to investigate their personal information and previous lesson learning states. When students start using the proposed system to navigate, this module records students' event logs, such as moving to another place, or choosing a guiding target.

The u-TA guiding module is established based on the u-TA architecture and leads students in a script-oriented manner. The agent first helps students learn the operation of system. When users ask the agent questions, the agent attempts to provide appropriate answers. If users cannot solve their problems in a short time, the agent requests them to follow its instructions step by step to solve the problems.

(2) Multi-modal User Interfaces

The proposed system also provides multi-modal user interfaces, such as application on the mobile phones and Web pages. Students can use application on the smartphone outdoor and browse Web pages on their notebooks or computers. Students can obtain course information and interact with u-TA in different interfaces. When students use applications on mobile phones, they receive a location-based guiding service from the proposed system using the position information of the

GPS receiver. Otherwise, if students use Web pages on their notebooks or computers, they can choose the area to begin acquiring the guiding service from the proposed system.

(3) The Data Service

The data service comprises physical DBMSs and files of data. The proposed system includes a course materials database and a campus map database. The course materials database stores course data and the campus map database stores campus maps and geography information. The customized maps, certain related figure files and data files are stored in the corresponding system file folders.

5. Implementation and System Prototype

This section introduces detailed information regarding the proposed system, including system environment, Mobile APP, custom cartographic design, and GPS receiving Web service.

(1) Custom Map Design

Because campus map details are unavailable from free maps (such as Google maps), self-made maps become imperative for implementation. To create a custom map, this study used Goode maps to obtain the ratio of the real campus size before drawing detailed items of the custom map using the campus map available from the website of Feng Chia University. Lastly, we used smartphones to access GPS positions information of the customer map, and used the GPS positions information of Google maps to verify the results. Figure 4 demonstrates the original map (a) and the customized map (b).

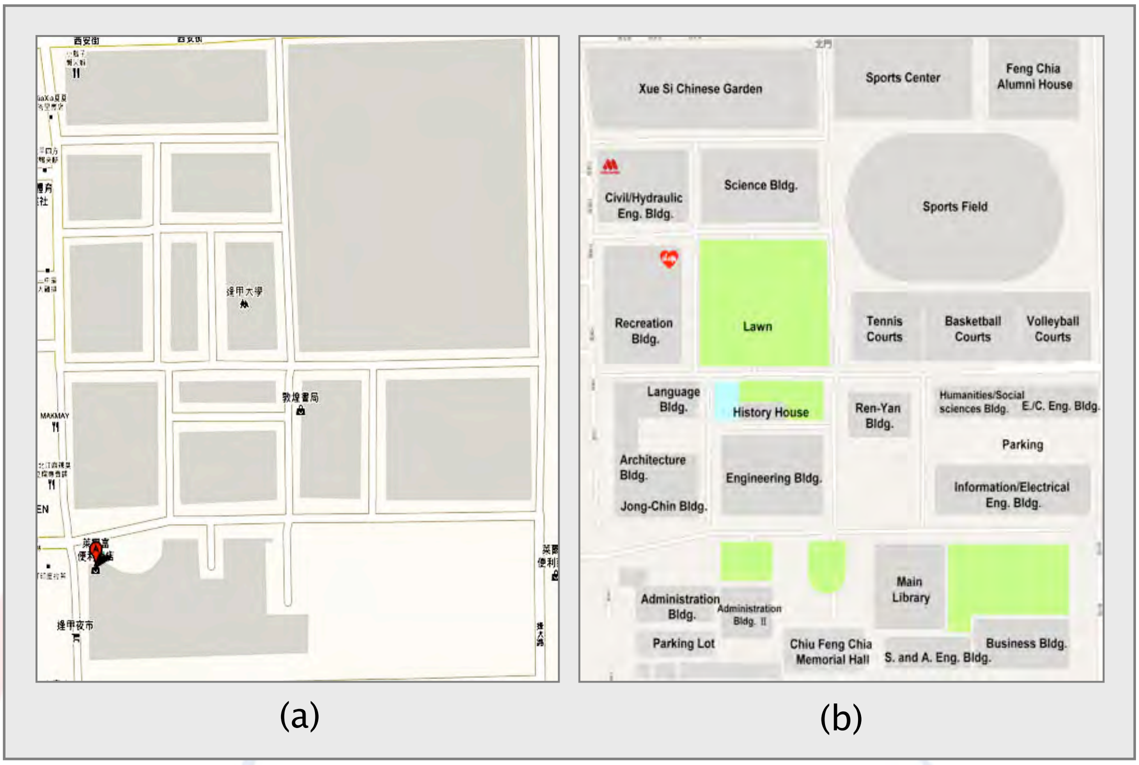

Figure 4 (a) Original Google Map (b) Customized Map Design

(2) Receiving GPS Client Application

The receiving GPS client application was created using Java programming language and used in the smartphone. The receiving GPS client application has two main functions: receiving GPS signals from satellites, and sending the messages to receive GPS Web services. The other function guides users with user interface, which was built using the Web browser component. When the receiving GPS client application receives signals from GPS satellites, it sends a request to the receiving GPS Web service

(3) Converting User's GPS Messages to Map Position

Because GPS coordinates cannot be used directly to map user locations, it is required to convert these GPS coordinates to the map locations. We can see buildings, scenes, or roads on the map and divide the map into areas indicated by some coordinates. According to possible campus tour routes, the campus map is divided into many rectangles, as shown in Figure 5(a), and each rectangle is assigned an identifiable number, as shown in Figure 5(b). We store identifiable numbers and four corresponding map locations of each rectangle in the database for calculating map locations of user real locations.

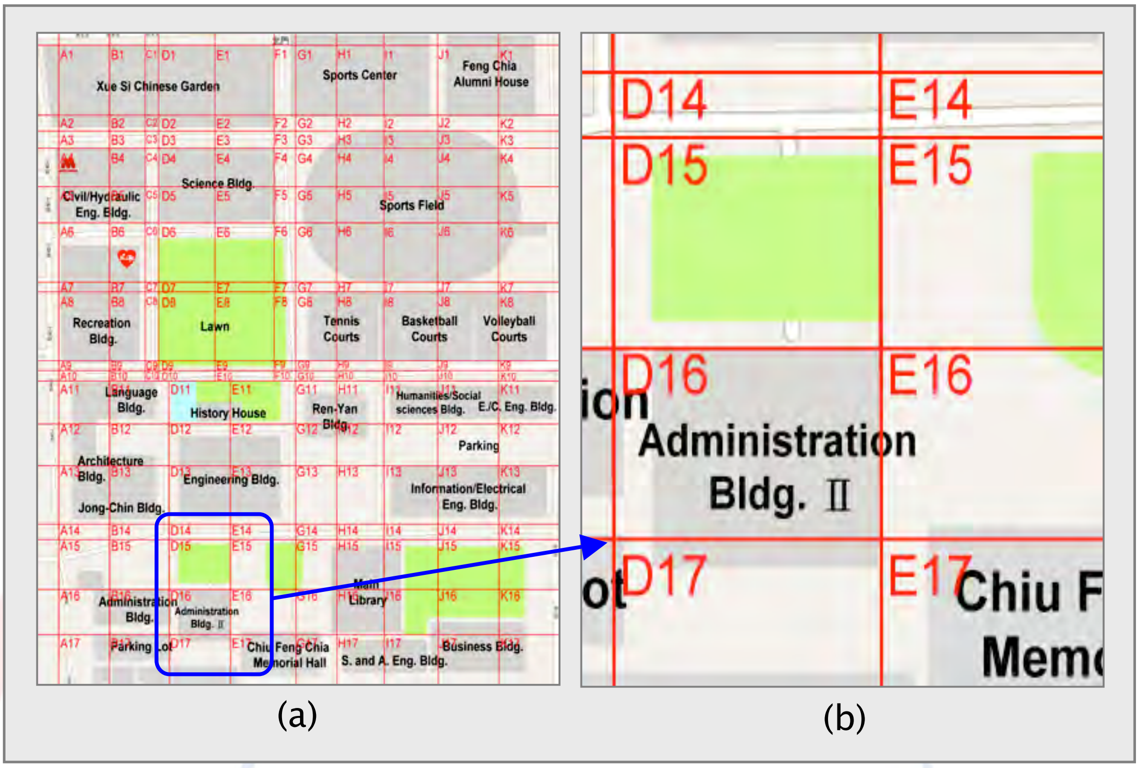

Figure 5 (a) Converting User's GPS Messages to Map Position

(b) Part of Magnification Map

(4) Before Guiding

When students use smartphones to access course information navigation, they first see GPS signals of their location from the GPS position receiver, as shown in Figure 6(a). When the GPS position receiver obtains GPS signals from satellites, it sends these GPS messages to the receiving GPS Web service and displays the response hints. To enable u-TA of the proposed system to know student-based personal data, students must pretest the questionnaire, as shown in Figure 6(b). The u-TA guiding module analyzes the questionnaire results and provides a context-aware framework to guide students.

Figure 6 (a) GPS Position Receiver (b) Questionnaire Pretesting

(5) Start Location-based Guiding

Upon completing the questionnaire, according to the results and student location, the proposed system provides student content and guides the student to reach interesting destinations to obtain more information. Figure 7(a) shows information of various Service-Learning courses resulting from the analysis of student interests, expertise, and experience. Students can choose their interested course to navigate with the campus map, as shown in Figure 7(b), and will see their current location, certain hints with heart-shaped marks for course information, and u-TA. The proposed system shows the direction of the destination, and u-TA guides the student in time.

Figure 7 (a) List of Service-Learning Information

(b) Navigating Students to the Destination

6. Experiment Results

Experiments were conducted with students of Feng Chia University to demonstrate the feasibility and effectiveness of the proposed system. This section describes the experiment and evaluation.

(1) Methods

The experiment was planned to evaluate the location-based and context-aware benefit of the proposed system and the interaction between the proposed system and the students. This research first focused on introducing the Service-Learning courses to guide students to learn how to join an appropriate Service-Learning course and to understand the purpose of Service-Learning courses. The proposed system helps students to browse Service-Learning course information.

We invited 69 volunteers who are students of Feng Chia University to join the experiment. The grades of students included freshmen, sophomores, the institute, and so on. Students were divided into an experimental group and a control group. The experimental group comprised 34 students and 35 students in the control group. The experimental group used the proposed system with smartphones to complete tasks, and the control group only used smartphones.

In this experiment, both the experimental group and the control group must use smartphones on campus for learning the Service-Learning course, where the experimental groups used the proposed system and the control group did not. The experimental group students were required to fill in a questionnaire before the experiment began. The goal of the questionnaire was to investigate personal basic data, expertise, interests, and so on of the students. The system subsequently provided context-content to students, so that they could browse interesting information using the map mode. After a period of time, when students completed courses and filled in another questionnaire, they completed the experiment. Before the experiment began, the control group of students was also required to fill in the questionnaire. They tried to understand the Service-Learning course information using only Internet-enabled smartphones. After students filled in another questionnaire, they completed the experiment. Due to equipment limitations and seeking volunteers, students took turns using smartphones. We spent approximately three weeks to complete the experiment.

In the experiments, the proposed system provided the experimental group of students with context-aware and location-based course content. u-TA of the proposed system also guides students when browsing data. However, if students who did not use the proposed system must access Service-Learning information, they must inquire on the information on websites. Students must also confirm where the classroom or office of the curriculum is. The control group did not use the proposed system and spent more time than the experimental group.

(2) Discussions

Experiments were conducted and surveys were taken to evaluate the reliability, validity and partialness of the system. We investigated the user satisfaction of the system from the point of view of students for the following system metrics, including interaction, guiding, and content. The interaction function could provide a friendly interface between the student and the proposed system and this function is provided by u-TA multi-modal user interfaces. The guiding function could be used to guide the student to a destination based on the student's choice and assist the student in obtaining related course information and this function is provided by u-TA guiding module. The content function could be used to provide the student context-aware course information according to the student's location and this function is provided by the positioning module, user profile analysis module, and u-TA guiding module. The feedbacks of students for the three system metrics are shown in Figures 8.18 and 8.19, respectively. We can observe that students have positive feedbacks for the proposed system. Both the guiding capability and context-aware functions can be used to achieve students' requirements.

The experimental results also show that most students in both groups wished to participate in volunteer service activities, but often lacked motivation, and therefore, took no real action. In the experiment, most students did not participate in voluntary services. Because they did not know what Service-Learning courses are, only a few students took Service-Learning courses. Therefore, the guiding system is important to promote Service-Learning courses. The proposed system uses u-TA to construct a location-based and context-aware guiding system to introduce the essence of Service-Learning to students and help them browse the content of the Service-Learning course resources on campus. When students have questions, they can interact with u-TA and attempt to obtain answers. Most reactions from the experimental results show that this guiding ability is acceptable. These results suggest that the proposed system is helpful for students. The proposed system not only guides student learning of Service-Learning course information on campus, but also gives rise to student interest in participating in Service-Learning courses. Through learning about Service-Learning courses, students can understand the current promotion situation of Service-Learning to help increasing practical actions. Figure 8 shows the learning outcomes of the experimental and control groups before and after the experiments. Before the experiment, students in both the experimental and control groups have basically the same trend in the chart distribution. Among them, the number of students who did not understand the Service-Learning course was more than the students who understand servicing-learning. Following the experiment the experimental group of students learned more than before and the control group of students also learned more than before. However, 14% of students still did not understand what Service-Learning courses are. The results demonstrate that the proposed system is effective in guiding students to learn about Service-Learning courses on campus and helps students learn while walking on campus.

In this experiment, most students were willing to participate in voluntary service activities, but realized no practical actions because they are passive. Knowing that the MOE in Taiwan is promoting Service-Learning courses raises student willingness to participate. Understanding what services-learning courses are encourages students to choose those courses. The survey results of student attitude showed that the proposed system increases student learning interest.

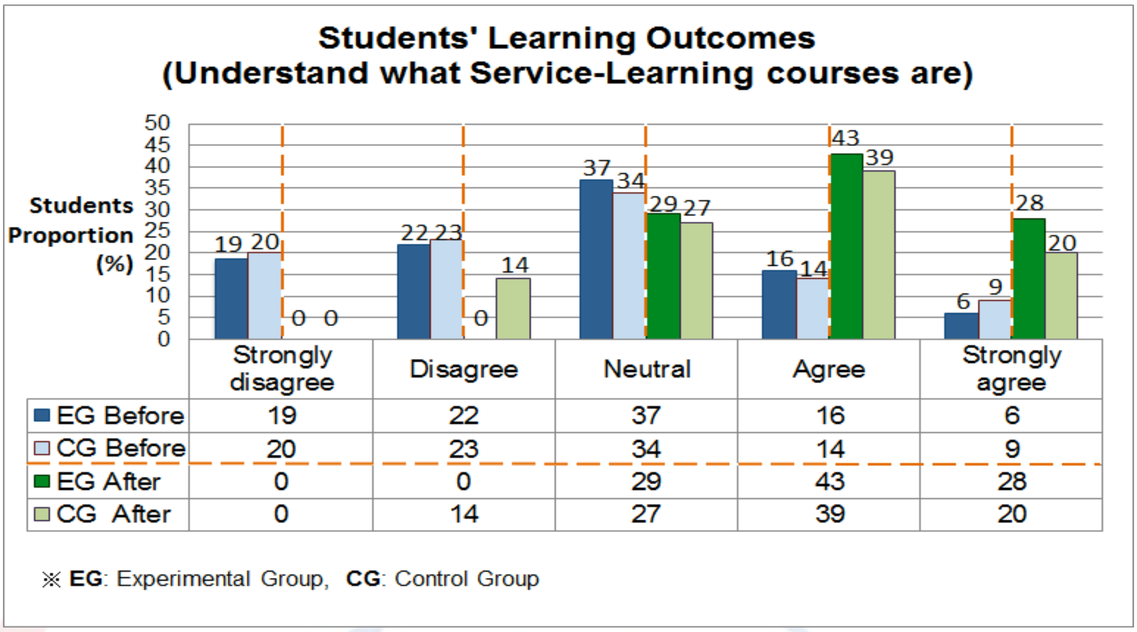

Figure 8 Students' Learning Outcomes

7. Conclusions

In this study, we proposed the u-TA framework, and the LBS u-TA system. The contributions of this study are listed as follows.

(1) u-TA Framework

The u-TA framework provides several system modules for constructing adaptive virtual assistants. It consists of two major parts, system modules and multi-modal user interfaces. The system modules include event module, guiding module, learning module, feedback recording module, knowledge retrieval module, positioning module, learning activity module. The multi-modal user interfaces include Web, MSN and Mobile APP user interfaces. This work presents the u-TA framework that can be used to share teacher or TAs' workload and solve students' problems in the virtual learning courses.

(2) Mobile Learning System

The vigorous development of mobile learning recently, virtual teaching assistants should also consider providing LBS functions of virtual assistants. The proposed LBS u-TA system provides a learning system structure for outdoor learning. Students can use the mobile devices at any time and any place to learn. The system also improves learning efficiency for outdoor learning courses.

Students' learning behaviors for using mobile deavices in mobile learning and using computer at indoor learning are different. Students may use Mobile APPs to learn uncontinuously in outdoor, and learning behaviors are not easy to be forecasted. Therefore, this part is a promising topic for our future plans.

Acknowledgement

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Information Technology Teacher Candidates' Action Competencies to Solve Society-Wide Problems in Turkey

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Abstract:

ICT action competence is the capacity and motivation of using ICT competences to select and represent democratic actions to solve society-wide problems, which are noticed by individuals. ICT integration to society is a challenge and a complex process. IT teachers have significant roles regarding the active and efficient use of ICT. The purpose of this research was to investigate the indicators of ICT action competence and to examine how Information Technology (IT) teacher candidates can contribute to solve society-wide problems. Qualitative design methodology was used in the research. Participants were eight IT teacher candidates. A focus group interview form was used to collect the data. Two main themes emerged as a result of the data analysis: The features of ICT action competence and areas of ICT action competence.

Introduction

Problem-solving capacity is one of the determinants of quality of life. To solve a problem, understanding the problem, expressing the problem, developing solution suggestions and implementing these solutions are required. Individual knowledge and capacity are important in each of the problem solving stages. This capacity and knowledge can be developed through training or experience (Uçar & Altun, 2006). Problem-solving action is required to involve individual or social transformations. Individual capacities like leadership and representing actions are important to achieve these transformations as efficiently as possible. Problems encountered can be either at the personal or social levels. Individuals who are initiators of changes with the purpose of solving problems are usually educated and have higher levels of social awareness. These individuals are named as "action competent" individuals in the literature (Breiting & Mogensen, 1999; Jensen & Schnack, 1997; Mogensen, 1997; Odabaşı et al., 2011).

Individuals' skills and motivation related to the consumption of resources, and their dependence on these resources are critical components in the democratic processes. These skills and motivation are defined as action competence (Odabaşı et al., 2011). Motivation, democracy and critical thinking are emphasized in the definition of the action competence.

Action competence is studied firstly within the scope of environmental and health education issues in the Northern European countries (Breiting, Hedegard, Mogensen, Neilsen & Schnack, 1999). Then, as well as these topics, action competence is studied within topics like peace, equality of opportunity, and social welfare. At this point, action competence stands out as an interdisciplinary subject area (Breiting & Mogensen, 1999; Jensen & Schnack, 1997; Mogensen, 1997). One of these disciplines is the information and communication technology (ICT). ICT action competence is the capacity and motivation to use ICT competence for selecting and representing democratic actions to solve society-wide problems noticed by individuals (Odabaşı et al., 2011). ICT integration to society is a challenge and a complex process. In this regard, IT teachers have significant roles about active and effective use of ICT.

The purpose of this research was to investigate indicators of action competence and to examine how Information Technology (IT) teacher candidates can contribute to solve society-wide problems.

Method

Qualitative design methodology was used. A focus group discussion was conducted to investigate IT teacher candidates' ICT action competence to solve society-wide problems related to ICT. Participants were eight IT teacher candidates. Five of the participants were males, and three of them were females. Focus group discussion was conducted on time slots that were convenient to teacher candidates; and a certain place that every participant can reach was arranged for the interview. The focus group interview form was prepared by researchers. Experts examined the interview form and gave some suggestions, and in line with their suggestions, the form was revised. Then, piloting was realized with a similar target group who examined the interview form and stated the points they did not understand. There were four questions in the focus group interview form:

- What are the characteristics of an action competent individual?
- Would you consider using your ICT professional knowledge to solve society-wide problems?

- Which society-wide problems can be solved with IT teachers' ICT professional knowledge?
- Which ICT tools do you use to solve society-wide problems?

Eight participants and three researchers from the research team attended the focus group discussions. The interview lasted about 80 minutes. The interview was recorded with two different audio recorders and a video recorder. In the video record process, video camera was focused on the speaker. The data analysis was carried out by four researchers who did not participate in the interview. During the data analysis, the video records were supported with the voice records. The purpose was to prevent the possible loss of data. Data records were transcribed which were 36 pages. Four researchers under two groups analyzed the data through coding and theming. Then, two groups reached a consensus through comparing their codes and themes. To sustain validity and reliability, other three researchers reviewed the video and audio records.

Results
Two main themes emerged as a result of the data analysis: The features of ICT action competence and areas of ICT action competence. Features of ICT action competence are being sensitive, not being selfish, voluntariness, awareness, being responsible, motivation and culture (Table 1).

Table 1.
Features of ICT Action Competence

Features of ICT Action Competence
Being sensitive
Not being selfish
Voluntariness
Awareness
Being responsible
Motivation
Culture

Some direct quotations for features of ICT action competence are in the following:

Being sensitive: *... actually this (ICT action competence) is a matter of sensitiveness. This is about being uncomfortable with problems and struggling to solve them.*

Not being selfish: *An action competent person solve problems without expecting any pecuniary advantage.*

Being responsible: *We (IT teacher candidates) become responsible in the ongoing process of ICT action competence and in starting the action.*

An ICT action competent individual can support such areas as culture, communication, equal opportunities, family, education, professional development, personal development, environment, e-applications, ethics, consumption, health, research-development and IT crimes (Table 2).

Table 2.
Areas of ICT Action Competence

Areas of ICT Action Competence
Culture
Communication
Equal opportunities
Family
Education
Professional development
Personal development
Environment
E-applications
Ethics
Consumption
Health
Research-development
IT crimes

Some direct quotations for areas of ICT action competence are in the following:

> **Communication:** ... *We can develop and publish a web site that deals with general problems such as the importance of ITs role in the society.*
> **Family:** *...For example, families… Technology perceptions of children and families are different. Children perceived technology as an entertainment tool but families perceived technology as bad thing.*
> **e- applications:** *A new course named e-commerce can be added to the curriculum. This course can include what people should pay attention to in online shopping, how can we understand which web site is vulnerable for shopping.*

Conclusion

Two main themes emerged as a result of the data analysis: The features of ICT action competence and areas of ICT action competence. Integration of the action competence approach into the education system is thought to be one of the critical educational system changes. In the current study, the ICT action competence was discussed with regard to the perspectives of prospective IT teachers. They need to be trained as ICT action competent individuals.

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Constructivism and Computer-Mediated Communication in ESL Class in Pakistan

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Abstract:

It has been observed that speaking plays a vital role in second/foreign language learning situations; but, in many Pakistanis schools, students hardly communicate in English with other people effectively due to their educational system. The present study is aimed towards exploring the implementation of constructive role plays, e-learning and its effects on Pakistani students' speaking-skills in college English classes. Speaking pretests and post-tests, student questionnaires and students' role play recording analysis have been employed to collect data during the six week teaching period. Findings show that the e-learning role plays have constructive effects on student's performance in speaking skills in terms of language fluency and accuracy. Furthermore, all students exhibited positive views regarding the e-learning implementation of constructive role plays. The findings from this study are directly applicable and useful to all ESL teachers.
Key Words &Phrases: E-learning, Constructivism, Role Play,ESL

1. INTRODUCTION

Speaking skill is the most important language skill in ESL settings; yet, in Pakistan, students find it extremely difficult to converse with others in English in an efficient manner. This situation is faced by most of the students in Pakistan, because many students of Pakistan can take their exams with the help of rote learning, plus they can become good test takers, but they lack communication skills because they do not know how to utilize that language in real life situations .They cannot differentiate between use and usage. English is learned as a compulsory subject in schools in Pakistan but our students rarely speak English in their daily lives. Nevertheless, in order to take part in international seminars, or present research papers at international conferences, situations which students may eventually encounter in their academic and/or working lives, they do need to be able to give oral presentations and discuss with other people in English, here with the help of rote learning they can deliver their presentation, but in question answer session they feel shy and hesitant. Therefore, being able to speak English efficiently has a particular importance to Pakistani university students and thus also to the L2 learning and teaching processes. Continual attention must therefore be given to the processes of learning and teaching English to the students in Pakistan. In order to develop English learning and teaching in Pakistan, computer assisted language learning is one significant teaching/learning methodology to improve the situation. Computer technology is nowadays becoming more and more prevalent in many aspects of people's lives. The development of computer technology and the Internet has become the trend in language learning and teaching.
In this light, computers for e-learning have been introduced to some government schools in Pakistan, but according to the School curriculum requirements and computer illiterate teachers, it has faced many hurdles and opposition as well. But luckily with the help of some enthusiastic and energetic teachers, the plan became quite successful. E-learning has been developed for online EFL courses where students can engage in self-study with the help of instructor. Moreover, it could also be incorporated into a traditional classroom setting to assist instruction and learning; however, in the beginning learning does not function properly in supplementing EFL speaking classes. From students' evaluation, the problem of the student's e-learning rests with its behaviorist nature, especially in the speaking section. It involves such speaking activities as behaviorist role-playing, recording and comparing, and listening and retelling, which require students to repeat the speaking materials over and over again. Students reported to losing interest in doing behaviorist role plays and they pay less attention to practicing their speaking. Therefore, it is necessary to develop and implement new kind of role plays in the speaking classes. Hence, constructive role plays could play a role to improve students' L2 speaking.

2. LITERATURE REVIEW

Constructivism is a psychological theory of knowledge which tells that humans construct knowledge from their experience. The constructivist view of language learning and teaching are considered as the major theoretical framework for CALL pedagogies. Bonk and Cunningham (1998) pointed out that "the blending of technological and pedagogical advancements has elevated the importance of research on electronic learner dialogue, text conferencing, information sharing, and other forms of collaboration". Active and collaborative construction of knowledge instead of knowledge transfer from one person to another (Cobb, 1994; Jonassen, 1994; O'Malley, 1995; Schank & Cleary, 1995), engagement in contextualized authentic tasks as opposed to abstract instruction, and less controlled environments versus predetermined sequences of instruction where "conditions for shared understanding" are created and "alternative solutions and hypothesis building are promoted through learners' interaction. Computer assisted language learning is concerned with many aspects of language learning and teaching. Computer assisted language learning is administered not only as a teaching method but also as an effective tool to help teachers in language teaching, and to promote learners' interactive learning. The implementation of CALL in a college English class all over the world shows that it provides a constructive language learning environment to students and can improve students' interest in learning English. It is noticeable that in an ESL speaking class, the use of computer as a teaching tool has a significant effect on enhancing learners' motivation (Bax, 2003).The recommendations on the use of CALL are provided to create self learning and learner-centered consciousness for both learners and teachers, which can motivate learners to practice more by actively constructing new knowledge instead of passively accepting what teachers teach .E-learning has become the main trend in CALL because of its technicality, practicality, diversity, and interactive nature. Learners can access the Web to go through sequences of instruction to complete the learning activities, and to achieve learning outcomes and objectives (Ally, 2002) According to Dawley (2007), e-learning can encourage learners to seek information, evaluate it, share it collaboratively and, ultimately, transform it into their own knowledge .In this study, constructive role plays refer to speaking activities. Naidu and Linser (2000) pointed out that constructive role plays enhances the motivation level of learners. Brown and Yule in (1995) also highlighted the positive role of constructive role play in ESL setting. Constructive role play can help students become more interested and involved in classroom learning by addressing problems, and exploring alternatives and creative solutions in terms of not only material learning, but also in terms of integrating the knowledge learned in action. These kinds of activities encourage students to engage in ESL speaking freely and creatively, as well as explore options through the creative use of language .Constructive role play activities into the ESL classroom provide opportunities for a lot of language production, and also a lot of amusement .

3. RESEARCH QUESTIONS

To achieve this, the present study addresses the following research questions:

1) Does constructive role play improve the speaking ability of students with different levels of proficiency?
2) What are ESL learners' views about the E-learning constructive role plays in their English speaking classes?

4. PARTICIPANTS OF THE STUDY

32 Intermediate level students enrolled in college were chosen to be the sample in the study. They were familiar with using computers. In addition, all of them had undergone basic speaking skill trainings from their schools.

5. RESEARCH METHODS

In the 4-week research study, all 32 students were required to read five units of the book ‘Getting on in English ‘1 hour for the lecture based class and 1 hour for the computer lab class. In the one-hour tutorial class, all the participants of the study in the experimental group and the control group studied the same textbook getting on in English. After the lecture, students started the one-hour computer lab class to act role plays.. The researcher implemented constructive role plays for the experimental group in the one-hour computer lab class. The constructive computer lab class gives them the opportunity to practice speaking by talking with their classmates actively. It is a tool for text presentation and learner interaction. Students effectively construct new conversations based on what they have learnt from the lecture based class and from their already learnt language studies. Instructions from the researcher were delivered to scaffold and to make sure students understood what they were going to do in the computer lab class. The researcher provided role play instructions before students began to act out the role play. After that, students began to act out different role plays by actually interacting with their partners in the classroom using microphones and earphones. Learners began the role plays by reading the role scripts out in front of individual computer for 15 minutes. The traditional computer lab class provides the platform for students to practice speaking without interaction among them. Students came to class, sat in front the computer and kept reading the same speaking materials out from the monitor. Students passively practiced speaking at a low cognitive level without having instructions from the teacher. After the one month instruction students in the experimental group and the control group were required to take the speaking post-test to find the effects of the role play activities on their speaking performance. The post-test mean scores in the experimental group were compared to the scores of the control group. The data obtained from the pretest and the post-test scores were used for further quantitative analysis. Students in the experimental group were required to fill in the questionnaires, and the data attained from these instruments were used for the analysis.

6. RESULTS

After the one month investigation on usage of e-learning constructive role plays, and from the data analysis, the summary of the results as under:
1) Speaking-skills performance of the Students
2) Students language productivity in different interactions
3) Students perception about e-learning constructive role plays.

6.1. SPEAKING-SKILLS PERFORMANCE OF THE LEARNERS

All participants were post-tested. As shown in Table 1, from the paired Samples t-test analysis, the mean scores of the post-test of the two groups (Experimental/control) are 10.381 and 7.846 respectively.

Table 1: Comparison between the two tests scores between the experimental group and the control group

Group	Scores	Mean	SD	N	df	t	Sig.
EG*	Pretest	8.912	.8223	130	129	-18113**	.000
	Post-test	10.381	1.4895				
CG*	Pretest	7.835	.8454	130	129	-. 199	842
	Post-test	7.846	.7745				

*EG: Experimental Group; CG: Control Group
** t value of experimental group is significant at the 0.05 level (2-tailed)

In the experimental group, there is a statistically significant difference between the two speaking tests scores, significant at p = 0.000. However, in the control group, there is no statistically significant difference between the two speaking tests scores because the p value is higher than 0.05 (p = 0.842 > 0.05). The mean scores of the pretest and the post-test are nearly the same (7.846/7.835).In addition, in terms of different language proficiency levels, in the experimental group, from the paired samples t-test analysis, as shown in Table 2, the post-test mean scores for each level respectively higher than the pretest mean scores.

Table 2: Comparison between the two tests scores among high, medium and low proficiency levels in the experimental group

Proficiency level	Scores	Mean	n	df	t	Sig.
High	Pretest	10.536	14	13 -	12. 022*	000
	Post-test	12.786				
Medium	Pretest	8.918	97	96 -	16.331*	000 .
	Post-test	10.546				
Low	Pretest	7.684	19	18	-5.091*	000
	Post-test	8.447				

*t values are significant at the 0.05 level (2-tailed)

From the data shown in Table 2, it is noticeable that students in the experimental group at all language proficiency levels displayed an improvement on their speaking performance. This result validates the answer to the first research question, that constructive role play improve the speaking ability of students with different levels of proficiency?

6.2. LANGUAGE PRODUCTIVITY STUDENTS LANGUAGE PRODUCTIVITY IN DIFFERENT INTERACTIONS

In terms of language productivity, two types of language alteration, word replacement and sentence deviation, can be found from the analysis of students' performance .

Table 3 : Summary

1	Words replacement	82.3%
2	Sentences deviation	77.0%

82.3% of the students in the experimental group produced different words from the original conversations to perform the constructive role plays.

Example 1	
Original role play	**Constructive role play**
Hi, my name is Pamela. ***But*** you can call me Pamy. It's nice to meet you, Pamy. My name is Sophia. ***Nice*** to meet you, too, Sophia. I'm a ***new student here***. ***What*** about you? Me, too. I'll have my first class ***today*** What class is that? English ***language*** Oh, really? We're going to be in the same class! Oh, that's great!	Hi, my name is 00000000. ***And*** you can call me 0000000. Nice to meet you, 00000. My name is0000000 ***Glad*** to meet you, too, 0000000. I'm a ***new student*** here. ***How*** about you? Me, too. I'll have my first class ***tomorrow*** What class is that? English Language Class. Oh, really, I will be in the same class Oh, that's wonderful!

Original role play	**Constructive role play**	
Pamela, what are you planning to do this Weekend? I haven't ***made*** any plans yet. You got ***any good ideas***? I want to ***watch movie on this week end*** Sounds ***great***! And what do you think we will watch? We will see English movie I like Good idea!	0000000, what are you doing on this Weekend? I haven't ***got*** any plans yet. You got ***Anything***? I want to ***be*** away from the busy life ***Movie on Sunday***? We could invite you as well Sounds ***good*** And what do you think .We will go there? Good idea!	

6.3. STUDENTS PERCEPTION ABOUT E-LEARNING CONSTRUCTIVE ROLE PLAYS.

All 32 students in the experimental group were required to answer the questionnaires after they finished their study.

Table 4: Responses from Students' Questionnaires

	Items	**Strongly agree**	**Agree**	No Idea	Disagree	Strongly Disagree
1	The teacher should give instruction before performing e-learning constructive role plays	32	0	0	0	0
2	E-learning constructive role plays are enjoyable	32	0	0	0	0
3	E-learning constructive role plays enhance learning process	32	0	0	0	0
4	E-learning constructive role plays help me speak idiomatic English	32	0	0	0	0
5	E-learning constructive role plays help me produce similar language easily	32	0	0	0	0
6	E-learning constructive role plays improve my speaking in class	32	0	0	0	0
7	E-learning constructive role plays enhance my motivation level	32	0	0	0	0
8	E-learning constructive role plays should be given ample time in ESL classroom	32	0	0	0	0
9	In the beginning I feel shy but later I overcome the situation	32	0	0	0	0
10	I prefer reading out the script to acting the role out with a partner	32	0	0	0	0

Data from the questionnaires suggested that majority of the students preferred working on e-learning constructive role plays in speaking classes. The percentage of students who agreed that the instructions were necessary for them to get better understanding on how to carry out constructive role plays is 93.8%, with a significant difference among the agreement, indecisiveness and disagreement. From item 2, item 3, and item 4, 100% of the students agreed that e-learning constructive role plays were interesting. The data is quite significant and the process of learning to speak English was more interactive and enjoyable. All students showed agreement that e-learning constructive role plays provided them with useful information on how to speak English in a better way. The data also showed that e-learning constructive role enhanced their motivation level. Most of the students agreed that in the beginning they were hesitant and they were very nervous and shy, but gradually they overcame, but at the same time they complained that they did not have much time to complete the task .It showed that for this kind of an activity students should have been given much time to accomplish the task. Students felt that they did not have enough time to finish the role play, because students found the role play very tiring. So, the teachers should get students involved in role plays for between 10 and 15 minutes. Only in this way could students get enough training on how to effectively carry out e-learning constructive role plays within an appropriate time.

7. CONCLUSION

The results derived from the speaking pretest scores, student role play recording analysis and questionnaires, clearly demonstrated that e-learning constructive role plays have an overall optimal impact on the speaking performance of students at various language proficiency levels and these also assist in improving students' speaking-skills. Students' performance was observed to be quite well and they applied the knowledge to role-playing successfully. Moreover, most of the students were in the favor of getting instructions from the teachers, because it plays a major role in constructive role plays and it helps students in building an understanding of the tasks better before they begin role plays. Interaction amongst the students is another crucial element to advocate the benefits of learner-centered learning. The whole process of learning as well as teaching is centered round students, and e-learning constructive role plays can motivate them to be active participants in the learning process. In turn, students are interested in applying as much previous knowledge as possible towards gaining new knowledge. Students actively explore the knowledge instead of passively accepting it. It is vital for the creation of an interactive, constructive learning scenario in L2 classrooms. In such a process, the teacher takes on the role of assisting instead of mere lecture deliverance.

It is observed that learning devices such as Role plays are greatly beneficial for L2 teaching and expedited learning. Moreover, constructive role plays raise the students' level of interest in the learning process and in turn they are more engrossed in classroom learning not only in terms of the teaching material, but also in terms of integrating the knowledge learned in action Computer-assisted language learning.

Constructive learning theory stresses the active role of the learner and hence it can be applied in constructing interactive knowledge and in creating further developments/improvements in the learning process. Certain innovations can be applied by teachers in this process, by encouraging students' to produce a variety of responses, instead of the usual, prescribed responses to a given situation that a role demands. Hence, the results and analysis of the investigation demonstrate that e-learning constructive role plays have an overall positive impact on students' speaking-skills of a second language. Also, students concede that these role plays should form a part of their formal curriculum at college.

8. IMPLICATIONS

The primary goal of the investigation was to carry out constructive role plays in ESL students' speaking-skills classes. Certain implications that can be derived from this are as under:

First of all, the results show that incorporating CALL and Internet, is integral to the whole process of second language speaking, learning and teaching. It is a vital part of learning because it helps in the growth of students from passive learners to active participants in the ESL classroom. The findings from this study are also useful for other language teachers by helping them in developing students' L2 speaking-skills.

Secondly, this study helps in promoting and clarifying the role of CALL, e-learning, and constructivism in a country such as Pakistan where the new educational doctrine, focusing on quality education is a major shift from its previously applied methodology. This experiment provided critical insights into the usage of constructivism and e-learning and incorporation of such a teaching methodology as a part of the formal curriculum so as to promote a reformed educational system in Pakistan.

Research in the future may also be extended to examine the role of constructivism, CALL and e-learning and its importance towards formation of new knowledge paradigms in terms of all four language skills.

Thirdly, the present study has highlighted a very significant aspect about new learning models. In such a model as the one experimented in the study, a shift was observed. The instruction became more interactive in nature and focus shifted more towards engaging students actively instead of merely revolving around teacher-centered approach of learning. Basically, the whole emphasis is now on the students rather than the teachers and this is why, future research studies may continue to investigate how such an environment based on e-learning can effectively promote and in how many other ways can it enhance learning.

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A New Look at Problem-Solving Difficulties of Novice Students: An Innovative Classroom Setting Using Fischertechnik Kit

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Abstract:

This study was intended to investigate problem solving difficulties of novices in a classroom setting while using the German instructional technology *Fischertechnik kit*, which contains approximately 400 parts. Students were required to complete a vehicle body while enabling the mock-up vehicle to overcome three kinds of topographical barriers within a limited time. In order to analyze their thinking process as they solved the problems, verbal protocol analysis (VPA) were used to record the students' thinking process and action stages for three case problems.

The novice students in this study displayed the following characteristics during their problem-solving process: (1) All of them employed "working forward" cognitive strategies, which displays that while novices usually rely on certain operations to change the current situation. (2) These novices tended to adopt their responses based on their assessment of the linkages between their previous and new experiences, which leads to the continuous development via a process of equilibration. (3) Due to these novices' inabilities to fully clarify the key problem elements, they mostly adopted an *intuitive trial and error* approach. When confronting problems, novice students tended to implement their solutions immediately after examining the problem, and either misuse problem-solving strategies or rely on the strategies and methods they have habitually used in the past.

Finally, this study provides specific recommendations for future instructional design based on the results of this study.

I. Introduction

1. Rationale

Since Taiwan's engineering education heavily emphasizes engineering theory, recent graduates tend to have a good understanding of theory, but lack the ability to implement their knowledge into practice. As a consequence, many industrial employers specifically require graduates of engineering design programs to have problem-solving abilities as well as general engineering and scientific knowledge (Lattuca, Terenzini & Volkwein, 2006). In order to overcome this crisis faced by engineering education in Taiwan, this study seeks to provide instructional recommendations based on an investigation of students' behavioral characteristics while solving practical problems.

Many scholars (Atman et al. 2007; Kligore et al. 2007) have studied problem solving by novices, and have sought to investigate the problem-solving behavioral characteristics of novice students in order to devise problem-solving behavioral models that can be used to improve students' problem-solving abilities and to develop teaching strategies. This study takes a similar stance: that a complete understanding of novice students' problem-solving procedures and difficulties is needed in order to derive optimally-effective teaching strategies. This study aims to achieve that goal by gaining an in-depth understanding of the sources of students' difficulties when solving practical problems, and thereby make recommendations for appropriate instructional strategies.

2. Research Goals

This study is an interdisciplinary collaborative project, including mechanical engineering and pedagogy, that seeks to investigate the problem-solving process under experimental conditions. The German Fischertechnik construction kit is used as a problem-solving tool to explore the problem-solving process and difficulties with it, as well as differences between students, when novice students solved a practical problem employing this kit. Accordingly, this study's main research goals are:

(1) Investigation of novice students' performance when using the Fischertechnik kit to solve a problem.

(2) Investigation of the differences between novice students in the problem-solving process and the problems that they encounter.

This study sheds light on individual differences in novice students' problem-solving difficulties, and thereby helps to provide teachers with student-centered methods for improving students' problem-solving and practical skills, while also establishing a basis for future improvements of instruction.

II. Literature review

When facing a problem, an individual will implement different problem-solving strategies in light of his/her knowledge and experience. These problem-solving strategies serve to guide the individual and the problem-solving method (Mayer, 1983). The following is an overview of the most common problem-solving strategies, and how these problem-solving methods have been applied in various fields (Gick, 1986):

1. Working backward vs. working forward strategies

"Working backward" and "working forward" strategies refer to an individual's two directions of action. A working forward strategy involves inspection of the current situation and the use of known information to develop ideas for how to reach the unknown target state.

In comparison with a working forward strategy, a working backward strategy requires that the individual have more knowledge and more ability in inverse deduction in order to implement a solution. If individuals cannot uncover an action strategy able to reduce the distance between the unknown target and initial states, this will make problem-solving using a working backward strategy less successful. According to Simon (1978), experts tend to solve problems by developing problem-solving ideas from knowledge schema, they are able to develop problem solving ideas working from known information to unknown information, and they consequently tend to use working forward problem-solving strategies. In contrast, because novices lack relevant knowledge schema when attempting to solve a problem, they can only search for ideas on the basis of the target and initial states, and they consequently tend to employ working backward and means-ends analysis as problem-solving strategies.

2. Empirical research concerning the problem-solving process

Coley, Houseman, and Roy (2007) performed a review of literature concerning differences in designers' cognitive behavior in the field of engineering design, and summarized commonly used research methods and issues concerning relevant research. Among these, the most commonly used methods are observing designers' sketching process and performing verbal protocol analysis of information derived from the designers' thinking out loud.

Atman and Bursic (1998) adopted a research tool that can investigate the problem-solving process under real-life situations. Called "verbal protocol analysis," this requires individuals to think out loud during the problem-solving process, enabling researchers to process the subjects' verbal data via transcription, segmenting, annotation, and analysis. Their research findings were as follows: 1. Situational design questions are likely to motivate students to consider situational factors. 2. In the design process, students' focusing behavior has inter-situational rules and characteristics (Atman & Turns, 2001). 3. The main differences between novice- and expert designers were in their stages of problem definition and information collection. 4. With regard to problem definition, experts spent a relatively long time in this preliminary or conceptual stage because they hoped to come up with a feasible and innovative solution method. 5. Novices not only spent relatively little time understanding the problems, but also were unaware of their lack of understanding for the problem. 6. While experts spent a relatively large amount of time at the information collection stage, novices put little effort into seeking information, and collected an insufficiently broad range of information, and therefore ended up with poor-quality finished product design (Kligore et al, 2007; Atman et.al, 2007).

In summary, the foregoing studies all employed multi-stage analytical methods to analyze the characteristics of individual design problem-solving behavior. The following section described the instructional design of the course and the data collection procedures regarding three novices' problem-solving procedures for the experimental problem.

III. Methodology

1. Subjects

The subjects in this experiment were three freshmen engineering students at a university in Taiwan. The subjects had all completed one semester devoted to a Fischertechnik project prior to participation in this experiment. However, since they had not yet received professional training in this field, including product design and mechanical knowledge, they could still be defined as problem-solving novices.

(1) Alina

During the semester-long classroom observations, it is noteworthy that Alina served as one of the main leaders for group activities, and she also led during assembly activities, with her partners only assisting by picking out parts and discussing their views. Accordingly, we felt that Alina had more extensive experience regarding assembling the mechanical building blocks and this helped her to work on the project independently.

(2) Chris

Chris worked closely with partners in group activities, was willing to accept his partners' views, and often implemented ideas with his teammates in the final stage. Chris believed that his partners' views often inspired him and helped him uncover key points in solving the problem, and he thus played a crucial role in the problem-solving process. However, he tended to solve problems cooperatively with his partners, and had less problem-solving knowledge and experience than the other two subjects.

(3) Denny

Denny had more mechanical building block knowledge and assembly experience than the other two subjects. He also interacted closely with his partners, and they together thought up many highly creative ideas. Furthermore, Denny was an outstanding executer. Not only was he uniquely creative and able to complete his ideas to a high degree, but he was also judged to possess a complete range of outstanding mechanical assembly knowledge and experience. In addition, this approach also enabled close interdisciplinary cooperation between education researchers and engineering department personnel.

2. Data collection

This study used a case study methodology, providing plentiful information, supplemented by data collection tools, including participatory observation in a laboratory environment and the subjects' thinking aloud about the case. Cross validation of the data was performed to enhance reliability of the study results. In addition, the use of verbal protocol analysis to investigate the problem-solving process allowed researchers to collect extensive information on individuals' problem-solving procedures, shedding light on individual thinking preferences and the evolution of their ideas. By helping researchers identify factors affecting the quality of problem-solving results, verbal protocol analysis can support the improvement of teaching strategies.

3. Course Description

In order to collect information on the subjects' problem-solving behavior and procedures, the researchers designed an experimental problem, whose process included assembling a vehicle and installing switches in order to successfully navigate around topographical barriers. The project was called "Against all Odds," and required students to complete a vehicle that was able to pass the three topographical barriers shown in Fig. 1 while carrying a doll, and activating the switches and positions satisfying the experimental conditions. The project had four basic requirements:

a. Assembly time was limited to less than four hours.
b. The subjects could use two boxes of Fischertechnik parts.
c. The subjects had to complete the experiment within the shortest possible time and overcome the obstacles.
d. The subjects had to use the minimum amount of parts to complete their vehicles.

Problem: Against all Odds

James Bond wants to rescue the kidnapped Princess Barbara, but the evil Dr. Murik has created difficult topographical obstacles around Princess Barbara. Please try to help Bond assemble a vehicle that can overcome these topographical barriers and enable Bond to rescue the Princess within the shortest period of time by driving the vehicle.

＊ **Seven Conditions to Consider**：

(1) Assembly time must be within four hours.
(2) Only two Fischertechnik kits may be employed.
(3) Please assemble your vehicle as efficiently as possible, i.e., in the shortest possible assembly time, using the fewest Fischertechnik parts, and with the most effective structure.
(4) The vehicle must be able to carry Bond. If Bond falls out, the vehicle will have to stop and start over again, which implies that you must design a switch device.
(5) The topographical barriers must be overcome in the shortest possible time.
(6) The vehicle may not overturn while crossing the barriers; if the vehicle overturns, it must set out again from the starting point.

(7) The vehicle must conquer the following topographical areas: a. a rough badland area, b. five steps with a height of 2 cm each, and c. a smooth 15° slope.

4. Experimental procedures

The experiment used the Fischertechnik kit, which contains over 400 mechatronic components. Through use of this kit, students can cultivate their problem-solving ability, and modify their solutions during the process. In order to promptly grasp the students' thought processes during the course of the experiment, the students were asked to think aloud, which was explained as speaking the ideas going through their minds as they worked on the experiment. Thinking aloud facilitated record-taking by the observers. The verbal data gathered from the participants' thinking aloud served as the primary information used when analyzing the students' problem-solving processes.

IV. Research results and discussion

After raw data had been recorded, classification was performed on the basis of the problem-solving stage and barriers overcome.

The three students participating in this study had little practical design experience, and were therefore novices in this field. Compared with experts, they were not influenced by any previous hands-on experiences, design methodology, or domain knowledge. To highlight the features of the novices' problem-solving efforts, the following presents a summary discussion and analysis of the problem-solving processes in the three cases and the students' finished products.

1. Comparison of problem-solving processes

The problem-solving stage was the most difficult for all three novices. Denny had wanted to use drawings to embody some of his ideas, but because of his lack of professional knowledge and hands-on experience, and especially lack of sketching skills, he was forced to give up this idea. Alina and Chris also encountered embodiment difficulties after they proposed abstract ideas. These findings suggest that none of these three students had drafting abilities, which was the major difficulty they encountered in the problem-solving process.

During the stage of "clarifying the problem," even though the experimental question provided information concerning the topographical barriers, Chris and Alina still spent considerable time conducting physical verification of the topographical information. On the contrary, Denny merely performed visual observation of the topography, and then proceeded to propose a representation of the problem. In addition, when dealing with the steps 2 cm in height, all three students used both actual testing and observation to clarify the problem. Because of the difficulty of these barriers, the students had to use multiple methods to uncover hidden topographical information. This reveals that the three novices tended to employ actual testing as a problem clarification

method.
During the problem-solving strategy search stage, all three students employed working-forward strategies, and Alina employed working-forward methods for all three barriers. Generally speaking, as long as problem information is fully clarified, individuals can establish an initial problem state, and then use their existing experience and knowledge to search for ways to arrive at the target state. Their use of a working forward strategy is therefore understandable. In addition, Chris and Denny also used working-backward strategies. When used by novices, however, this type strategy is by no means very effective; this point will be analyzed and explained further in the discussion of finished product quality.

During the stage of implementing problem-solving ideas, the biggest difficulty faced by the participants was to put their abstract conceptions into practices. In many cases, individuals can use their knowledge and experience to bridge the gap between concept and practice. Generally, in the problem-solving process, individuals can recall past experience and apply past knowledge, skills, and attitudes to similar or new situations, which is known as transfer of learning. For instance, Alina used an analogy strategy to first convert an abstract conception into a physical object before implementing her idea.

However, if past experience does not correspond to the present problem, individuals will have to use other methods to realize their ideas. The most commonly used strategy in this study was intuitive trial and error. However, since the three novices lacked sufficient domain knowledge, they frequently made decisions while still unsure of themselves, which may have led to gaps between ideas and their practical realization. As a result, the novices often ended up in a vicious cycle of dealing with superficial details at the expense of the main problems. Among the three, Denny had the most experience and knowledge, which enabled him to avoid too many divergent ideas, which would take him away from his problem-solving objective, when relying on his intuition to implement ideas.

2. Scoring Rubrics for Evaluating Finished Product Quality

The following rubrics (scoring items) were used to determine whether a case met the experimental conditions: 1. Structural simplicity: the quantity of parts used in each completed vehicle and the complexity of the vehicle structure; 2. Structural stability: stability of the vehicle structure and sturdiness of part connections; and 3.Uniqueness of switch design: creativity displayed by the doll, seat, and switch triggering methods in each case. The following is analysis of the quality of the finished products in the three cases. Table 2 shows the numbers of points (on a scale of 0 to 5) assigned by three scorers to the three aspects of the finished products created by Alina, Chris, and Denny. The average numbers of points from the three scorers are the students' final scores.

Table 2 Overview of finished product evaluations (rubrics)

Item / Subject	Structural simplicity				Structural stability				Uniqueness of switch design				Total
	A	B	C	Avg.	A	B	C	Avg.	A	B	C	Avg.	
Alina	4.0	3.0	4.0	3.7	4.0	3.0	3.0	3.3	2.0	2.5	3.0	2.5	9.5
Chris	2.0	2.5	2.0	2.2	3.0	2.5	3.0	2.8	5.0	5.0	4.0	4.7	9.7
Denny	5.0	5.0	5.0	5.0	5.0	4.0	4.0	4.3	4.0	5.0	5.0	4.7	14

Because this study sought to locate difficulties encountered in the problem-solving process, our investigation focused on those items with the lowest scores. The following is an explanation of problem-solving difficulties encountered when the students' performance was less than ideal.

(1). Comparative analysis of structural simplicity

In this item, the 2.2 points obtained by Chris constituted the lowest score. This low score was due to Chris's excessive attention to the most visible problems, and neglect of the vehicle's overall structure. As a result, Chris's finished product was too heavy, and could not overcome the stair barrier. On the contrary, because Denny considered the rough terrain and stair topography together at the start of the experiment, he was later able to focus on developing problem-solving strategies for the stairs and sloping topography during the subsequent problem-solving process. This enabled Danny to avoid dispersing his efforts and not wasting time and resources. Denny employed the method of minimizing the problem objective in the face of a poorly-defined problem situation.

(2). Comparison of structural stability and problem analysis

Chris's 2.8 points for this item was also the lowest score. Because the weight of the large motor exceeded the vehicle body load, the continuing operation of the large motor as the vehicle moved caused parts of the vehicle body to fall off. Alina's score for this item was only 0.5 points higher than Chris's score, due to sagging of the vehicle body she used caused by her use of an excessively large motor and due to the loose structure of her design caused by sectional assembly. Both of these problems were due to her failure to consider the overall finished product design. This suggests that novices are limited to developing problem-solving ideas addressing currently existing problems on the basis of the information available to them. This approach is rather superficial insofar since the improvement of one aspect often reveals the presence of another problem. Lacking guidance from past experience, novices tend to adopt this trial and error strategy.

Because the working-backward problem-solving strategy adopted by Chris required constant trial and error, he gradually diverged farther and farther from the target state, and this problem-solving strategy cannot be considered ideal. Although Denny also employed a working backward strategy, he supplemented it with convergent thinking, which enabled him to quickly switch to another idea whenever one idea proved impractical, allowing his problem-solving process to proceed without interruption. Denny also examined problems from a broader perspective while implementing his ideas.

(3). Comparison of uniqueness of switch design and problem analysis

Chris and Denny were tied for the highest score for the item of uniqueness of switch design, and both obtained nearly-perfect 4.7 points out of 5. In contrast, Alina scored only 2.5 points, which was chiefly attributable to the fact that she started the unfamiliar switch design task with only 40 minutes remaining in the experiment. Because she was forced to hastily wrap up design work when time ran out, her switch design can be considered only a semi-finished product.

The reason Chris received such a high score for switch design was the fact that his product design combined innovation and efficiency, and saved the time needed to re-attach the switch and seat. Denny's method of maintaining contact between the doll and switch incorporated situational innovative thinking. By letting the doll hold an iron rod in its hand and placing its foot on the switch, Denny achieved the task of rescuing the Princess, while also obtaining a high score for his switch design.

V. Conclusions and recommendations

The following are some conclusions and recommendations based on the foregoing results:

1. Novices' difficulties and characteristics in the problem-solving process

This study found that not every novice will encounter the novice problem-solving phenomena suggested by Atman et al. (1998; 2007). Novices' problem-solving difficulties are not invariably attributable to the superficial problem solving idea search, insufficient domain knowledge needed to apply ideas, and lack of ability to assess the overall problem situation. Instead, novices' difficulties could also attribute to their individual differences.

The novice students in this study displayed the following behavioral characteristics during their problem-solving process: (1) In the process of searching for a solution, all three students all employed working-forward strategies because they lacked an understanding of the ends in means-ends analysis; (2) These novices extracted guidance from their past experience, which is considered in cognitive psychology to be the most commonly used learning method. In this method, these novices adopt response steps based on their assessment of the degree of fit between their old and new experiences, which leads to the continuous development of their cognitive constructs via a process of equilibration. In other words, novices can only adopt general, customary methods when they have yet to learn effective problem-solving strategies. (3) The trial and error process will enable errors to gradually be eliminated, leaving effective and correct methods. Because these novices did not fully clarify the key problem elements, they tended to adopt an intuitive trial and error problem-solving approach. The most common problem of the novices in this study, the lack of plan implementation ability, is largely due to these novices' lack of drafting ability.

2. Teaching recommendations based on the students' problem-solving difficulties

This study discovered that the description of a contextualized problem can help students see the importance of understanding both the problem and the solution from a holistic perspective. Based on the research results, the researchers provide the following teaching recommendations to help novices overcome problem-solving difficulties:

(1) Need to strengthen novice students' drafting ability

The three subjects did very little drafting in the problem-solving process, and only Denny tried to compose a problem-solving plan via drafting. However, because of his insufficient training, he had to give up on this idea, and he ended up having to make many revisions during the subsequent idea implementation stage. Because drafting ability can help individuals embody their ideas, it can be a key factor for successful problem solving. We recommend that future courses seek to strengthen novice students' drafting skills, since good sketching skill could enhance the novices' ability to consider all aspects during the problem-solving process.

Meanwhile, the finding of this study show that novice students often tried to implement their solutions immediately after confronting the problem, and therefore either misused problem-solving strategies or relied on strategies and methods they had used in the past. Teachers should therefore provide more demonstrations and more sketching examples during the analysis and planning stages of the problem-solving process. This way, students will be better able to learn how to analyze problems and plan feasible solutions, enabling them to develop more robust problem-solving abilities.

(2) Need to provide different instructions for diverse talents of students

In contrast to Alina and Chris, Denny had the advantage of mechanical building block knowledge and assembly experience, and consequently performed better in the experiment. Therefore, we should provide a suitable range of instructional design appropriate for the various abilities of students. For instance, for those students who lack of domain knowledge to solve a problem, teachers should clearly point out the relationships between concepts, enabling the students to incorporate new problems into their existing schema of knowledge.

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Virtual Technologies for Learning System

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Abstract:

e-Learning is a popular technology and has been used extensively. The interactions between teachers and students are the basic activities of a learning process. In some learning activities, such as cooperative learning and virtual laboratories, learning servers need to support amount of loading and provide performance to ensure the application services. Nowadays, the popularity of multi-core processors led the rapid development of virtualization technology. Server virtualization can offer a wide range of applications and building the learning servers on virtual machines can enable a more flexible use of hardware resources. Therefore, this work presents an improving Dynamic Scheduling Indexes Scheme (DSIS) on virtual machines for learning servers. The improving DSIS scheme supports the real-time monitoring learning servers to provide available load information, including CPU, memory and network load status. Experiments were conducted to simulate the proposed method on the learning servers and observe the performance of learning services. The experimental results show that the proposed method can help learning servers to enhance the performance and to reduce the response time of client requests.
Keywords: learning systems, virtual machine, dynamic scheduling

1. Introduction

As Internet applications become increasingly ubiquitous, learning servers are encountering increasing workloads. Therefore, approaches by which to improve the performance of learning servers and reduce the response time of client requests have become crucial topics discussed by researchers.

With the rapid development of multi-processors in the past several years, computers are becoming increasingly powerful regarding hardware resource. However, system resources in most computers are extremely under-utilized, leading to the recent boom of applications driven by virtualization technology.

Currently, virtualization technology [1] is used in a wide range of applications, including operating system virtualization, desktop virtualization, application virtualization, network virtualization, storage virtualization, and server virtualization. Virtualized resources can consist of hardware facilities or a software environment. Server virtualization can be applied in a wide range of server types, such as learning servers, Web servers, mail servers, and database servers. A learning server cluster can be constructed using virtual machines to employ hardware resources in a more flexible manner.

This study proposes the Dynamic Scheduling Indexes Scheme, a load-balancing scheduling scheme for Moodle [2] cluster constructed on virtual machines. This scheme continually monitors load information concerning available servers within the Moodle cluster, including information about the load values for CPU, memory, and network bandwidth, and then converts load values into scheduling indexes that can be allocated by the scheduler server. Based on scheduling indexes, the scheduler server forwards client requests to Moodle servers, and then dynamically adjusts allocated scheduling indexes every 60 seconds.

The results of experiments conducted in this study indicate that, for performance, our Dynamic Scheduling Indexes Scheme is superior to Request Counting Scheduling [4,5,6,7], Weighted Traffic Counting Scheduling [4,5,6,7], and Pending Request Counting Scheduling [4,5,6,7]. This scheme has been verified to improve the performance of the Moodle cluster and to reduce the response time of client requests.

The structure of this paper is as follows: Section 2 discusses related technologies, including the architecture of a Web server cluster, load balancing scheduling schemes, Web server performance evaluation, and virtualization technologies. Section 3 describes system design architecture and implementation details. Section 4 discusses the configurations of the experimental environment and analytical results. Section 5 contains the conclusion and suggestions for future research.

2. Related Technologies

2.1 Web Server Cluster Architecture

A Web server cluster uses multiple Web servers to form a single system through the application of specific technologies or architecture in which the availability, reliability, and scalability of application services are improved.

When one of the Web servers within the cluster fails, the server load balancer assigns the client connection requests to other available Web servers, ensuring client access to service resources. Based on the position of the load balancer in the cluster, Web server cluster technology can be broadly divided into four approaches (elaborated in subsections 2.1.1, .2.1.2, 2.1.3, and 2.1.4).

2.1.1 Client-based Approach

In the client-based approach, clients select a Web server that receives connection requests. Depending on the methods by which it is implemented, the client-based approach can be divided into two types: the Web client type and the client-side proxy server type [3].

In the Web client type, a client sends queries to the Web server cluster periodically through Java applets installed at the client browser to obtain updated information concerning the number and load status of available servers and to determine which client requests should be redirected to the server. The major drawback of this approach is that excessive consumption of network bandwidth is caused by frequent communications between clients and Web servers.

In the client-side proxy server type, proxy servers can be used to forward client connection requests to a proxy service through configurations on the client-side browser. When a client sends a request, the proxy server retrieves information from the server, and then transfers it to the client.

2.1.2 DNS-based Approach

The DNS-based approach converts a domain name into a corresponding IP address using the Domain Name System (DNS); consequently, client connections can be evenly distributed.

When a client sends a connection request, a domain name server responsible for cluster architecture periodically converts the domain name into the IP address for one of the Web servers in the cluster. This cycle time is known as Time to Live (TTL) and is used to determine which client connection requests should be forwarded to a Web server.

Based on how implementation is undertaken, the DNS-based approach can be divided into three types: the Round-Robin DNS, the Server State-based DNS, and the Client State-based DNS [3].

2.1.3 Dispatcher-based Approach

The main goal of the dispatcher-based approach is to gain full control over HTTP connection requests. The dispatcher uses a cluster IP address to receive all client connection requests, and, by modifying the destination IP address (Packet Rewriting) or MAC address (Packet Forwarding), packets are forwarded to corresponding destinations.

To shorten the latency in packet forwarding, the dispatcher employs simple load-balancing scheduling schemes, including Request Counting Scheduling, Weighted Traffic Counting Scheduling, and Pending Request Counting Scheduling. The most suitable load-balancing scheduling scheme is selected according to specific requirements, and, consequently, the performance of the Web server cluster is enhanced.

Overall system performance depends substantially on how the dispatcher forwards packets to the most appropriate Web server in the shortest possible time. Therefore, if a dispatcher processing capability is inadequate, a bottleneck of the entire system architecture may occur.

2.1.4 Server-based Approach

When a client connection request is received, the domain name server forwards the request to the corresponding Web server using the Round-Robin DNS. Load information concerning Web servers is exchanged among servers on a regular basis. Based on the distribution of load among servers, a Web server determines whether to forward a request to another server with a lower load.

Two major drawbacks of the server-based approach exist. The first drawback is that additional bandwidth consumption results from frequent communication between clients and Web servers. The second is that additional load is placed on a Web server because of the frequent exchange of load information among different servers.

2.2 Load-balancing Scheduling Scheme

In high-performance Web server cluster architectures, if an appropriate load-balancing scheduling scheme can be used, the performance of the Web server clusters can be maximized. Several of the most commonly employed load balancing schemes are described as follows.

2.2.1 Request Counting Scheduling

Request Counting Scheduling [4,5,6,7] is a simple load-balancing technique suitable for Web servers with identical software and hardware specifications or similar computing capacity. If the performance of these Web servers varies, the performance of the Web server cluster cannot be maximized. To achieve enhanced load-balancing performance, other scheduling schemes are used in conjunction with Request Counting Scheduling.

2.2.2 Weighted Traffic Counting Scheduling

Weighted Traffic Counting Scheduling [4,5,6,7] is a modification based on Request Counting Scheduling. It is suitable for Web server clusters in which the computing capacities of the Web servers vary. Web servers with higher computing capacity are allocated more weight, and are therefore assigned more connection traffic. Conversely, Web servers with lower computing capacity are allotted less weight, and are consequently assigned less connection traffic.

2.2.3 Pending Request Counting Scheduling

Pending Request Counting Scheduling [4,5,6,7] is suitable for Web servers with similar computing capacity. This scheme distributes client requests to Web servers according to the number of requests each Web servers is currently assigned. The load balancer periodically checks the number of connections for each Web server to ensure that the next incoming request is assigned to the server with the fewest connections.

2.3 Web Server Performance Evaluation

The performance of the Web servers is generally evaluated using Web server stress testing software to simulate scenarios in which multiple users connect to the server simultaneously. Connection information is also collected during this process. Commonly applied Web server stress testing software is explained as follows.

2.3.1 ApacheBench

ApacheBench [8] is a utility software bundled in the Apache Web server that is specifically designed for testing the performance of the Web servers. Regarding Web server performance analysis, the results of testing with ApacheBench can display a large amount of information, including the complete time for an overall Web server stress test, number of completed requests, transmission rate for connection requests, and average response time.

2.3.2 httperf

Developed by HP Labs, httperf [9] is employed for Web server stress testing and performance evaluation. Regarding Web server performance analysis, the results of an httperf test can display the complete time for an overall Web server stress test, number of completed requests, number of incomplete requests, transmission rate for requests, and average response time.

2.3.3 Siege

Siege [10] is an open source software for Web server benchmark that can be used for Web server stress testing and performance evaluation. Regarding Web server performance analysis, results from testing with Siege can display the complete time for an overall Web server stress test, number of completed requests, number of incomplete requests, transmission rate for requests, and average response time.

2.4 Virtualization

Virtualization is a broad technological concept. In the computer science field, virtualization technology can be employed for a wide range of applications, including operating system virtualization, desktop virtualization, application virtualization, network virtualization, storage virtualization, and server virtualization. In this paper, emphasis is placed on server virtualization, which is also known as hardware virtualization.

Server virtualization enables the implementation of multiple physical servers in the form of virtual machines in a single physical machine. Each virtual machine runs a separate operating system such as Windows, Linux, or FreeBSD. The operations of the virtual machines are independent from each other, and, when one virtual machine fails, other machines are not affected. Moreover, because the computing resources of physical machines can be shared by all virtual machines, hardware resources are employed more effectively.

The management tool employed in a virtualization environment is referred to as a hypervisor, or a virtual machine monitor (VMM). Hypervisor technology can be basically divided into three types: Full Virtualization, Paravirtualization, and Hardware-assisted Virtualization [11].

2.4.1 Xen

Xen [12,13,14] is an open source virtual platform capable of executing 128 fully functional operating systems on a single physical machine. Xen originated as a research project at the University of Cambridge Computer Laboratory (initially led by Ian Pratt), and is now jointly developed by a group of members from the open source community.

The main feature of Xen is that it can support Paravirtualization through which increased performance is achieved by modifying the core of the Guest OS. In normal scenarios, the system performance loss in Xen is approximately 2%; in worst case scenarios, the system performance loss in Xen is approximately 8%. By contrast, the system performance loss in Full Virtualization can reach 20%.

Starting with version 3.0, Xen began supporting instruction sets for CPU virtualization, such as Intel VT or AMD-V extensions, which enabled Full Virtualization and allowed an unmodified Guest OS to run on the VMM. Using Hardware-assisted Virtualization technology, virtual machines can directly access hardware devices to improve low system performance caused by the application of Full Virtualization.

2.4.2 VMware

VMware [15] is a commercial virtual platform comprising VMware Workstation, VMware ESX Server, VMware vCloud, and other editions. Users of VMware can select appropriate products according to their practical needs. VMware can run on Windows and Linux operating systems and supports Full Virtualization and Hardware-assisted Virtualization technology.

VMware architecture consists of multiple layers. The VM Virtualization layer is a mapped layer between the hardware and operating system, which can communicate directly with hardware using the drivers of the device. It is responsible for hardware virtualization and management of the operational resources for the physical machine.

Using the interface provided by the VMware Virtualization Layer, multiple virtual machines can be run on a single physical machine, and each virtual machine can be installed with different operating systems and a wide range of applications. Virtual machines can communicate with hardware only when employing the VMware Virtualization Layer.

2.4.3 KVM

The Kernel-based Virtual Machine (KVM) [16,17] is an open source virtual platform that provides a Linux-based virtualization environment. By incorporating CPU virtualization instruction sets, such as Intel VT or AMD-V extensions, the KVM can support Full Virtualization technology.

Linux processes can be divided into the User Mode and the Kernel Mode. The User Mode is usually executed using general applications. When applications perform system calls, Linux processes transfer from the User Mode to the Kernel Mode. Privileged instructions can be executed only in the Kernel Mode.

The KVM includes a Guest Mode in addition to the User and Kernel Modes, which runs on the Guest OS of the virtual machine. Within the KVM Full Virtualization framework, each virtual machine is considered an individual Linux process, and is therefore implemented in the form of standard Linux scheduling.

3. System Design and Implementation

3.1 System Architecture

The architecture for our system is shown in Figure 1. The scheduler server, information server, Moodle cluster, and database server are all designed using KVM virtualization technology.

The scheduler server assigns client requests to an available Moodle server within the Moodle cluster using the Dynamic Scheduling Indexes Scheme. The information server receives load information concerning each Moodle server within the cluster through Network Management Service (NMS) [18]. The Moodle cluster employs multiple Moodle servers, each of which monitors current status using an Agent that collects the load values of server CPU, memory, and network bandwidth every 5 seconds, and converts load values into scheduling indexes allocated by the scheduler server. These indexes are then transferred to the information server. The storage and queries for load information are performed by integrating the information and database server.

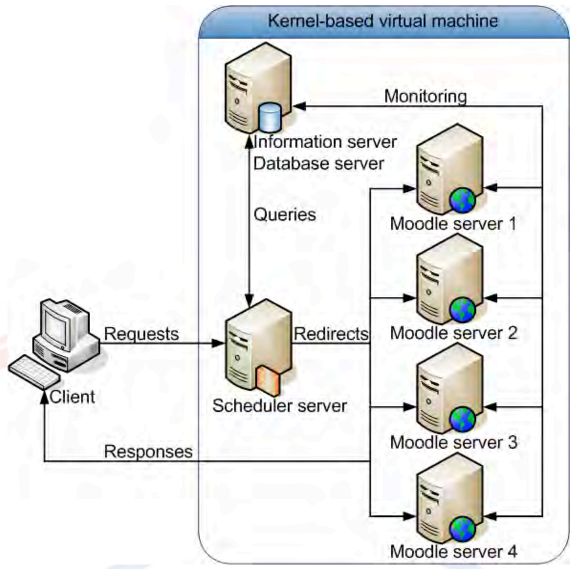

Figure 1: System architecture

3.2 Dynamic Scheduling Indexes Scheme

The Dynamic Scheduling Indexes Scheme is discussed in two sections. The first section pertains to the acquisition of parameters for load information [19,20,21,22], and the second section discusses computing methods for scheduling indexes [19,23].

The main factors that affect Moodle server performance include the idle rate for the CPU, remaining available memory, and network bandwidth usage. The Agent is installed in Moodle servers to acquire information concerning these three parameters, as shown in Figure 2.

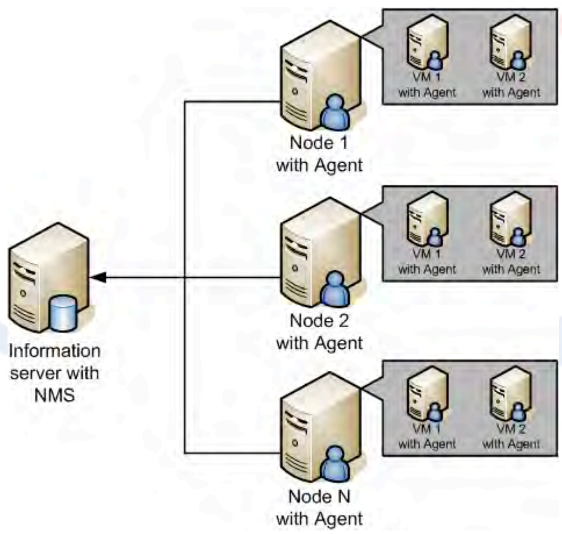

Figure 2: NMS architecture

In Linux systems, an additional mechanism that allows the kernel and kernel module to transmit information to processes, which is called the */proc* virtual file system, exists. The */proc* virtual file system was initially designed to facilitate the retrieval of process information; however, it is now used to return any portion of information from the kernel. For example, */proc/modules* provide a list of mounted modules, and */proc/meminfo* provide statistical information concerning the use of memory [24,25].

The Linux systems record a log of CPU activities in the */proc/stat* virtual file system, which is continually maintained and updated by the system. Using information from the */proc/stat* virtual file system, the utilization rate of virtual CPU in the Moodle server *n* at time *t* can be calculated using the following formula:

$$Uvcpu_{n,t} = \frac{(user_{n,t} + nice_{n,t} + system_{n,t} + iowait_{n,t} + irq_{n,t} + softirq_{n,t})}{(user_{n,t} + nice_{n,t} + system_{n,t} + iowait_{n,t} + irq_{n,t} + softirq_{n,t} + idle_{n,t})} \quad (1)$$

where *user* is the CPU running in user mode, *nice* is the CPU running in user mode with lower priority, *system* is the CPU running in system mode, *iowait* is the CPU running in I/O wait, *irq* is the CPU running in hardirq, *softirq* is the CPU running in softirq, and *idle* is the CPU running in idle task.

The Linux system records a log of memory activities in the virtual file system */proc/meminfo*. Using the information from the virtual file system */proc/meminfo*, the utilization rate of virtual memory in the Moodle server *n* at time *t* can be calculated using the following formula:

$$Uvmem_{n,t} = \frac{(MemTotal_{n,t} - MemFree_{n,t})}{MemTotal_{n,t}} \quad (2)$$

where *MemTotal* is the total amount of RAM and *MemFree* is the amount of RAM, left unused by the system.

The Linux system records a log of bandwidth consumption activities in the virtual file system */proc/net/dev*. Using the information from the virtual file system */proc/net/dev*, the utilization rate of virtual network bandwidth in the Moodle server *n* at time *t* can be calculated using the following formula:

$$Uvnet_{n,t} = \frac{(receive_{n,t} + transmit_{n,t})}{2} - \frac{(receive_{n,t-1} + transmit_{n,t-1})}{2} \quad (3)$$

where *receive* is the number of bytes each interface received and *transmit* is the number of bytes each interface sent.

Using information concerning CPU, memory, and network utilization provided by the virtual file system, the weighted dynamic scheduling indexes of the Moodle server *n* at time *t* can be calculated using the following formula:

$$Dindexes_{n,t} = 0.8 \times (1 - Uvcpu_{n,t}) + 0.1 \times (1 - Uvmem_{n,t}) + 0.1 \times (1 - Uvnet_{n,t}) \quad (4)$$

where *0.8* is the CPU weight, *0.1* is the memory weight, and *0.1* is the network bandwidth weight.

For updating the scheduling indexes of the scheduler server, we used the state change driven policy. Under the scheduling policy, the information server sends the load information to the scheduler serve when load changes from one level to another. On receiving the load change information, the scheduler server updates the scheduling indexes.

Using information concerning CPU utilization provided by the virtual file system, the scheduling policy of the Web server *n* at time *t* can be calculated using the following formula:

$$Scheduling_{n,t} = \begin{cases} Dindexes_{n,t}\text{ , } 25\% \leq Uvcpu_{n,t} \leq 75\% \\ Sindexes_{n,t}\text{ , } Otherwise \end{cases} \quad (5)$$

where *Dindexes* is the dynamic scheduling indexes, *Sindexes* is the static scheduling indexes, and a default value is 50.

The flowchart of the Dynamic Scheduling Indexes Scheme is shown in Figure 3.

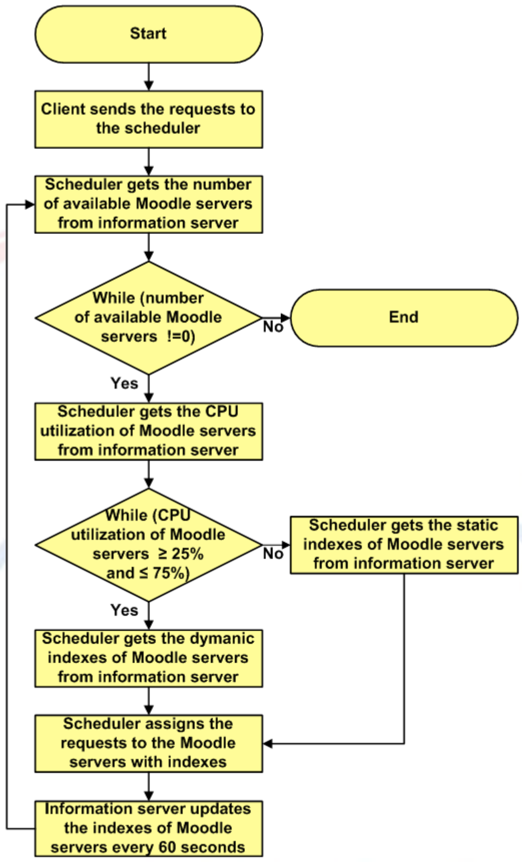

Figure 3: The flowchart of the DSIS

Step 1: The client sends requests to the scheduler server.

Step 2: The scheduler server queries the information server for the number of the available Moodle servers in the Moodle cluster, and the information server responds to the scheduler server.

Step 3: If the Moodle servers in the Moodle cluster are available, the scheduler server queries the information server for the CPU utilization of the Moodle servers, and the information server responds to the scheduler server.

Step 4: If the CPU utilization of the Moodle servers are between 25% and 75%, the scheduler server queries the information server for the scheduling indexes of the Moodle servers, and the information server responds to the scheduler server, providing relevant dynamic scheduling indexes, otherwise providing relevant static scheduling indexes.

Step 5: Based on the scheduling indexes, the scheduler server forwards client requests to the Moodle server.

Step 6: The information server dynamically adjusts allocated scheduling indexes every 60 seconds.

3.3 System Implementation

In Figure 4, the system is implemented using a number of services, including scheduler server service, network management service, information server service, Moodle server service, and database server service. These services are discussed in subsections 3.3.1, 3.3.2, 3.3.3, 3.3.4, and 3.3.5.

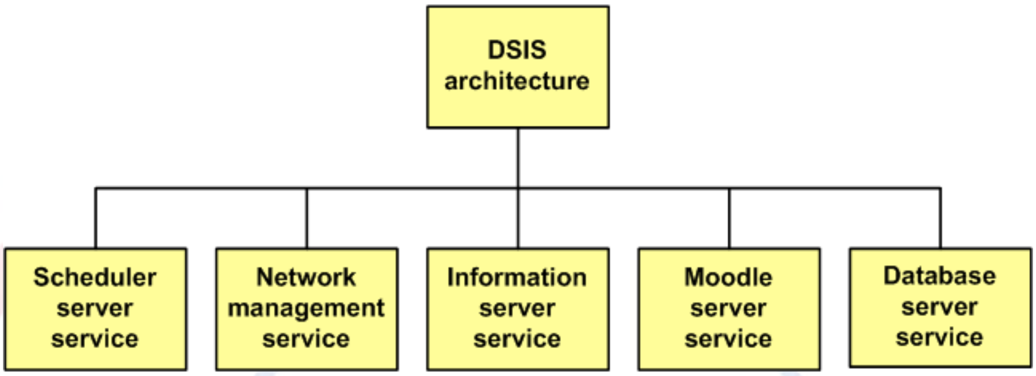

Figure 4: DSIS architecture

3.3.1 Scheduler Server Service

We employed the Apache Web server and the proxy module to implement the scheduler server.

In Figure 5, a Apache Web server contains two types of proxy modules. The first proxy module called proxy_http, which provides the features used for proxying HTTP requests, supports HTTP/0.9, HTTP/1.0 and HTTP/1.1. The second proxy module called proxy_balancer, which uses to distribute client connection requests, provides load balancing and failover across the server cluster. Starting with Apache version 2.2, there are three scheduling schemes available for use: Request Counting Scheduling, Pending Request Counting Scheduling and Weighted Traffic Counting Scheduling.

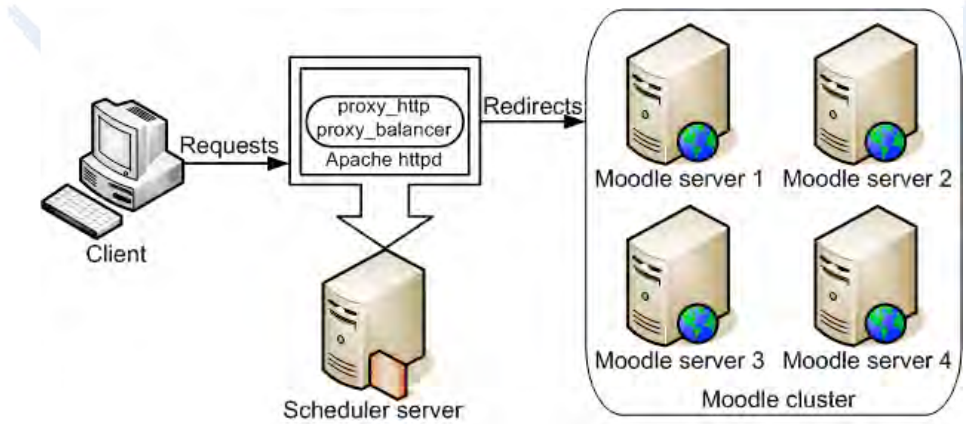

Figure 5: Proxy module for Apache

The default scheduling scheme with the proxy module for Apache is based on simple Round-Robin approach that does not consider the server CPU, memory, and network utilization. In Figure 6, a new proposal for improving, the scheduler server adapts the distribution policy for allocating client requests based on load status of the Moodle cluster.

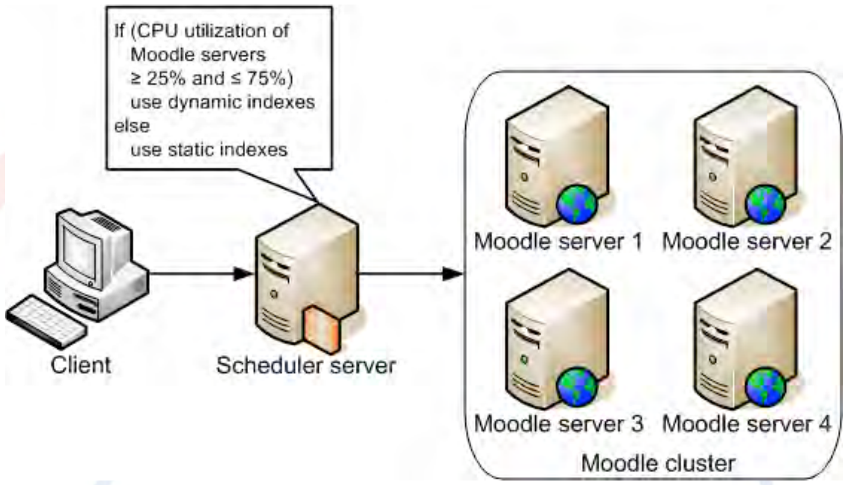

Figure 6: Scheduler server policy

3.3.2 Network Management Service

Network management service consists of two components: the NMS server and the Agent, all of which are coded using Java programming language. More details about the NMS and Agent components are described as follows.

In Figure 7, the Agent collects load information concerning Moodle server CPU, memory, and network utilization every 5 seconds. These load values are transformed into scheduling indexes for the scheduler server, which are then transmitted to the NMS Server. The NMS Server is responsible for receiving the load information transmitted by the Agents for each Moodle server, and then for storing it in the database server.

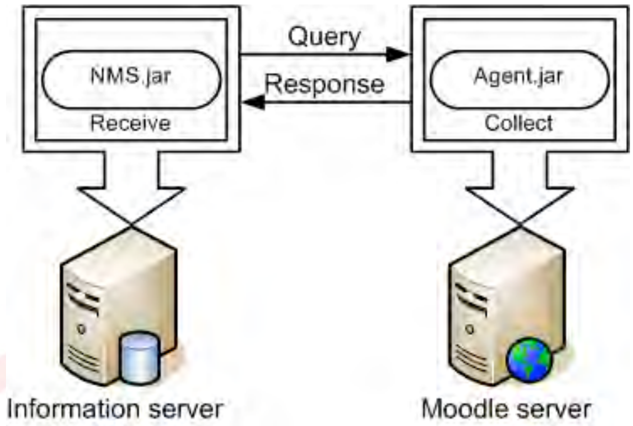

Figure 7: Relationship between an NMS and an Agent

3.3.3 Information Server Service

In Figure 8, the Information server contains the user management interface, node management interface, virtual machines (VMs) management interface, resources monitoring interface, and resources control interface, all of which are coded using PHP interpretive programming language. The functions of the different interfaces are described as follows.

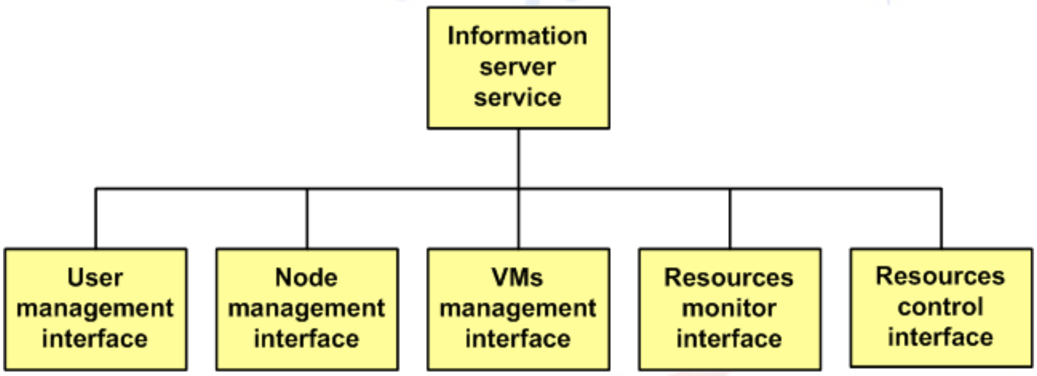

Figure 8: Information server service architecture

User management interface: This interface provides numerous functions, such as List User, Add User, Modify User, and Delete User.

Node management interface: This interface provides numerous functions, including List Node, Add Node, Modify Node, and Delete Node.

VMs management interface: This interface contains several functions, including List VM, Add VM, Modify VM, and Delete VM.

In Figure 9, the process, memory, and network bandwidth of a VM for any node can be monitored in real time using the resources monitoring mechanism.

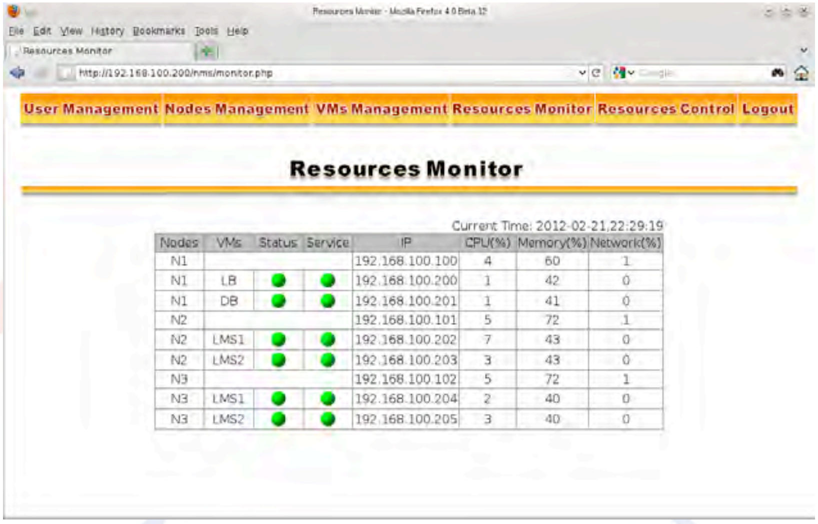

Figure 9: The Resources Monitor function

In Figure 10, the scheduling indexes are dynamically adjusted at 60-second intervals using the dynamic scheduling mechanism. Furthermore, by employing the health checking mechanism, faulty Moodle servers can be removed in a proactive manner.

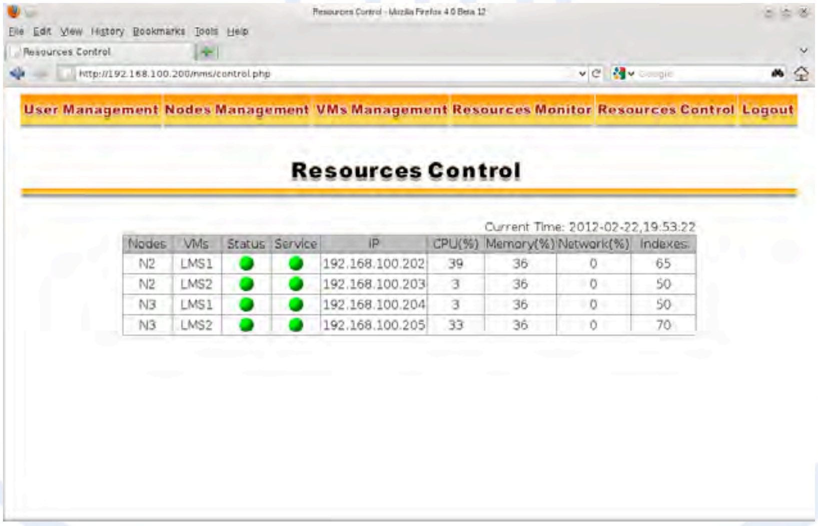

Figure 10: The Resources Control function

3.3.4 Moodle Server Service

Moodle [2] is an open source software for course management system, also known as a learning management system or a virtual learning environment. Moodle provides several system modules for different virtual learning environments and also supports the multi-modal user interfaces, such as mail, chat, calendar, blog, forum, wiki, etc.

3.3.5 Database Server Service

The design for the database tables includes tables for user information, monitoring information, and testing information, as shown in Figure 11.

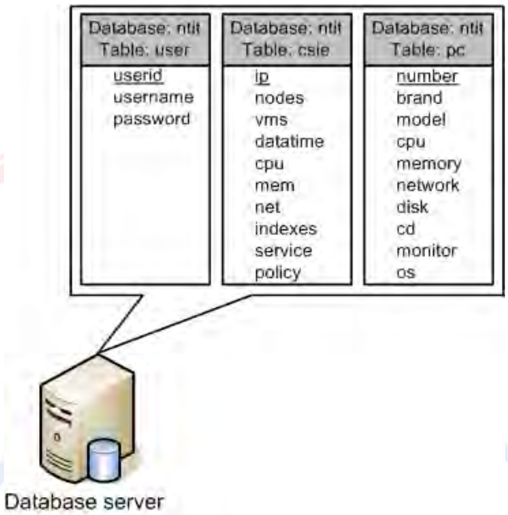

Figure 11: The schema of the database

4. Experimental Environment and Results Analysis

4.1 Hardware Environment

The hardware portion of the experimental environment consisted of four physical machines. The physical Machine with server service type is planned into two virtual machines using KVM virtualization technology. The physical machine with client service type is used to simulate client connection requests. Detailed hardware specifications are listed in Table 1 and Table 2.

Table 1: Hardware specifications for physical machines

Node	Service	CPU	RAM	Disk	Network
1	Server	Intel Core i7 2.93GHz	8GB	500GB	Intel 82578DC 1000Mb
2	Server	Intel Core i7 2.93GHz	8GB	500GB	Intel 82578DC 1000Mb
3	Server	Intel Core i7 2.93GHz	8GB	500GB	Intel 82578DC 1000Mb
4	Client	Intel Core i7 2.93GHz	4GB	500GB	Intel 82578DC 1000Mb

Table 2: Hardware specifications for virtual machines

Node	VM	Service	CPU	RAM	Disk
1	1	Scheduler Information	4 vCPU	2GB	100G
1	2	Database	4 vCPU	2GB	100G
2	1	Learning	4 vCPU	2GB	100G
2	2	Learning	4 vCPU	2GB	100G
3	1	Learning	4 vCPU	2GB	100G
3	2	Learning	4 vCPU	2GB	100G

The topology of our experiment is depicted in Figure 12. In the experiment topology, the client IP address is set to 192.168.100.1, the IP address for the scheduler server and information server is 192.168.100.200, the IP address for the database server is 192.168.100.201, the IP address of the Moodle server 1 is 192.168.100.202, the IP address of the Moodle server 2 is 192.168.100.203, the IP address of the Moodle server 3 is 192.168.100.204, and the IP address of the Moodle server 4 is 192.168.100.205.

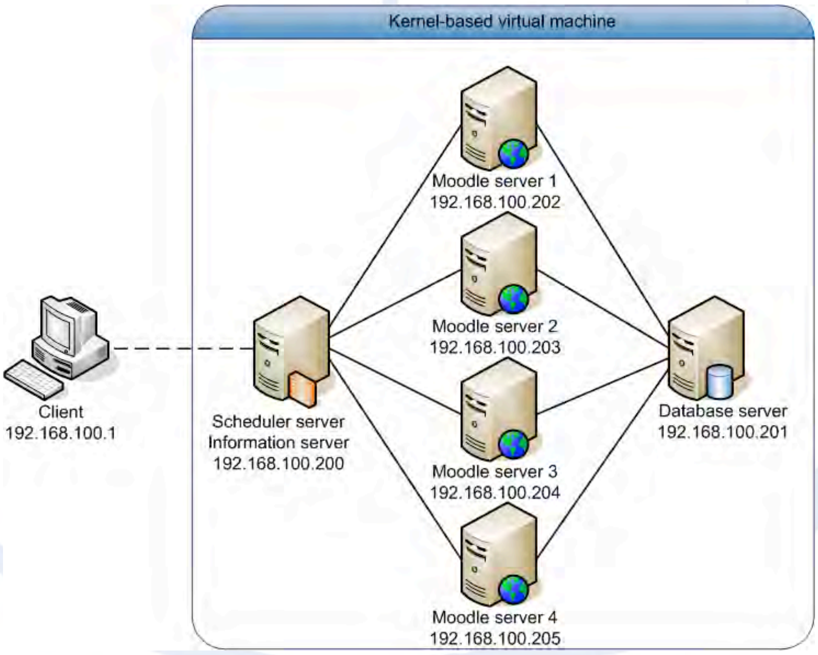

Figure 12: The experimental topology

4.2 Software Platform

The software platform for the experimental environment consists of two parts: the client and the server.

The client simulates 1000 to 5000 connection requests using Siege to obtain an average response time for requests. The timeout parameter for Siege is set to 60 seconds.

The server employed a scheduler server, an information server, a database server, and four Moodle servers. Each Moodle server is connected to the MySQL database through the MySQL module of PHP. Fifty entries of information are created for queries. Software specifications are outlined in detail in Table 3.

Table 3: Specifications for the software platform

No	Service	Software
1	Scheduler server	Apache 2.2.17 with Proxy module
2	Information server	Apache 2.2.17 with PHP 5.3.5
3	Database server	MySQL 5.1.53
4	Learning server	Moodle 2.0.2 and Apache 2.2.17 with PHP 5.3.5
5	Learning server	Moodle 2.0.2 and Apache 2.2.17 with PHP 5.3.5
6	Learning server	Moodle 2.0.2 and Apache 2.2.17 with PHP 5.3.5
7	Learning server	Moodle 2.0.2 and Apache 2.2.17 with PHP 5.3.5
8	Client	Siege 2.70

To analyze the effect of Moodle server system load on system performance, we used the CPU hammer script [26] to simulate the system load of the Moodle server system.

4.3 Results Analysis

Experiment 1: The impact of scheduling indexes on performance of the Moodle cluster.

Different weights can be assigned to the three parameters for scheduling indexes according to their importance. Among these parameters, α represents the weight of the CPU, β represents the weight of memory, and γ represents the weight of network bandwidth, where $\alpha + \beta + \gamma = 1$. In Figure 13, when the system load reaches 100% of the Moodle cluster, the client simulates 5000 connections using Siege. Weights are set to $\alpha = 0.8$, $\beta = 0.1$, and $\gamma = 0.1$, and the elapsed time is 742s. Compared to other weight setting combinations, the performance for this particular weight setting is significantly superior.

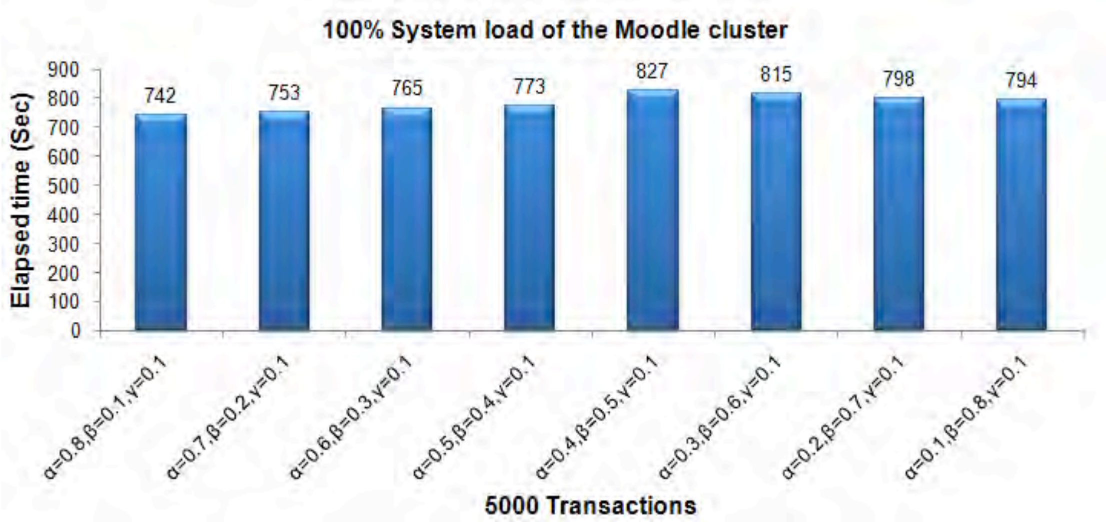

Figure 13: The impact of scheduling indexes on performance

Experiment 2: The impact of system load on performance of the Moodle cluster.

In Figure 14, the client is set to simulate 1000 to 5000 connections using Siege when the system load reaches 0% of the Moodle cluster. Compared to other counting-based scheduling schemes, our Dynamic Scheduling Indexes Scheme reduces elapsed time by 1.7% to 2.3%.

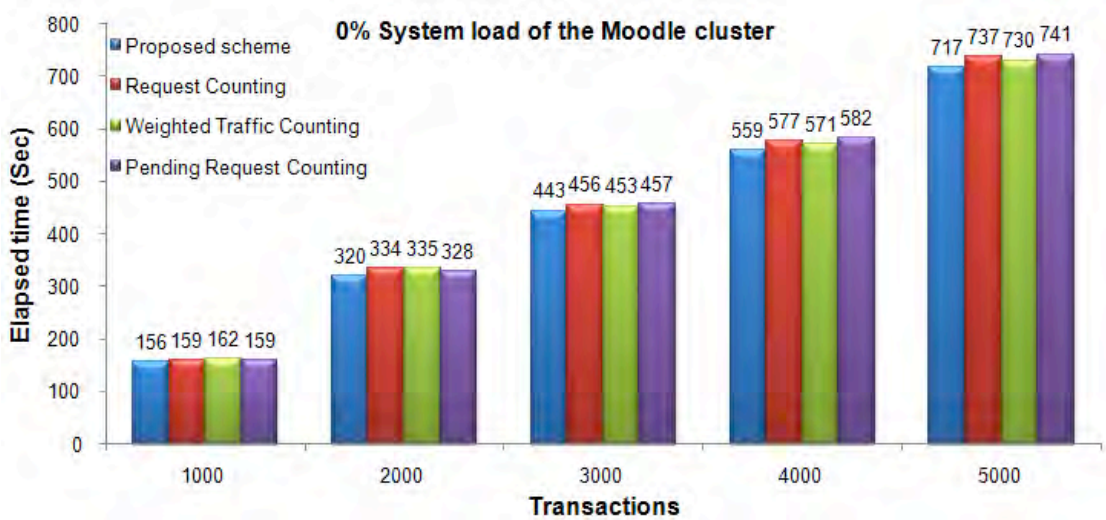

Figure 14: Performance comparison for the 0% system load

In Figure 15, the client is set to simulate 1000 to 5000 connections using Siege when the system load reaches 25% of the Moodle cluster. Compared to other counting-based scheduling schemes, our Dynamic Scheduling Indexes Scheme reduces elapsed time by 2.2% to 5.6%.

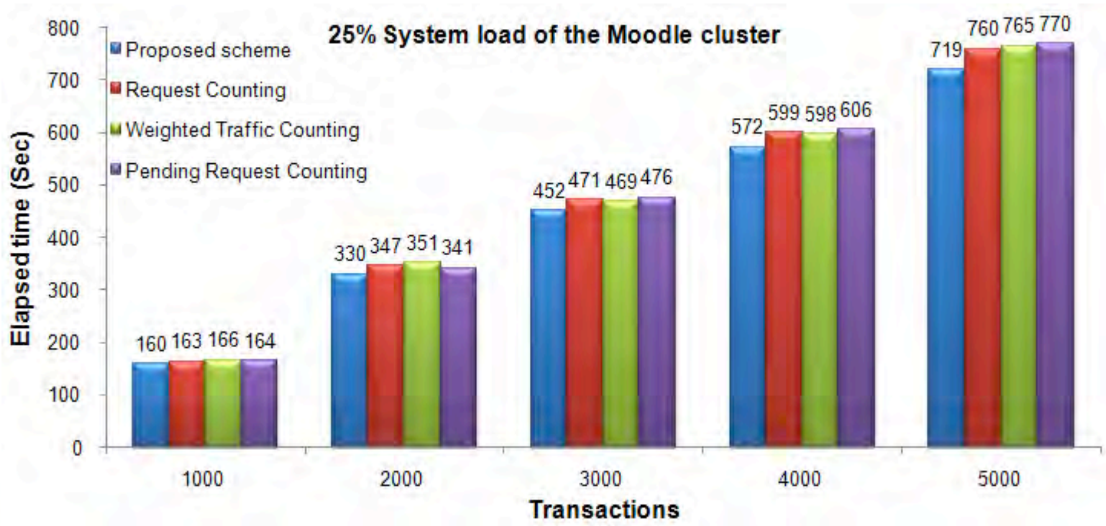

Figure 16: Performance comparison for the 25% system load

In Figure 16, the client is set to simulate 1000 to 5000 connections using Siege when the system load reaches 50% of the Moodle cluster. Compared to other counting-based scheduling schemes, our Dynamic Scheduling Indexes Scheme reduces elapsed time by 3.5% to 6.6%.

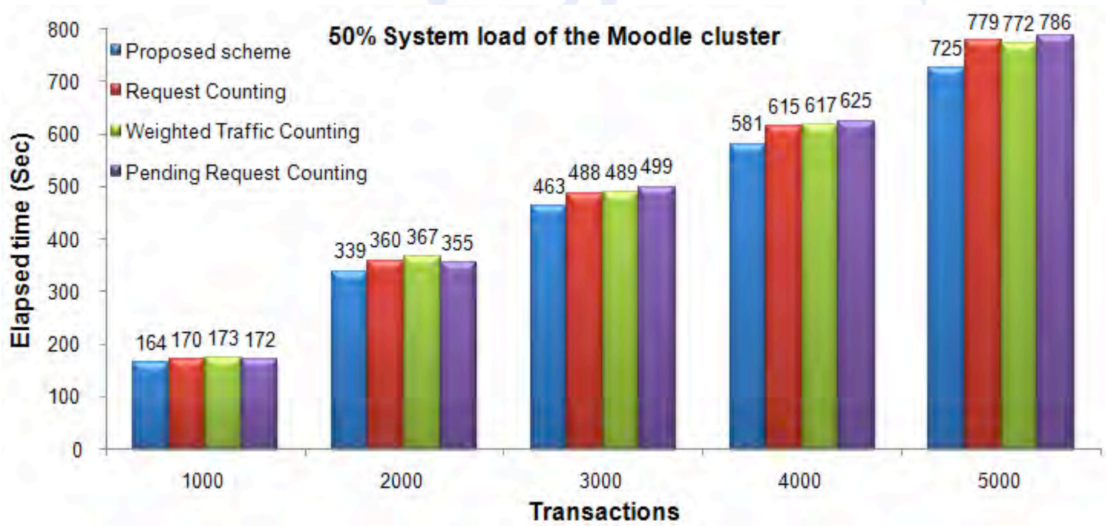

Figure 16: Performance comparison for the 50% system load

In Figure 17, the client is set to simulate 1000 to 5000 connections using Siege when the system load reaches 75% of the Moodle cluster. Compared to other counting-based scheduling schemes, our Dynamic Scheduling Indexes Scheme reduces elapsed time by 3.9% to 7.6%.

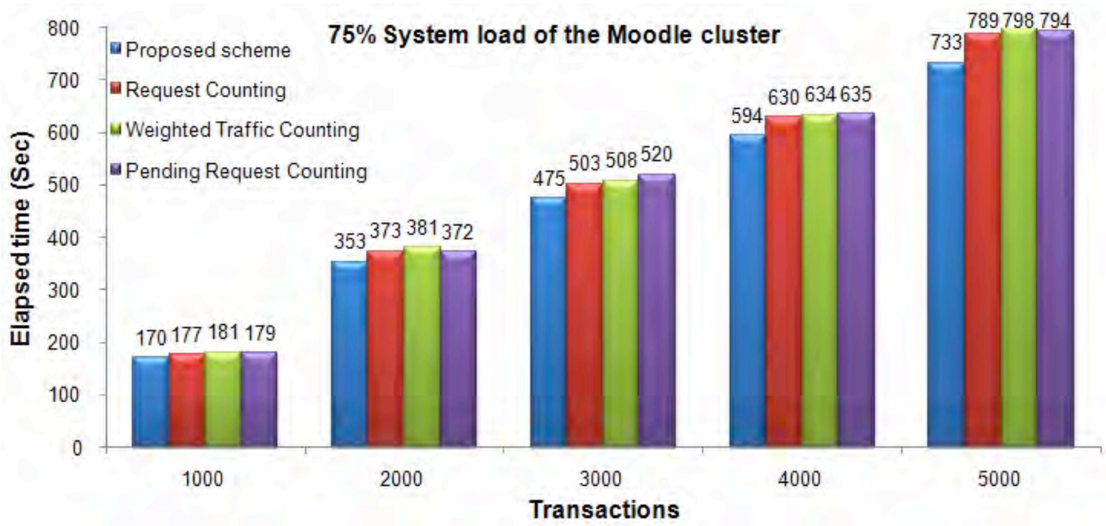

Figure 17: Performance comparison for the 75% system load

In Figure 18, the client is set to simulate 1000 to 5000 connections using Siege when the system load reaches 100% of the Moodle cluster. Compared to other counting-based scheduling schemes, our Dynamic Scheduling Indexes Scheme reduces elapsed time by 4.5% to 7.7%.

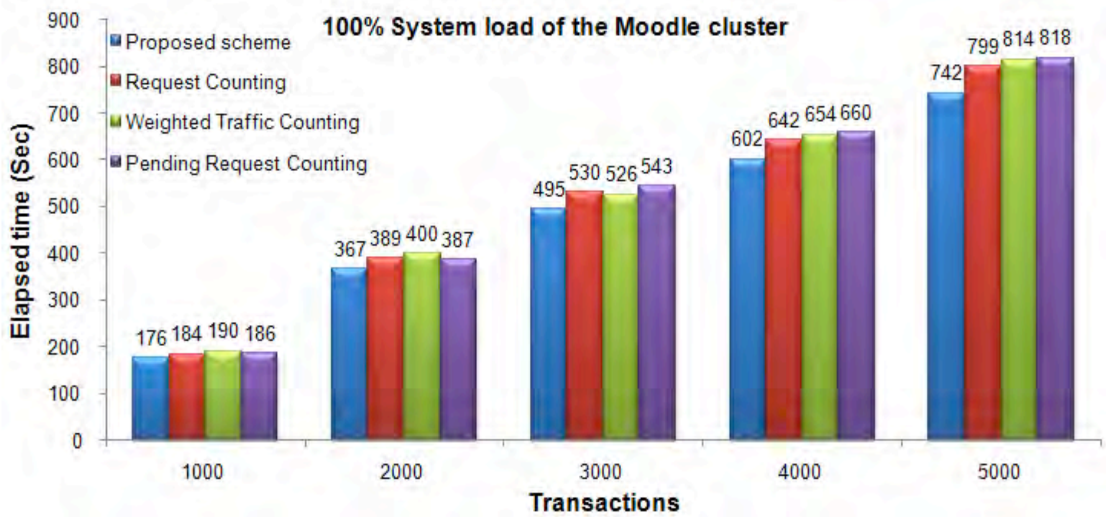

Figure 18: Performance comparison for the 100% system load

As depicted in Figure 19, as the load value and number of connections for available servers of the Moodle cluster increases, the performance of our Dynamic Scheduling Indexes Scheme improves correspondingly. This improvement is especially obvious in environments in which a higher amount of load value and connections.

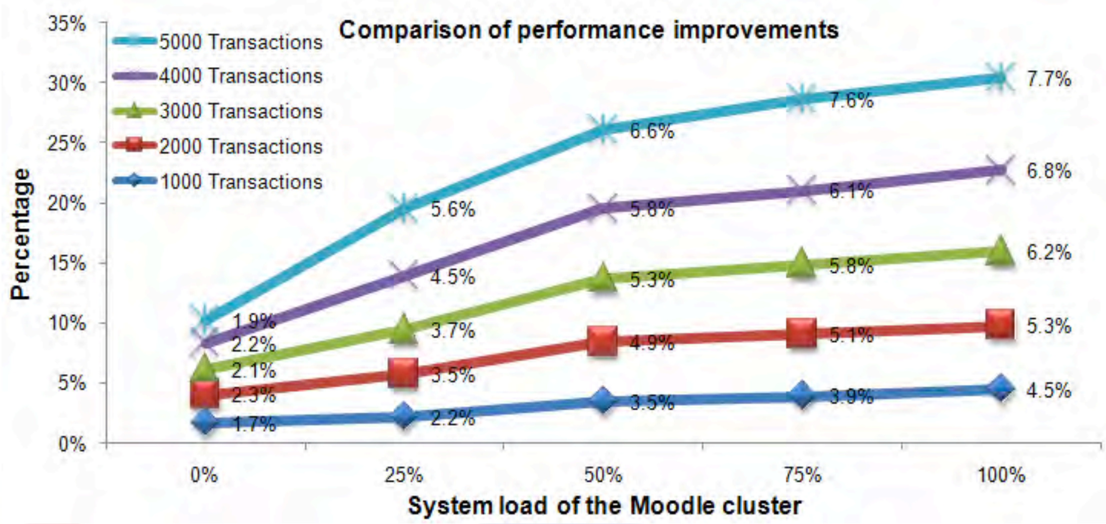

Figure 19: Comparison of performance improvements

5. Conclusion and Suggestions for Future Research

This paper contributes to these discussions because it presents a high-performance mechanism for dynamic scheduling and health checks of Moodle cluster that dynamically adjusts scheduling indexes allocated to Moodle servers at 60-second intervals. Furthermore, faulty Moodle servers can be removed in a proactive manner when the health checking mechanism is employed.

An analysis of our experimental data demonstrates that our Dynamic Scheduling Indexes Scheme shows relatively good performance when compared to Request Counting Scheduling, Weighted Traffic Counting Scheduling, and Pending Request Counting Scheduling. This scheme can improve the performance of the Moodle cluster and reduce the response time of client requests.

Suggestions for subsequent research based on this topic are as follows:
Additional parameters should be added to the load features: Our Dynamic Scheduling Indexes Scheme continually monitors load information for available servers within the Moodle cluster, including information concerning the load status of CPU, memory, and network bandwidth. However, other parameters, such as server response time and number of connection requests, also affect performance. Therefore, these factors should be included in future research to improve the accuracy of load forecasting.

The VM Live Migration mechanism should be added to virtual machines: When the load of a virtual machine attains a certain level, VM Live Migration can move the virtual machine in real time into a physical machine that has abundant system resources to improve overall operation performance.

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Building Future e-Classroom with Software and Hardware Integrations based on Web 2.0 Services

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Official Conference Proceedings 2012

Abstract:

This paper develops an e-Classroom system that integrates software services and hardware devices based on the proposed Web 2.0 learning portal (Edu 2.0). Three-facet integrations form the future e-Classroom environment. 1) To equip each traditional classroom with a low-cost interactive whiteboard (IWB), wiimote-based IWB software system (named with wkeIWB) is implemented based on open source libraries so that wkeIWB can be deployed in the classroom's computer. 2) The Edu 2.0 is implemented to automatically collect high-quality educational materials and digital contents from the Web, extract metadata and integrate them into significant and valuable learning objects. By organizing learning objects into "the General Guidelines of Grades 1-9 Curriculum in Taiwan", teachers can easily get teaching supplements recommended from Edu 2.0. Different roles of members like Administrator, Teacher, Student, Parent, and Volunteer can join the Social Network of Edu 2.0 so that these learning objects can be shared among members. 3) Integrating digital pens into the learning environment of wkeIWB and Edu 2.0, teachers can therefore easily assign homework to students who take practice with digital pens like traditional trainings on paper-writing. In particularly, the handwrite script is recorded by the digital pen and synchronized with Edu 2.0 through wkeIWB installed in the classroom computer. Consequently, teachers or volunteers can correct those works anytime and anywhere through mobile tablets connected the Edu 2.0, and students or their parents can realize the correction process on the Edu 2.0.

1. Introduction

The Problem of "digital divide" (Bélanger and Carter 2009) in education is original from the imbalance of resource allocations between urban and rural areas. Imbalanced budgets result in that schools within rural areas have much more money to buy hardware equipments like electronic interactive whiteboards (IWB). Consequently, almost each classroom is equipped with several computers, one or two projectors and one IWB. In other words, rural teachers and students have more opportunities to access technologies in the classroom. The vicious circle enlarges the gaps of digital divide between urban and rural areas. Although wiring classrooms and providing students with physical access to computers – normally desktops – has been (and, in fact, still is) either a way for institutions to bridge the digital divide or a way of measuring how deep and wide the digital gap is (Peña-López, 2010). However, software services facilitate the usage of hardware equipments in the classroom is more important to shorten the gap.

As governments worldwide increasingly implement e-government services, the potential impacts of the digital divide continue to grow (Bélanger and Carter 2009). The interlocking between access divide and skill divide is the major reason. *Access divide* is the lack of change to access the Internet and classroom-related technology, rural teachers and students are therefore hard to learn efficiently in the classroom. For example, IWB connected with computers makes more interactions between the teacher and students in the classroom. *Skill divide* is the lack of technical competence to operate computer hardware and software for finding information, sharing knowledge, or making decision. Obviously, the vicious circle of access and skill divides traps rural teachers and students into the weakness.

In this paper, we develop the Web 2.0 educational portal (**Edu 2.0**) to automatically collect web sites and pages, extract objects with metadata from web pages, and integrate them as learning objects. Based on metadata-based matching, Edu 2.0 organizes learning objects into the portal directory constructed from "the General Guidelines of Grades 1-9 Curriculum for Elementary and Junior High School Education in Taiwan". Based on the Grades 1-9 Curriculum, Edu 2.0 analyzes the related-metadata of each learning unit and recommends web contents as supplements of the learning unit. Based on Edu 2.0, the future e-classroom learning environment is designed with software integrations on hardware and Web 2.0 services in three facets.

- To upgrade each traditional classroom to e-classroom, IWB is the necessity. The best low-cost IWB solution is wiimote-based IWB software system. Therefore, we implement the *wkeIWB* based on the "Wii project" (Lee 2007) open source libraries. The source code of wkeIWB is maintained as an open source project in the OpenFoundry (Lin 2010) and can be easily deployed into the classroom's computer. In this way, the weakness of access divide in rural areas can be relieved due to using the wiimote-based IWB solution.

- The Edu 2.0 automatically collects high-quality educational materials and digital contents from the Web, extract metadata and integrate them into significant learning objects. By organizing learning objects into the Grades 1-9 Curriculum, teachers can easily get teaching supplements recommended from Edu 2.0. By integrating Web 2.0 and social network services into Edu 2.0, different roles of members like Administrator, Teacher, Student, Parent, and Volunteer can join Edu 2.0 to share or access these learning objects. Accordingly, users within rural areas can easily access learning materials and web contents from recommendations of Edu 2.0. Users can also easily share information and knowledge in this educational social network. Consequently, the problem of skill divide can be solved with software services provided by Edu 2.0.

- To attract more enthusiastic volunteers to contribute their effort in the student counseling, we integrate digital pens into the learning environment built by wkeIWB and Edu 2.0. In the future e-classroom environment, teachers can efficiently assign homework to students who will take practice with digital pens like traditional trainings of paper-writing.

2. Related Works

In this paper, we borrow ideas from Web 2.0 and social networks and apply data mining methods to build the Edu 2.0 web services on the cloud side. Based on the open sourced wiimote IWB, we build wkeIWB on the classroom side. Following studies are figured out to illustrate some surveys about the paper.

2.1. Web 2.0 and Social Network

The Web as a platform (Tim 2005) is the original idea of Web 2.0 and social networks, in which the website is not only a content channel for delivering information and messages but also an environment for users to publish contents, share experiences, and contribute the knowledge. The user-centric "interactive" and "sharing" features have upgraded the Web 1.0 to the Web 2.0 that consolidates geographically separated users to form various communities and social networks (Freeman 1978; Ressler 2006). The spirit of Web 2.0 is "share" rather than "proprietary" and focuses on "community" rather than "individual". New technologies and services from Web 2.0 provide users to easily study online that also create opportunities for educational and learning practices. Borrowing ideas and models from successful Web 2.0 sites helps us to think the model of Edu 2.0.

2.2. Wiimote-based Interactive White Board

In the end of 2006, the home video game console, Wii, was released by Nintendo. The Wii Remote, or wiimote for short, is the primary controller for the console. Wiimote uses a combination of built-in accelerometers and infrared (IR) detection to sense its position in 3D space when pointed at the LEDs within the Sensor Bar. Through the embedded Bluetooth, wiimote connects to the console and continuously sends data to the system. Based on the wiimote, in 2007, the CMU Ph.D. student, Johnny Chung Lee, applied the open source "Managed Library for Nintendo's Wiimote" to invent the new technology "Low-Cost Multi-point Interactive Whiteboards Using the Wiimote (Lee, 2007)", or called wiimote IWB for short. Lee also opens the key technology and source code, Wiimote Whiteboard v0.3. Nowadays, millions users and developers experienced the low cost IWB.

Wiimote IWB consists of a wiimote, IR pens (supporting maximal 4 pens), a PC or notebook with Bluetooth receiver, a projector, and the wiimote-based IWB software to build the IWB environment. The original design of wiimote is using IR camera to sense fixed IR LEDs connected with the console. In this way, the position data can be computed and sent to the console through Bluetooth.

Lee exactly utilizes the opposite approach by setting the fixed wiimote to cover the whole screen or projection area. As the same with handwriting on IWB, turning on and moving IR pens on the screen, the wiimote continuously receives IR position data and sends to the PC through Bluetooth. By calibrating four corners of the screen and the relative position of wiimote, the software program can simply calculate the IR position on the screen so that the mouse function can be easily simulated through the IR pen, like using the digital pen of the Tablet PC. Therefore, using any computer and projector, a wiimote, an IR pen, an USB Bluetooth, and the open source software, the traditional classroom can be upgraded to the e-classroom equipped with IWB, as shown in Figure 1.

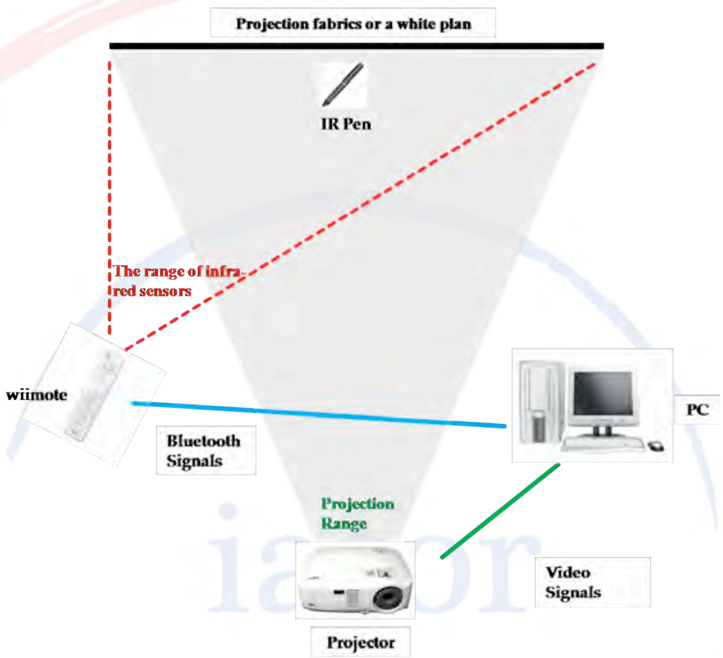

Figure 1: Components of the wiimote IWB.

2.3. Learning on/from the Web

Traditional classroom learning environment is a static learning model that few interactions happen between teachers and students. Teachers use textbooks, instruct the course with oral transmission, and write information on the blackboard or whiteboard. Then students listen to the voice, watch the board and textbooks, and take notes for important parts. In such a passive and static learning model, supplements of a lesson are restricted to textbooks and the teacher's domain knowledge. Without exciting materials related to the lesson or fresh teaching tools, teacher-student interactions seldom happen. Even the teaching history and interaction can not be recorded for sharing to the Web.

The exponential growth of the Web with facilities provided by community servers, search engines, content portals, electronic libraries, multimedia streaming servers, etc. has a revolutionary impact on the learning environment. These radical changes in learning needs and technology are fueling a transition in modern learning in the era of the Internet, commonly referred to as "e-Learning". Therefore, e-Learning can be defined as the use of computer network technology, primarily over an intranet or through the Internet, to deliver information and instruction to individuals (Welsh et al. 2003). Integrating traditional classroom learning with web technologies and models will upgrade the passive learning model to the active model. The Web has the capability of providing the whole world of knowledge and allowing teaching and learning online and ubiquitous. Web contents like educational flash games, YouTube videos, digital archives for various disciplines, and many qualified documents (blogs, photo, Q & A, etc.) enrich teaching and learning materials of a lesson. With fresh and exciting materials, such as an interactive flash game for teaching the Mathematics “addition”, students are interested in the class. As mentioned in the comparison table of traditional classroom learning and e-Learning models (Zhang et al. 2004), e-Learning environment emphasizes learner-centric activity and system interactivity so that remote learners can benefit from the ubiquitous learning model. However, without “face-to-face” instruction, e-Learning lacks for immediate interactions and feedbacks for learners so that some advantages of traditional classroom learning become drawbacks of e-Learning.

With the growth of the Web 2.0, e-Learning integrates the concept of Web 2.0 that more emphasizes on “interactions”. Users use a variety of interactive tools and social networking software to teaching and learning. Learners use the learning tools to learn and practice, then teacher or Web 2.0 volunteer analysis the learning process to realize the problem of learning and feedback to learner. Thus, e-Learning initiatives can require considerable investment in both information technology (IT) and staff (Welsh *et al.* 2003).

To take advantages from traditional classroom learning and e-Learning, the *e-classroom learning* model is proposed in this paper by supporting the software-based Interactive WhiteBoard (IWB) tools and Web 2.0 services.

3. Ideas and Methods

The kernel service, Edu 2.0 platform, is designed to effectively integrate web resources into the e-Learning environment. Based on the Edu 2.0 center, borrowing techniques from wkeIWB, mobile applications, and digital pens, the e-classroom system facilitates students, teachers, and volunteers to participate, share, and contribute their efforts in this social network as shown in Figure 2.

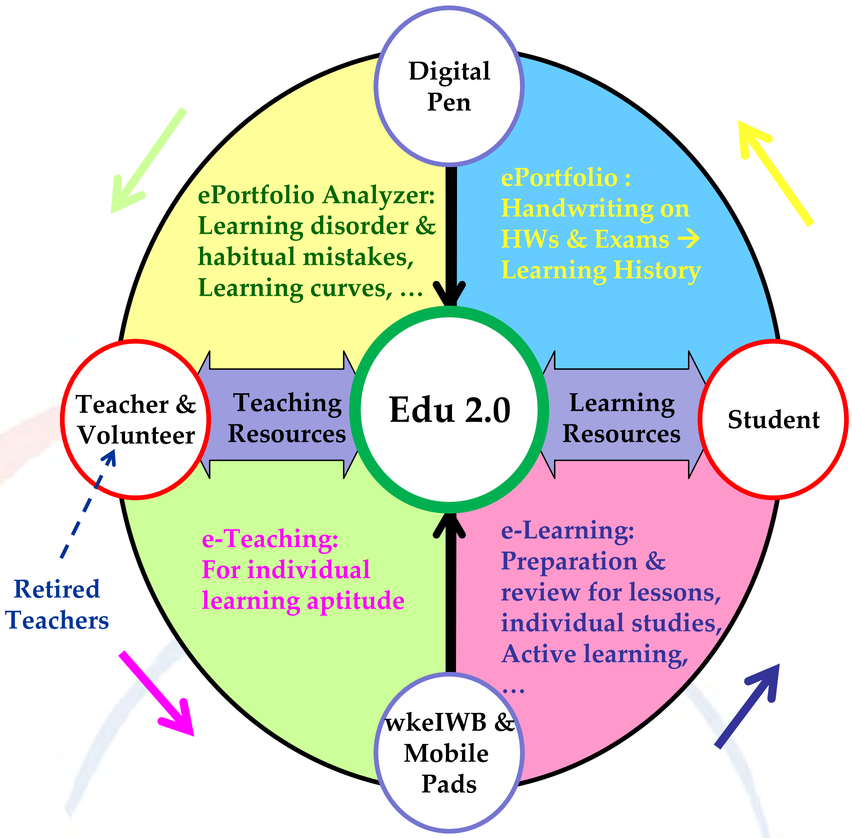

Figure 2: The conceptual design of Edu 2.0.

- The *Edu 2.0* is the core system that provides Web 2.0 and social network services. It consists of a meta-search system for crawling web resources, an information system for storing and managing metadata, a data mining system for extracting metadata knowledge of learning objects from the web, a recommendation system for delivering and recommending related learning objects, an account system for managing Web 2.0 users and groups. Basically, there are five groups (roles) in Edu 2.0: *School*, *Teacher*, *Student*, *Volunteer* and *Parent*. But new roles can be created as needs. Functions and services provided by Edu 2.0 include scheduling the school calendar, preparing lessons from recommended web resources, synchronizing with e-classroom software modules, previewing and reviewing lessons, storing and sharing teaching videos, managing homework written by students with digital pens, and matching volunteers with students for counseling.

- The *innovative teaching tool* (embedded in *wkeIWB*) is implemented to be installed in the classroom. 1.) The wiimote-based IWB improves the teaching and learning environment and upgrades the traditional classroom to e-classroom with very low cost. By installing the client-side software wkeIWB into the computer of each classroom, the e-classroom is equipped with facilitates for using IWB and accessing Edu 2.0 services easily. 2.) wkeIWB synchronizes with Edu 2.0 services so that teachers and students in the class can easily access relevant learning materials. 3.) wkeIWB implements several teaching tools such as whiteboard tools, Instant Response System (IRS), and screen recorder, therefore it is very convenient to store the teaching history and share on Edu 2.0 for students and parents. 4.) Teachers can assign homework through Edu 2.0 or wkeIWB, and students can print the homework and write with digital pens. These homework scripts stored in digital pens can be automatically upload to Edu 2.0 through wkeIWB. 5.) wkeIWB is implemented with Qt SDK (a cross-platform application and UI framework, http://qt.nokia.com/) and can be easily customized and designed for tablet devices (iPad, Win8 or Android tablets) used by teachers or volunteers.

- *Digital pens* like Livescribe (http://www.livescribe.com) or Anoto (http://www.anoto.com/) are integrated into the future e-classroom environment. A digital pen looks, feels and writes like a normal ballpoint pen. However, it contains an integrated digital camera, an advanced image microprocessor and a mobile communications device for wireless connection (Anoto 2012). From ink to digital data, the digital pen is a quick and easy method to digitize traditional handwrite trainings. Consequently, digital pens facilitate the software integration in the e-classroom since the learning and training process of a student become recordable.

- *Student* and *Teacher* (or *Volunteer*) on the two sides of Edu 2.0 are major users of the e-classroom system. Student can obtain lesson supplements recommended from Edu 2.0 and take practice with digital pens that transparently accumulate the student's e-Portfolio. Teacher can prepare lessons by referring supplements recommended from Edu 2.0. On aid of the e-Portfolio Analyzer, teacher or volunteer can efficiently and effectively realize the learning curves of a student.

4. The System – Future e-Classroom

4.1. Edu 2.0 Services

The system architecture of the Edu 2.0 platform is shown in Figure 3. Using well-known meta-search engine and crawler technologies, Meta-Crawler is designed and implemented to rapidly collect domain-related (the educational domain) pages from search engines and educational sites. The Metadata Extractor is applied to elicit metadata from these pages based on metadata attributes defined and labeled by educational experts. In addition to using web browsers to interact with Edu 2.0, users can also use wkeIWB installed in e-classroom to access Edu 2.0 services. In this way feedbacks are transparently stored into Edu 2.0. Extracted metadata form attributes of the learning objects, which is the minimal granularity managed in the system. Edu 2.0 Catalog Fusioner is proposed to integrate learning objects into the ontology that constructs the knowledge framework of the system. Therefore, learning objects related to lessons defined in the Grades 1-9 Curriculum can be retrieved by or recommended to users. Before the new semester, school administrators access the scheduling services, provided by Edu 2.0. Hence, teachers and students can see their personalized calendars of a new semester. Accordingly, the e-Learning environment supported by Edu 2.0 will join teachers, students, parents, and volunteers together to build the Edu 2.0 Social Network, in which many communities and creative teaching and learning models may be invented in the future.

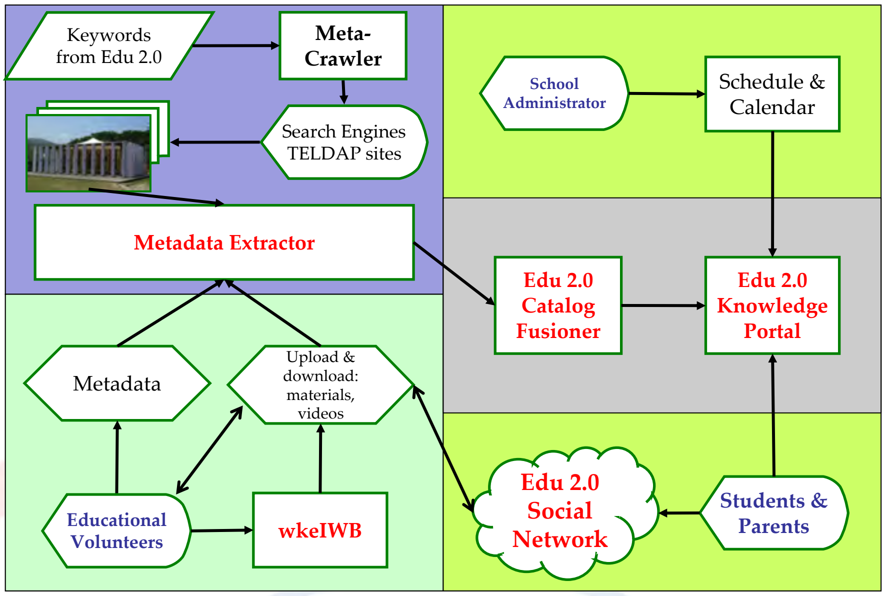

Figure 3: The Edu 2.0 platform.

Edu 2.0 is proposed to integrate educational resources and materials from web resources and educational sites. Different from the directory structure used by general portals, “the General Guidelines of Grades 1-9 Curriculum for Elementary and Junior High School Education” is employed as the knowledge framework from the educational perspective. The other reason supporting the Curriculum is that educational researchers have spend a lot of time in formulating the concept hierarchy with metadata from several facets, such as “Curriculum Goals”, “School-based Curriculum Development”, “Curriculum Evaluation”, “Learning Stages”, “Academic Attainment Indicators”, “Core Competence”, “Competence Indicators or Benchmarks”, etc. However, reading the details of the Curriculum and acquiring the knowledge into the ontology of Edu 2.0 is a tedious work. In this paper, our programmers cooperate with educator to do the whole knowledge engineering process to extract data and knowledge from dozens of documents from the Ministry of Education site. Consequently, the knowledge is finally transformed into the ontology of Edu 2.0. By automatically extracting keywords or key-phrases from textual descriptions within these metadata, extracted educational materials can be matched as recommendations of some learning unit defined in the Curriculum. Following three-phase processing policy is applied to mine educational resources from the web and fuse metadata into organized learning objects.

- Phase 1 - **Domain Data Collector** (**DDC**): By inputting several domain keywords about education such as, grade 1-9 (九年一貫) or textbook (教科書), the meta-search and crawler techniques are employed to rapidly collect tens thousands web pages from search engines like Google or Bing. By parsing large amount of pages, significant educational websites are identified based on statistic counting on hostnames and selected by educators. Basically, websites about educational content providers, national e-learning and digital archive projects and textbook publishers are identified and the whole site is set to be fully crawled. Special websites like Wikipedia and YouTube are also identified and set to "specific content site".

- Phase 2 - **Domain Metadata Extractor** (**DME**): By crawling and parsing millions educational pages, the system has accumulated enough text indices about the educational domain. Then, Phrase Extractor is applied to automatically extract phrases, in which high-frequency key-phrases are presented to experts and carefully selected as metadata attributes. For example, domain of class (科目), teaching plan (課程計畫), unit (單元), capability (能力指標), teaching goals (教學目標), and teaching activity (教學活動) were extracted and set as attributes. Based on these metadata attributes, Metadata Analyzer mines the regularities of HTML tag patterns and texts to extract metadata (attribute-value pairs) from these pages.

- Phase 3 - **Domain Knowledge Fusioner** (**DKF**): Two Metadata Fusion (MF) methods, Concept-based MF (CMF) and Object-based MF (OMF), are applied to fuse several metadata extracted from pages into the same learning object. CMF attempts to merge metadata with similar textual meanings. For example, some metadata objects can be merged into the same learning object due to similar meanings on the attribute "title". OMF tries to merge metadata extracted from pages that share common in-links or out-links.

4.2. Software-based e-Classroom

In our past studies (Yan *et al.* 2010), we already carried out the very low-cost IWB solution, wkeIWB, which is an open source project (Lin 2010). Therefore, traditional classrooms that were already equipped with one computer and one projector can be easily upgraded to e-classrooms with very low-cost on buying a wiimote, a DIYed IR pen, and a optional USB Bluetooth as shown in Figure 4. Based on wkeIWB, we furthermore enhance the e-classroom software with following functions.

Figure 4: Upgrade traditional classroom to e-classroom with wkeIWB.

- *Adding whiteboard modules*. Functions such as drawing pens, shapes, text blocks, magnifier, and snapshot, widely used in IWB are developed and integrated into wkeIWB.

- *Integrating services of Edu 2.0 into wkeIWB*. By synchronizing with Edu 2.0, supplements about the on class lesson can be preloaded into the classroom computer. It's convenient for teachers to instantly obtain contents prepared in his or her teaching plans.

- *Customizing teaching tools for lessons*. Using the school calendar in Edu 2.0, wkeIWB can acquire needed teaching tools (whiteboard modules) for the on class lesson. Therefore, teachers can easily access various triangle shapes for the lesson "trigonometric function".

Based on software integration, more and more creative ideas can be initiated by users and implemented by us. For example, teachers can upload their teaching videos for the whole or partial class to YouTube through wkeIWB. Those videos with metadata mined and fused into Edu 2.0, members can share more and more valuable videos, contents, information, and teaching plans in this social network.

4.3. The Future e-Classroom

Based on the Edu 2.0 on the cloud side and wkeIWB on the e-classroom, the future e-Classroom learning environment facilitates several users by integrating hardware devices, social network members, and traditional learning and training policy with software systems. The application scenarios are illustrated as follows.

- *School administrators* can easily set teacher accounts, assign courses and classes, set the calendar through web services provided by Edu 2.0. The system is able to remind administrators doing these SOP tasks before every new semester.

- *Teachers* prepare lessons before classes with the aid of Edu 2.0 by reviewing recommended web resources for lessons. While teaching in the classroom, wkeIWB synchronizes with Edu 2.0 to preload contents and tools for the upcoming lesson. Teachers also use wkeIWB or Edu 2.0 web services to assign homework practices to students. The system keeps records of grades for each student and analyzes the student's learning history and curve since all practices are done with digital pens.

- *Students* can preview supplements prepare by teachers before class. After class, students can also review videos of the class with their parents. By taking more practices with digital pens, correcting homework becomes heavy load for the teacher. We propose the innovative volunteer model and achieve the model with software systems.

- *Volunteer*s are enthusiastic at counseling students, but they are suffered from teaching students face to face and on specific time and place. The volunteer model is an online and ubiquitous model for counseling students based on the system proposed in this paper. On the student side, using digital pen insists on keep the traditional pen-writing trainings, however the hand script is recorded and digitized so that software-based integrations become feasible to carry out the ubiquitous volunteer model. In particularly, the handwrite script is recorded by the digital pen and synchronized with Edu 2.0 through wkeIWB installed in the classroom computer. Consequently, teachers or volunteers can correct those works anytime and anywhere through mobile tablets connected the Edu 2.0, and students or their parents can realize the correction process on the Edu 2.0. By re-implementing wkeIWB facilities and functions into the mobile tablet platforms, such as iPad, Android or Windows 8 tablets, the ubiquitous learning, training, teaching and counseling environment is becoming feasible.

5. Conclusion and Future Work

In this paper, we propose the model and application for build future e-classroom based on software integrations on hardware devices. In the future e-classroom environment, teachers and students can easily access learning materials recommended by Edu 2.0. Teachers would have zeal for preparing lessons with supplements. By integrating with wkeIWB software installed in the classroom, teachers can easily get those supplements in the classroom while they login the Edu 2.0 through the classroom computer. In this way, more attractive contents with interactions between teachers and students are fused into the classroom environment through facilities provided by Edu 2.0 and wkeIWB. While using wkeIWB, recording the whole teaching history during class becomes trivial, these teaching stories can be encoded into videos and automatically uploaded to YouTube and share on Edu 2.0. Using the successful Web 2.0 model like YouTube, teaching experiences, plans and videos can be shared to anyone anytime anywhere through Edu 2.0. Teacher peers easily share and learn teaching plans and instruction videos for improving the teaching ability. Students can find adequate learning solutions for different learning units or lessons from various teaching plans and videos. Parents will have confidence in teachers by realizing their teaching processes through videos. In this way, Edu 2.0 will attract more and more web volunteers and users, in which teachers contribute their teaching heuristics and students or parents contribute their feedbacks while learning on Edu 2.0. Consequently, the proposed solution in this paper achieves the virtuous circle to seal the digital divide problem.

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Translations of terminologies defined in the Grade 1-9 Curriculum Guidelines is available at http://teach.eje.edu.tw/9CC/about/about3.php.

The Using Of Facebook as a Medium of Learning in an Effort to Improve the Student Learning Outcomes

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Abstract:

So far, Faceb
So far, Facebook is known as one of the sites of friends / social networking on the internet, which was launched on February 4, 2004. In 2011, have been recorded more than 600 million people in the world using Facebook. Associated with features-owned by facebook, this paper will discuss the use of facebook as a learning media of teacher and student in the classroom in an effort to improve learning outcomes. What teachers should be prepared to use Facebook as a medium of learning, what should the students do to the media, how to evaluate learning, whether there is a significant improvement of learning outcomes after apply Facebook as a medium of learning? The results of this discussion shows that through the learning medium by use Facebook, in addition to improved learning outcomes, teachers can provide opportunities to student assist and support other students. Also, building a group or join a group that founded / created by their friends, especially in distributing tasks, discuss assignments, collaborate doing group assignments and projects in an online environment and to improve both teacher-student interaction and students in the form of web-based communications.

Introduction

Among a number of services available on internet, with which nowadays tend to be very widely used to communicate, is a form of social network service *FaceBook (FB). We* know that FB serves to establish online community for those who would like to share interesting experiences or daily activities. By means of this social network, people can show their expression, communicate with friends or business colleagues, and also expand networking by inviting or being invited in a friendship. *FB* describes itself as a "social utility that connects people with friends and others who work, study and live around them" (*FaceBook*, 2009). *FB* is also equipped with bulletin boards, instant messaging, email, and the ability to post videos and pictures. As one type of virtual communication, FB has a number of benefits. Among of them, in accordance with characteristics of virtual world, are: it is quick and easy; It also serves as communication that can be done in real and unreal time, in an individual or group and in various amount and types of texts, voices, and picture messages or even combination of those three.

According to Susilo (2008), there are four important factors that influence learning in communities, they are: 1) interactivity that means the way in which the group dynamics of interactive, networked, learning communities are seen as desirable for educational philosophies that emphasize student-centered as opposed to teacher directed learning. 2) opportunities for collaboration, that means through enhanced collaboration, learners become involved in learning activities that are associated with a social network, which provides them with greater motivation and opportunity to articulate, discuss, and reflect on their learning strategies and the changes within themselves. 3) Learning cannot be adequately facilitated, therefore, solely by introducing learners to prototypical or decontextualized concepts, even when they are well defined and 4) Sustainable Learning Environments continuous learning comes to be seen more and more as a necessity for almost everyone in our rapidly changing and increasingly global society, the demand for more flexible educational environments increases accordingly.

In particular, networked learning communities have attracted the attention of educators partly due to the growth of on-line learining in which the learning process is supported by interaction via a computer network (Goodyear, Salmon, Spector, Steeples & Tickner, 2001). Hence, *FB* provides students opportunities to help and support one another by either establishing their course group or joining the established groups made by friends. FB also increases both teacher-student and student-student interactions in web-based communication. *FB* helps instructors get more connected with students on distributing assignments, upcoming events, useful links, and samples of work outside classrooms. Students can also use FB to contact classmates on discussion about class assignments or examinations as well as to collaborate on doing assignments and group projects in online environment. Building the face-to-face and teacher-student relationship, social networks allow students to glimpse instructor profiles containing their personal information, interests, background, and "friends," which can enhance students' motivation, affective learning, and classroom climate (Mazer, Murphy, & Simonds, 2007). In addition, FB can positively impact students life, because students can use FB to contact other students concerning course assignment, group poject or teachers contacting their students regarding useful course links (Munoz & Tower, 2009).

In relation to classroom environment, teachers have to manage their learning to the optimum in order to achieve maximum learning outcomes leading to quality learning. One of activities to carry out is assigning students to complete off school hours of which steps should be embedded in an overall effort to achieve the quality learning. Giving assignments to the students is considered important, given the content of the lesson material felt quite a lot, while the allocation of teaching time in schools is quite limited. For that assignment is performed as an alternative teaching method if the number of teaching materials is not equal with the available time (Djaramah, 2006).

In an effort to improve optimum learning outcomes, it is important for teachers, along with digital literacy era, to be able to utilize and follow current technological development which, in this sense, refers to FB. They can early introduce the use of this technological application, as means of supporting the learning process, by initially training and directing students on how to operate it to get them used to it. Using FB, teachers can upload assignments for students to complete thus it enables student-teacher engagement in an online setting. Therefore, it is recommended that teachers have mastery in this technological literacy in line with student needs to help student always update their learning process.

Based on the above explanation, this paper will focus on the use of FB as a learning medium in an effort to improve student learning outcomes; steps to be prepared by teachers and students on what to do, especially for distributing and discussing tasks.

Steps to Use *FB* as a learning medium

According to Caroline and Towner (2009), there are steps of using *FB* for medium of learning. Firstly, an instructor should create an additional *FB* profile for professional use only. The additional FB itself should be entirely separated to their social/other FB for privacy. This professional-use *FB* should contain contact information, especially an email address, office address, and phone number. Secondly, to get connected with students, the instructor must inform students that they have an *FB* profile for a special group or class or subject. Then, the instructor can simply list web links on their *FB* profile in their course syllabus, email signatures or other course management software. Thirdly, to get students started the *FB*, the instructor should create an icebreaking activity, i.e. a posting a topic to solicit student discussion or inserting a video accompanied with study questions, to help develop a classroom community and establish positive relationships. Fourthly, when integrating *FB* into their courses, the instructor should designate student involvement on *FB* as an option as not all students are registered users, and provide students other alternatives. Lastly, it is suggested that instructors post pod costs, websites, and videos on *FB*, also use Google Documents, link students to study guides, *power point f*iles, assignments, and tutorials. The instructor can contact students on *FB* by sending messages, posting comments on "*wall*" or chatting during virtual office hours. By increasing student involvement through communication and community, instructors can tailor their courses towards a variety of learning styles.

Generally, from the above explanation, the important thing to be considered is the readiness between teacher and student to use *FB* as a learning medium. Therefore, Iriani (2011) suggested that to using FB, not only the ability and understanding on important factors in using *FB*, but also the substance materials become very important on how and what the concepts, principals, procedures, or facts are so that the objective of learning itself can be obtained well.

Application of FB as a learning medium

FB as a medium for giving students assignment is carried out by utilizing group facilities available on this site. FB is selected because it is the site students most favor, and almost all of them has had the account. FB has more complete facilities than any other social networking sites i.e. Twitter, so that its application becomes easier and more diverse. Hence communication and interaction between student-teacher in task completion will run easily. By having a frequent access to FB, students will find it useful in the attempt to share information with the absence of space and time limit. Thus the interaction would continuously form its shape.

Previously explained, FB has also been used as a support in the learning process. Existing facilities in FB will be utilized to create group of subjects. The group functions as a medium for giving students tasks to promote interaction between student-student and student-teacher on the task and subjects discussed. Differentiated tasks can be assigned to each group of students and uploaded to FB. Students complete the tasks by sending the answer via email as an attachment in Microsoft Word file. Students will fully make use of internet network in this sense i.e. they find their tasks on FB, look for the answer by means of internet investigation, and complete the task by sending the answer via email. It aims to make students more active in figuring out the tasks assigned to him, exploring the learning source, and deciding the problem solving. To perform such activities, students are motivated to have a discussion with other the teacher and classmates. The detailed implementation of FB in this study based on Indrawati (2012) is as follows:

1. Create a group of subjects specified in the teachers FB account.
2. Then add all students in a class taught to the group. Because the majority of students rarely want to be friend with the teacher at this sort of site, the teacher selects two students who have been friends with the teacher as an administrator to manage the group. The administrator here can add and/or approve friends in his/her FB account as a member of the group. Here the group will serve as a medium, where teachers and students can meet and have interaction with the absence of prior acquaintance.

3. Having all students joined the group of subjects, teachers can perform task administration. It might be either material or drawing tasks. The material task is posted by typing the problems on either the status or documents available in the group. In addition to the material posted, it should also include instruction to deal with the problems, along with the contact email to send the answer, the deadline to submit the answer as well as plus minus points to motivate students. A column to leave a comment is provided below the status and the document or photo bars. This column can serve as discussion thread. All groups can read any posting i.e. questions, answers, and discussions in this column. Besides, it is also possible to open a chat among members of the group in order to boost better communication. Some requirements of the course can also be posted on FB feature i.e. plus minus points, submission deadline to excite students with the given task. They are parts of tasks administration program arranged in such a way.

4. A task is assigned previously and followed by a question answer session in a classroom setting for teachers to welcome and respond to student inquiries. Teachers ask questions referring to the given task. Students answer the questions based on what they have been working on the task. Teachers would correct the less accurate answer then give and explain the accurate one. This task is assigned in a group of students. Students of different groups are welcome to help give the accurate answers by working collaboratively among its members. After a series of tasks has been proportionally assigned, a summative test is then administered as an evaluation.

The results of a study conducted by Indrawati (2012) at 60 middle school students showed that a positive and significant relationship exists between the effectiveness of Internet use on student learning outcomes especially with the use of FB which showed a significant influence on its application in terms of task administration. Learning process does not have to only occur in a classroom, yet it should enable students to freely do the work with no fear of being sent to school. Such facilities FB offers will promote cooperation, curiosity, learning independence, creativity, and motivation to encourage active students to complete their work. They also promote mutual communication between students and teachers.

Indrawati (2012) reported that 71% of the respondents (students) claimed to see the task through FB and at the same time look for answers through the search engine on the internet. Communication between respondents who had collected the task, made the respondents always feel motivated to do their job immediately.

With varied facilities available on FB, it can meet the needs for information, communication and interaction. The messages, wall, comment and chat on FB feature can be made useful for students to have discussion among friends, help each other complete assignments, share links and build cooperation as all evidently ranked the highest percentage. The use of FB facilities proves that FB has potentially given aid in eliciting discussion, disseminating information and engaging student when performing a given task. This is in accordance with Mazer et.al (2007) pointing out that student can also use FB to contact classmates for discussion of a class assignment or examinations as well as to collaborate on tasks and projects within the online environment. Regarding the use of FB in the learning process Susilo (2009) pointed out there are three important aspects a system would need to take to prove that FB is more valuable when used continuosly throughout a course as an integral part of the learning experience. First, Reflection (the student can map out his or her throught on a course, a piece of work or more general experience); second, Communication (the student can communicate his or her reflections to other student, tutor and teacher) and third, Sharing (the student can give selected other users access to their digital objects).

Finally, FB could be an alternative instructional medium while traditional instructional communication in classroom setting has always been at a premium. When delivering an instruction off class by means of technology, it is important that teachers be familiar with its application and techniques to support students and promote communication and engagement between students and teachers.

Conclusion

The development of FB as an online social network has been widely expanded. Not only does FB be beneficial to establish a wide interaction due to its speed and practicality but also it serves as a medium for teacher to improve student learning outcomes. Owing to FB, learning might not only take place in a classroom environment. FB can ease students to work on their assignments in an online setting and leave their fright of staying hours at school behind. In addition, FB can promote cooperation, curiosity, learning independence, creativity, motivation and encourage students to be more active in working on their academic task while enhancing communication between student and teacher at the same time. In conclusion, all benefits FB brings about have led to improving student learning outcomes to the maximum.

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Storybook Cover Metaphor to Facilitate Young Children's Online Book Searching

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Abstract:

Young children love to read their selected storybooks and consequently engage more with the reading processes that contribute to the development of interest and lifelong readers. However, the rapid growth and abundant types of digital contents accentuate the need to improve youngster's processes of online browsing and searching from a digital library since traditional keyword-based search techniques for adults hardly fulfill youngster's information-seeking requirement. Young children's limited vocabulary and Boolean logic skills may particularly prevent them from selecting and combining effective search term in finding appropriate information. The purpose of this paper is to develop an intuitive book-searching query interface for youngsters to facilitate book searching. The proposed interface uses storybook cover metaphor, which enables young children to drag-and-drop story's characters and scenes on a virtual book cover to depict the cover content of target storybooks. The book-searching interface will suggest digital storybooks based on the dropped characters and scenes with an order that displays the best match books in the top. A pilot study which included 8 young children was conducted to explore the usability of the interface. Participants were shown four storybook covers and asked to find them with the query interface from a digital library containing about 150 storybooks. Results shows participants could identify characters and scenes from the storybook covers and find the target storybooks. Almost all participants constructed their virtual book covers by firstly arranging story characters and lastly establishing scenes. They all felt the searching activity was fun and the query interface was useful.

Introduction

Access to books and reading activity has shown their improvement in young children's language literacy development (Neuman, 1996). Among activities in formal vocabulary instructions or informal parent-child reading, storybooks have especially demonstrated their importance to enhance children's vocabulary word meaning or reading literacy (Baker, Mackler, Sonnenschein, & Serpell, 2001; Biemiller & Boote, 2006). Regarding to choosing storybooks, children love to read their selected books and consequently engage more with the reading processes that contribute to the development of interest and lifelong readers (Kragler & Nolley, 1996; Swartz & Hendricks, 2000).

Statistics shows, in 2010 over 53% of U.S. children age 5-9 and more than 79% of children age 10-13 used the Internet (NTIA, 2011). The rapid growth and abundant types of digital contents accentuate the need to improve youngster's processes of online browsing and searching (Hutchinson, Bederson, & Druin, 2006) since traditional keyword-based search techniques for adults hardly fulfill youngster's information-seeking requirement (Druin, 2005; Liu, Nakashima, & Ito, 2007). However, most of search interfaces for digital libraries involve a set of categories or text entry boxes where keywords or Boolean operators can be typed. These categories help readers select relevant information by examining the relationship between categories and their target information. This approach requires readers to have sufficient knowledge about these categories. On the other hand, searching by keywords involves the combination of keywords and Boolean operators, which requires sufficient domain knowledge, vocabulary and the use of Boolean operators.

Bruckman and Bandlows (2003) pointed out that dexterity, background knowledge, and interaction styles may differentiate interfaces designed for kids from those for adults. Among these characteristics, dexterity refers to how well young children can control interactive devices. Devices that require the ability of fine motor control may be difficult for children to use. Background knowledge may influence the choice of interaction metaphors. When unfamiliar metaphors are used in interfaces to young children, they might have difficulties to use or need to learn the interfaces. Finally, young children have brief attention span and are easily distractible. Audio, graphics, or animation may attract their attention and improve their engagement. Since most digital library interfaces are designed for adults, young children have difficulties to use the interfaces for their information need. Young children's limited vocabulary and the need of search strategy formulation and Boolean logic skills may particularly prevent them from selecting and combining effective search term in finding appropriate information (Bilal, 2000; Large & Beheshti, 2000). These difficulties can limit children's ability to find information and impair the possibilities for cognitive and social development (Druin, 2005).

The purpose of this paper is to develop an intuitive book-searching query interface for youngsters to facilitate query formulation. The interface uses storybook cover metaphor, which enables young children to drag-and-drop graphic keywords on a virtual book cover in order to depict a book cover of target storybooks. The book-searching interface will suggest digital storybooks based on the dropped graphic keywords with an order that displays the best match books in the top of search results.

Storybook cover metaphor query interface

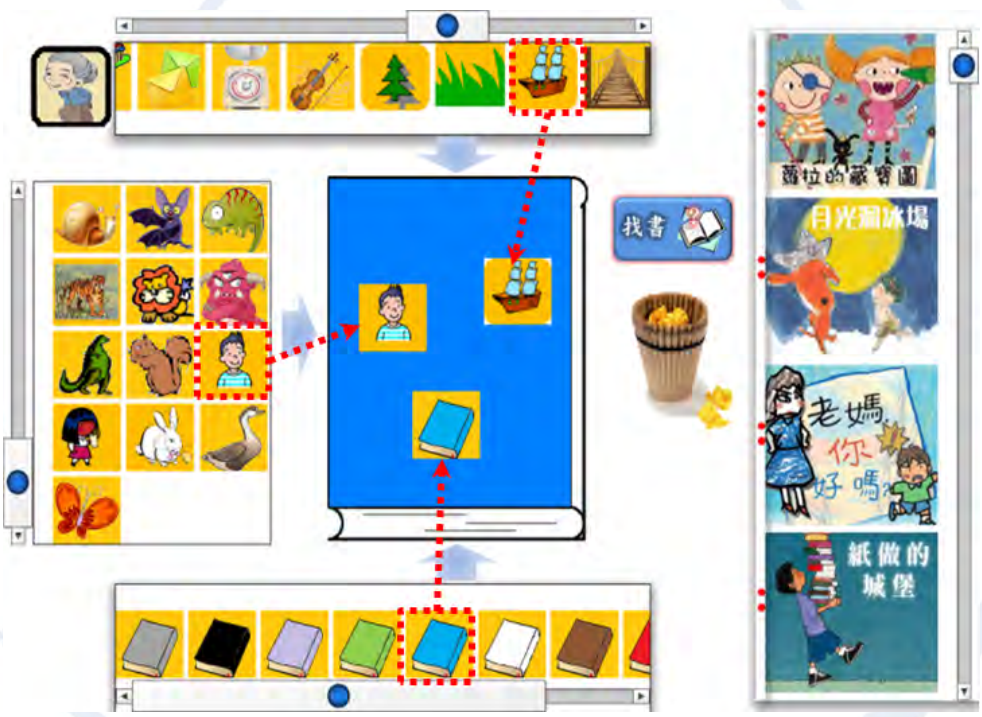

Figure 1. Composing a storybook cover for book searching

As shown in Figure 1, the storybook cover metaphor query interface is mainly divided into two areas. The area on the left of Figure 1 is an editable book cover surrounded by different classes of graphic icons. The other area on the right of Figure 1 is the search result which suggests matched storybooks based on children's imaged storybook covers. Children drag-and-drop graphic icons on the editable book cover to composite their imaged book cover. To specify a main character in a story, children select appropriate icons from the menu on the left by the editable book cover. They also can drag icons on the top by the editable book cover to represent scene of a story. Finally, young children can change the background color of editable book cover by selecting graphic icons on the bottom by the book cover. For example, a child wants to find storybooks about a boy's adventure on a sea (see Figure 1). The child first drag-and-drop a boy icon and a ship icon on the editable book cover. The child then selects a blue icon to color the imaged book cover. The query interface will suggest storybooks of blue background color which have boys or ships in a storybook cover. Children can pick their favorite storybooks by examining the characters, scenes, or background colors on the storybook covers in the suggest list (see Figure 1).

Evaluation

A pilot study was conducted to explore the usability of the storybook cover metaphor query interface. Ten participants aged from 6 to 9 (4 females, 6 males) were asked to find their favorite storybooks or specific storybooks with the query interface from a digital library containing about 150 storybooks.

Figure 2. Four color storybook cover for book searching

To explore young children's searching behavior of self-generated and assigned search tasks, two of ten participants were asked to find their favorite storybooks with the query interface. The rest of ten participants were shown with 4 color storybooks (Figure 2) and asked them to find the shown storybooks with the query interface. All the participants were interviewed about their feeling to the use of the query interface.

Figure 3. Finding scary storybooks

Regarding self-generated search tasks, both of two children first found their favorite characters from the character menu. They generally browsed the characters in the menu and drag-and-drop icons on the editable book cover. For example, as shown in Figure 3, one child filled up the editable cover with scary animals and made the background black. He wanted to find scary storybooks. He finally chose a storybook telling a story about a spider wants to eat a fly.

Regarding assigned search tasks, almost all participants could find the four books. We found the number of characters in a storybook cover would not influence the successfulness of finding a target storybook. However, the ability to identify what kind of a character in storybook covers did influence the effectiveness of their query statements, which are composed of graphic icons used to find storybooks. Similar with the self-generated search task, participants generally identified main characters in a storybook cover and drop the graphic icons belonging to the same category. They would make the scene of the imaged storybook cover finally. When asking about their feeling to the query interface and searching activities, all participants though the search tasks were fun and useful in finding interesting storybooks.

Conclusion

Based on the difficulties young children may encounter when finding books in an online query interface, the purpose of this paper is to develop an intuitive book-searching query interface for youngsters to facilitate query formulation. The interface uses storybook cover metaphor, which enables young children to drag-and-drop graphic keywords on a virtual book cover in order to depict a book cover of target storybooks. The result of a pilot study showed that young participants could use the storybook cover metaphor query interface to find storybooks. Almost all participants constructed their virtual book covers by firstly arranging story characters and lastly establishing scenes. They all felt the searching activity was fun and the query interface was useful.

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Analysis of the KKU Students' Synchronous Online Communication

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Abstract:

This article presents the Thai students' discourse characteristics and communication strategies of non-academic private one-to-one synchronous online communication. 30 Thai students from Khon Kaen University from different faculties conducted their online communication in English with both Thai and non Thai chatters. The types of motivations that lead chatters to communicate in English for social and language improvement purposes are also included. The objectives were to investigate communication strategies employed by KKU students via instant messaging, to investigate discourse characteristics of students' instant messaging use, and to investigate students' motivation in communicating via instant messaging. Communication strategies framework based on communication strategies taxonomy from Dornyei & Scott (1997) and the studies from Lee (2001 and 2002) was used to analyze 90 chat log transcripts from the participants. The findings revealed 12 most commonly used communication strategies by Thai students. The first three most frequently used strategies were approximation (38.6%), the use of fillers (19.5%) and literal translation (19.0%). Pinned and text symbol emoticons and a wide range of acronyms and abbreviations were widely used. The motivations for participants to start using online chat in English were both instrumental motivation (63%) and integrative motivation (37%). However, 26.7% of participants were motivated to continue chatting. Consequently, the findings can be used as fundamental information for considering the use of online communication in the classroom.

Introduction

As English is considered to be an international language, students in many countries, including Thailand, learn English as a foreign language as well as a second language. Thai students start to study English as a compulsory subject when they are in primary school (Ministry of Education, 2002; cited in Siriphotchanakorn, 2005), but most of them cannot communicate in English. Many students who are not majoring in English have a short-term goal in learning English, which is to pass university entrance examination, which is based on reading skill and grammar (Wongsothorn, Hiranburana & Chinnawongs, 2004). They almost neglect their speaking and writing skills. Thus, their communicative ability in terms of speaking and writing is low. The opportunity to perform the oral skills outside of class is one of the important factors.

The students' short-term goal in studying English just to pass the university entrance exam may be solved by encouraging students to see the use of English in the global community (Zhou, 2007). Synchronous online chat or instant messaging (IM) is one of the most popular medium in CMC. Language used via IM is considered to be a hybrid form of language, which inherited both characteristics from the written and spoken language, or as Jonsson (1997) stated it is "a written speech or spoken writing". As a result, chatting via instant messaging requires reading skills in order to understand the message and writing and speaking skills to interact with others.

This study aims to examine the Thai students' discourse characteristics and communication strategies in private instant messaging outside the classroom. It also observes the types of motivation that leads chatters to communicate in English for social and language improvement purposes.

Instant Messaging

Instant Messaging (IM) is a messaging software application that allows people from all over the world to communicate with other people in the network. Chatting via IM refers to people having online conversations in real time in terms of text, audio and video (Almeida d'Eda, 2003).

Communicating via instant messaging is a basic form of writing (Al-sa'di & Hamdan, 2005; Arnold, 2007). The conversation between the Internet users is composed in terms of reading and typing text that occurs in real time and is almost similar to normal conversation, but the users do not use verbal means in their communication (Freiermuth, 2002; Al-Sa'di & Hamdan, 2005). As mentioned earlier, the existence of a real audience in communication via IM results in a different form of writing. Language used in synchronous online chat has both written and spoken characteristics. It is more like spoken language in the written form (Herring, 2004).

Writing communication via IM is a new form of communication. It includes both spoken and written English. The appearance of emoticons is one of the prominent characteristics that make the written communication via IM differ from the traditional written text. The language used is considered to be informal with non-standard form of written English. In verbal communication, people do not have to deal with how a word is spelled, but the meaning of the word is the matter (Lee, 2007). In online communication, chatters type as close to the spoken language. They tend to focus on the meaning of the context that they are talking about more than the form or the accuracy of the language structure (Lee, 2002).

Communication Strategies

Communication strategies refer to the ways that people with limited knowledge of L2 try to communicate with other people (Ellis, 1997). The lack of knowledge in lexicon or grammatical rules causes the interlocutors to figure out how to make communication successful. As remarked by Dornyei and Scott (1997), problems in communication are divided into four categories:

resource deficits, own-performance problems, other-performance problems and processing time pressure. To avoid communication break down, both interlocutor and speaker seek for the ways to succeed in communication by using different types of communication strategies. Dornyei and Scott (1997) have divided communication strategies into three groups; direct strategies, indirect strategies and interactional strategies.

The wide range of communication strategies can reflect language development of second language learners (Smith, 2003). This study aims to investigate whether Thai students are able to employ different types of communication strategies to overcome their problems in communication and it also investigates the factors that lead them to use specific communication strategies. Moreover, this study looked at how Thai students mastered their communication.

Communication Strategies Framework in the Present Study

A communication strategies checklist was used in this study to identify the strategies that were most used among KKU students. The communication strategies framework was based on communication strategies taxonomy from Dornyei & Scott (1997), and were selected according to IM and CMC communication strategies studies from Lee (2001 and 2002), Smith (2003) and from the pilot trial in this study. Thirteen strategies were included in the communication strategy analysis framework including:

1. *Requests for help* refer to the participants seeking help from their chat partners.
2. *Clarification check* refers to the participants expressing confusion or asking for help due to unfamiliar words or incomprehensible messages.
3. *Self-repair* refers to the participants correcting their own errors made on lexical items or grammatical structure.
4. *Other repair* refers to the participants correcting their chat partners' errors made in lexicon items or grammatical structure.
5. *Comprehension check* refers to the participants making sure that the message is understood.
6. *Confirmation check* refers to the participants repeating parts of the statement to ensure understanding.
7. *Code switching* refers to the participants turning to the use of a language other than English (e.g. Thai) in their conversation.
8. *Approximation* refers to the participants constructing their utterance by using single word that shares the same meaning or share the same grammatical structure as the target word.
9. *Circumlocution* refers to the participants trying to talk about a particular thing but not knowing the proper word for it. So, they explain its properties instead.
10. *Literal translation* refers to the chatters translating a lexical item, an idiom, or a compound word or structure from L1/L3 to L2.
11. *Use of all-purpose words* refers to chatters using a general 'empty' word when they cannot think of the specific word.
12. *Word coinage* refers to chatters creating a non-existing L2 word by applying a supposed L2 rule to an existing L2 word.
13. *Use of fillers* refers to chatters using gambits to fill the pauses to maintain conversation during a time of difficulty.

Technology and Motivation

Computer-mediated communication (CMC) allows learners to communicate with people from all over the world by exchanging e-mails, sharing ideas on web board, joining social networking such as Facebook or Twitter, and using IM. The advance technology encourages the use of online communication. They also learn other cultures while they are communicating and they learn to respect other's cultures and beliefs.

Related Studies

In Thailand, there was a survey of writing characteristics in IM among Thai students (Sumlitpanit, 2004). The data of this study showed the use of emoticons, acronyms and abbreviations and informal language such as omitting punctuation and capitalization.

Most research on communication strategies via online communication is conducted as ~~the~~ classroom based with control groups (Lee, 2001:2002, Smith, 2003). The searcher found different types of communication strategies used by the students.

In conclusion, there has been much research conducted on communication strategies in online communication that was classroom-based. However, there has been no research conducted on investigating communication strategies of private English instant messaging communication among Thai students. To fill this gap, this study is conducted to examine the use of English in the online communication of KKU students.

Research Questions

There are three questions in the study:

1 What are the proportions of communication strategies employed by KKU students when they are communicating via instant messaging?

2 What are the discourse characteristics of KKU students' instant messaging communication?

3 What kind of motivation leads KKU students to communicate via instant messaging?

Research Methodology

Participants

The population for this research was Khon Kaen university students who communicated via synchronous online chat. The participants were those who used English to communicate with their chat partners via Windows live messaging. Participants of the study included 7 male and 23 female KKU students from 5 faculties; the Faculty of Humanities and Social Sciences, the Faculty of Management Science, the Faculty of Nursing, the Faculty of Science and the Faculty of Technology.

Research Instruments

In order to obtain both qualitative and quantitative data, five research instruments were used in this study. They were a participant selection questionnaire, Windows Live Messenger (MSN messenger), a communication strategies checklist, a discourse characteristic checklist and follow-up interview questions.

Data Collection

Data collection was carried out through several steps during the period of March to September of 2011. The details of each step are as follows:

Firstly, information about Khon Kaen University students' online communication was collected from participant selection questionnaire. The information from the questionnaire was used in order to recruit participants to the study. Secondly, data was collected from participants' chat log transcripts as the main data for analysis. The researcher printed out the transcripts for further analysis. The follow-up interview was carried out after participants submitted their chat log transcripts. Every participant was interviewed individually by the researcher

Data Analysis
The chat log transcripts were printed out to analyze for communication strategies. The frequencies of strategies used were counted as well and presented in the form of percentages. There were an L1 speaker of English and a Thai rater in this study working on communication strategies analysis. The raters worked separately on categorizing communication strategies from the 90 chat log transcripts to get the most frequently used strategies. The uses of emoticons, abbreviations, acronyms were analyzed by the researcher. Data from the interview were analyzed for the motivation that leads the participants to use English via online chat and were used to support chatters' claims in communicating online in English.

Results and Discussion
A total of 90 chat log transcripts were analyzed. There were 9,043 turns with a total of 39,833 words. The amount of words per one chat log transcript varied from 85 words per session to 1,689 words per session. The shortest session consisted of 20 turns; whereas the longest one was 400 turns per session. The average number of words per turn from the participants and their chat partners was 4.40.

Table 1 Communication Strategies from the Study

		Frequency Use and Percentage		
	Communication Strategies	**fx**	**%**	$\bar{x}$
1	Approximation	217	36.8	2.58
2	Use of Fillers	136	23.1	1.62
3	Literal Translation	106	18.0	1.26
4	Code Switching	41	7.0	0.49
5	Self-Repair	26	4.4	0.31
6	Confirmation Check	19	3.2	0.23
7	Clarification Check	17	2.9	0.20
8	Asking for Help	9	1.5	0.11
9	Word Coinage	8	1.4	0.10
10	Use of All Purpose Words	5	0.8	0.06
11	Other Repair	4	0.7	0.05
12	Circumlocution	1	0.2	0.01
13	Comprehension Check	0	0	0
	Total	589	100.0	7.00

According to the table, the total number of communication strategies is 589. The average communication strategies used is 7.00. The most frequently used strategy is approximation, with total of 217(36.8%). The second most used strategy is fillers at 136 (23.1%) and third is literal translation which accounts for 106 (18.0%). Code switching, self-repair, confirmation check, clarification, request for help, word coinage, all purpose word accounted for 41 (7.0%), 26 (4%), 19 (3.2%), 17 (2.9.0%), 9 (1.5%) and 8 (1.4%) respectively. The other three least used strategies which accounted for less than 1% each are all purpose word, other repair and circumlocution. They accounted for 5 (0.8%), 4 (0.7%) and 1 (0.2).

All of twelve strategies found in the study can be divided into four main categories according to Dornyei and Scott (1997). The first group consists of the strategies related to resource deficit. Communication strategies falling in to this group are approximation, circumlocution, use of all-purpose words, word-coinage, literal translation, code switching and appeals for help. Participants employed communication strategies in this group when they could not produce the correct sentences because of their limited knowledge of English. However, from the findings, the participants did not only use communication strategies to overcome their difficulties in communication, but they also used different strategies to make their communication more interesting, such as switching to L1 or L3 with their chat partners. In addition, the participants stated that their culture influenced them to choose a particular strategy such as adding the Thai honorific at the end of their message.

The second group includes the strategies related to the participants' own performance problems. The participants made use of strategies in this group when they found their own mistakes in conveying the message to others. The communication strategies in this group are self-repair, and comprehension checks.

The third group contains the strategies related to the chat partners' error in making a sentence. Both participants and their chat partners used communication strategies to clarify what their chat partner had told them. Communication strategies in this group are other-repair, ask for clarification, and ask for confirmation. The findings show participants from the study corrected their chat partners understanding of the topic that they were talking about. In the mean time, the chat partners from the study repaired the participants' errors on spelling and grammatical structures.

The last group includes strategies related to processing time pressure, which is the use of filler. Participants of the study used this strategy when they wanted to gain more time in constructing their response. In addition, they used it to show their presence in the conversation.

To sum up, participants used various kinds of communication strategies to solve their problems in communication and to keep their communication flowing. The purposes of choosing a strategy are varied. They used their limited knowledge of English to convey their message to make it understandable for their chat partners, to make their conversation more interesting, and also to confirm the understanding between the participants and their chat partners. Online chat provides chatters opportunities to use their knowledge to produce English and to overcome the obstacles in communication by using different kinds of communication strategies.

The Use of Text-Symbols and Emoticons

Symbols were used in the online communication as the way to show how chatters feel during the communication. Out of 18,835 words produced by participants, 719 were pinned emoticons and text-symbols. In this study, facial expression symbols are divided into two groups: the pinned emoticons and the text-symbols. The uses of both groups of symbols are slightly different. The percentage of using the pinned emoticons was 46.04, whereas, the text-symbols accounted for 53.96%.

The Use of Acronyms and Abbreviations

There were only 10 acronyms appearing in this study. The most frequently used in every group is "lol" (laugh out loud). It represented laughing in the conversation.

Table 2 List of Acronyms from the Study

Acronyms	**Frequency Used**
lol (laugh out loud)	130
btw (by the way)	6
dp(display photo)	4
OMG(Oh My God)	4
idk(I don't know)	2
brb (be right back)	1
ttyl (talk to you later)	1
wb(welcome back)	1
ic(I see)	1
Total	**150**

From 18,835 words produced by participants, there were 438 abbreviations used ~~by participants~~ in this study. The most frequently used abbreviation is "u" for "you" which accounted for 67.8% of all the abbreviations used. It is followed by r (are), ur or yr (your), thx (thank you) and n (and). (See appendix for the full list of abbreviations.)

Motivations and Online Communication

From the interview, the majority of the participants (19 out of 30 ~~participants~~ or 63%) admitted that they started using English in their online communication because they wanted to improve their English. This kind of motivation is instrumental motivation which leads participants to learn English because of the need to benefit their academic or their work skills (Brown & Attrado, 2003).

There are 11 participants or 37% who claimed that they used English via chat because they were interested in culture and people of other countries. This can be considered as integrative motivation, the motivation that leads people to learn English because of culture and people who use the language (Brown & Attrado, 2003).

It can be seen that there was none of the participants from the study who claimed the enjoyment was the main reason for them to start using English via online chat. However, 8 participants (26.7%) stated that the friendly environment and the enjoyment from the online communication resulted them in continuing to use it. This is the intrinsic motivation (Brown & Attrado, 2003).

Discussion of the Findings

Factors Influencing Chatters to Choose a Specific Communication Strategy

From the analysis of the chat log transcripts, the factors that influenced the participants to choose a specific communication strategy are divided into 3 categories: the participants' English knowledge, the chat partners' online discourse and culture interference.

The participants' English knowledge in both grammar and lexicon is one of the most important factors for the communication strategies used. With limited knowledge of English, the participants tried to construct messages by employing different kinds of strategies such as approximation, literal translation, code switching, word coinage, use of all-purpose words, and circumlocution. Even though they still made mistakes from choosing the communication strategies, they succeeded in getting their message across.

They also sought for help from their chat partners when they had problems in understanding messages. They asked for confirmation and clarification from their chat partners.

The chat partners influence the use of communication strategy. The participants chose strategy that was best suited ~~to~~ their chat partners. They switched the language if their chat partners requested it or if their chat partners also switched to another language.

The chat partners' discourse also affected the way the participants chose their communication strategies. The participants' use of acronyms, abbreviations, and emoticons also increased if the chat partners made use of those. The participants tended to use emoticons more often if their chat partners did the same.

The last factor is culture interference. Learning a language cannot be separated from learning the culture (Cote & Waugh, 2004). So, using language in communication is influenced by the culture. For example, the participants code switched by adding Thai honorific to a sentence.

Factors Contributing to the Discourse Characteristics of Synchronous Online Communication

The nature of synchronous online communication requires quick response. It resulted in the length of words per turn or transmission to be short. Compared to 5.4 words in Baron's IM used by native speakers of English (Baron, 2008), the average words per turn from the study was 4.40. This shows that the length of language used via online communication is close to native speakers' informal spoken language.

The use of emoticons is one of the unique features found in online communication. The participants and their chat partners used both pinned emoticon and text-symbol emoticons in their conversation to represent their facial expression. Sometimes, when emoticons could not tell the feeling of the chatters, they were chosen to suit the context of which the chatters were discussing.

The need for a quick response results in the use of different kinds of acronyms and abbreviations. In this study, lol (laugh out loud) was the most widely used acronym, which corresponds to Baron's study in 2004. This shows that chatters in the virtual world share the same common trends in the language used.

Besides acronyms and abbreviations, the participant omitted some linguistic features such as skipping typos and omitting punctuation and capitalization. Herring (2001) stated that chatters know the correct form of language before they shorten the term. They did it to make their conversation to be more speech like.

Synchronous Online Communication and Motivations

The finding from the study showed that most of the participants (63%) were motivated by instrumental motivation to employ English as a medium for synchronous online communication. In Thailand, people do not see wide use of English outside the classroom (Wongsothorn, Hiranburana & Chinnawongs, 2004). They are willing to learn English to pass the requirement for the school and to get a good job. Some of the participants claimed that they wanted to work overseas after graduation. Thus, instrumental motivation plays an important role in Thai society.

However, there were many students (37% from the findings) who were motivated by their willingness to be accepted by the community or because of their interest in the cultures, people and communities that use English. According to Norris-Holt (2001), students with integrative motivation seem to be the most successful students in language learning. These students will find ways to improve their language proficiency as they want to know more about the cultures and the societies.

In addition to these two motivations mentioned earlier, the participants were also motivated by the intrinsic motivation – the enjoyment of doing the online chat - that kept them continuing with online communication.

Conclusion and recommendations

The conclusions of the findings are based on the answers to each of the research questions as follows:

What are the Proportions of Communication Strategies Employed by KKU Students When They are Communicating via Instant Messaging?

The participants used 12 communication strategies during their synchronous online communication.

1. Approximation is the most used strategy with an average use of 36.8%. The high use of approximation shows that the participants in the study tried to keep their conversation flowing although they had limited knowledge in constructing a statement. They could succeed in their communication although they still made some mistakes in the remark.
2. The use of fillers is the second most used strategy. It accounted for 23.1%. This shows that the participants in all of the groups knew how to gain time in constructing their message and they could show their chat partners that they were still in the conversation.
3. Literal translation is the third most used strategy accounting for 18.0%. The chat partners also used literal translation with the participants.
4. Code switching is the fourth most used strategy. It accounted for 7.0%. The participants switched to their L1 or used L3 more often when their chat partners were not native speakers of English.
5. Self-repair is the fifth most used strategy. It accounted for 4.4%. This shows that the participants did not bother to correct their errors when they communicated with their Thai friends.
6. Asking for confirmation is the sixth used strategy. It accounted for 3.2%. It shows that the participants checked for understanding with their chat partners regardless of the chat partners' nationality.
7. Asking for clarification is the seventh most used strategy accounting for 2.9%. It shows that the participants asked for more explanation from their chat partners. They got help from chat partners in all three groups.
8. Appeal for help is the eighth most common strategy. This strategy accounted for 1.5%. The data show that the participants who communicated with Thai chat partners used this direct appeal for help the most.
9. Word coinage is the ninth most used strategy. It accounted for 1.4%.
10. Use of all-purpose words is the third least used strategy. It accounted for 0.9%.
11. Other repair is the second least used strategy. It accounted for 0.7%. The participants in all groups used this strategy.
12. Circumlocution is the least used strategy.
13. It can be noted that comprehension check, which is among the top ten strategies used among ESL students from many research studies of CMC (Lee, 2001; 2002) was not found in this study. It shows that the participants in this study were not aware of their chat partners' understanding of the message. They claimed that if their chat partners did not understand anything, they would have asked directly. However, this strategy was used by the chat partner who was a native speaker of English twice.

What are the Discourse Characteristics of KKU Students' Instant Messaging Communication?

Communication via synchronous online communication is considered to be a new form of communication. It is more like spoken language in the written form (Herring, 2004). Discourse characteristics found in the study are presented as follows.

1 The average length of words per turn in this study was not much different for the participants in the three different groups. On average, the length of words per transmission from both participants and their chat partners from the study was 4.40.

2 The most used pinned emoticons was the open-mouthed smile () , whereas, text-symbols representing smiling faces such as ^_^ or ^^ or ^.^ were the most widely used. There was a higher number of emoticons used by female participants than male participants.

3 The three most frequently used acronyms from the study were lol (laugh out loud), btw (by the way), and dp (display photo).

4 U (you) was the most commonly used abbreviation in this study, followed by r (are) and ur/yr (your).

What Kind of Motivation Leads KKU Students to Communicate via Instant Messaging?

1. Motivations in this study were divided into three groups. 63% of the participants in the study were motivated by instrumental motivation to employ English via their synchronous online communication.
2. 37% of the participants were motivated by integrative motivation to start the synchronous online communication.
3. Even though the intrinsic motivation is not a factor in participants starting to use English via their synchronous online communication, 26.7% of participants were motivated to continue chatting as they enjoyed the communication.

Recommendations for Further Studies

1. This study was conducted to see the communication strategies used via private online communication outside the classroom. There should be a research study to investigate Thai students' communication strategies via online chat in the classroom.
2. This study did not focus on language improvement. There should be research on the chatter's language skills either speaking or writing. There should be assessment tests before and after employing online chat to determine the students' English language improvement through online chat.
3. In society, males and females use language differently. There could be a study to investigate the similarities or the differences between language used between males and females, including the communication strategies used via online communication.
4. This study focuses on synchronous online communication via Windows Live Messenger. However, nowadays there are other social network sites which provide chatters with synchronous online communication as well, such as Facebook or Twitter. Those websites and texting using mobile devices are becoming more and more popular. There should be research conducted to see the discourse characteristics of people using the social networks in different platforms.

In conclusion, online communication is one medium in which chatters can benefit from ~~the~~ interaction with other people although it cannot entirely replace face-to-face communication. This study has presented the finding that should be considered in making use of online communication, both for classroom use and for private communication in terms of language learning. It can be one of the many alternative strategies that can encourage students to learn how to communicate effectively in English.

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Introducing an Intelligent e-learning Content Constructor Engine for Language Learning: A Case Study

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Abstract:

Multimedia elements can be integrated through the use of authoring tools, and this makes it possible for learners to have control over the elements based on the learning scenario. Current authoring tools are not subject-specific. Therefore, in the area of language learning and teaching, we need authoring tools of the type which are specific to language learning, and which are capable of focusing on four major skills (listening, speaking, reading, and writing). Nowadays, given the learning path, computers are used in producing intelligent contents. Based on the results of assessments made on learners and also with reference to their various learning styles, personalized learning paths are introduced to them. In this paper, we attempt to introduce a constructor engine for producing e-learning content, one which was built by our own work group.
This engine is capable of producing skill-based language learning content.

1. Introduction

Learning objects are the building blocks of any e-learning content. Authoring tools aimed at developing e-learning contents provide the required framework for establishing links among learning objects and operationalizing them. Learning objects, in turn, have their basis in the learning scenario and are placed within the content (Ghebghoub, Abel, & Moulin, 2008; IEEE, 2002). For instance, a crossword puzzle is a learning object which seeks to introduce vocabulary items interactively, and which can be formed as a flash file.

As already discussed, authoring tools put learning objects together. They make use of methods in order to afford an environment where the e-learning content is able to organize learning objects within the context of a particular learning process and to make them utilizable for users. Generally speaking, authoring tools have several features which make them capable of generating different e-learning contents for various subject matters. These features include the ability to establish links among learning objects, the ability to provide a graphical user interface, indexing ability on leaning objects, as well as the ability to define standardized assessment tools. But in order to produce contents on specific subject matters such as language learning, these features cannot meet all the requirements of developers. Consequently, in search for an authoring tool appropriate for language learning, still another feature has to be added, and that is the ability to produce specialized learning objects which are aimed at language learning and which follow a specific pattern. Other features include making assessments that are in line with the previously-specified learning objectives, and also making contents intelligent in such a way that they are able to present users with their own right learning paths. This article attempts to introduce a content constructor engine which has been developed by our workgroup and which builds upon the requirements for producing language e-learning contents (Keynejad, Khademi, Haghshenas, & Kabir, 2011).

2. The Structure of Our Language Learning Content

In the language learning content developed by our engine, reusable learning objects are placed within pages. These objects could be simulated files (in the format of SWF or XML) developed with reference to skill-based scenarios and would be used interactively.

As a matter of fact, the engine provides developers with control panels through which they are able to produce their own needed learning objects. Examples of these learning objects include activities such as crossword puzzles, classifications, matchings, fill-in-the-blanks, role plays, and so forth. These activities and their learning values will be fully explicated in the following section.

Figure 1 schematically presents the structure of the engine. It is worth mentioning that in this structure, learning objects are called “tasks”. Apart from tasks, the control panel adds other less sophisticated learning objects to pages. This second group of objects contains simpler multimedia structures such as sounds, images, movies, and animations, and they can accompanied with appropriate tools to render them more practical. An example in case is the use of recent text-to-speech techniques and also providing a dictionary tools like Babylon to be used in looking up the meaning of unfamiliar words immediately (Keynejad, 2011b).

The next stage is to classify pages into SCOs (Sharable Content Objects) while observing the standards defined for developing e-learning contents. For each SCO, there is a set of specific learning objectives. Later, reusable SCOs are classified into lessons, and finally several lessons make up a course (Advanced Distributed Learning, 2004).

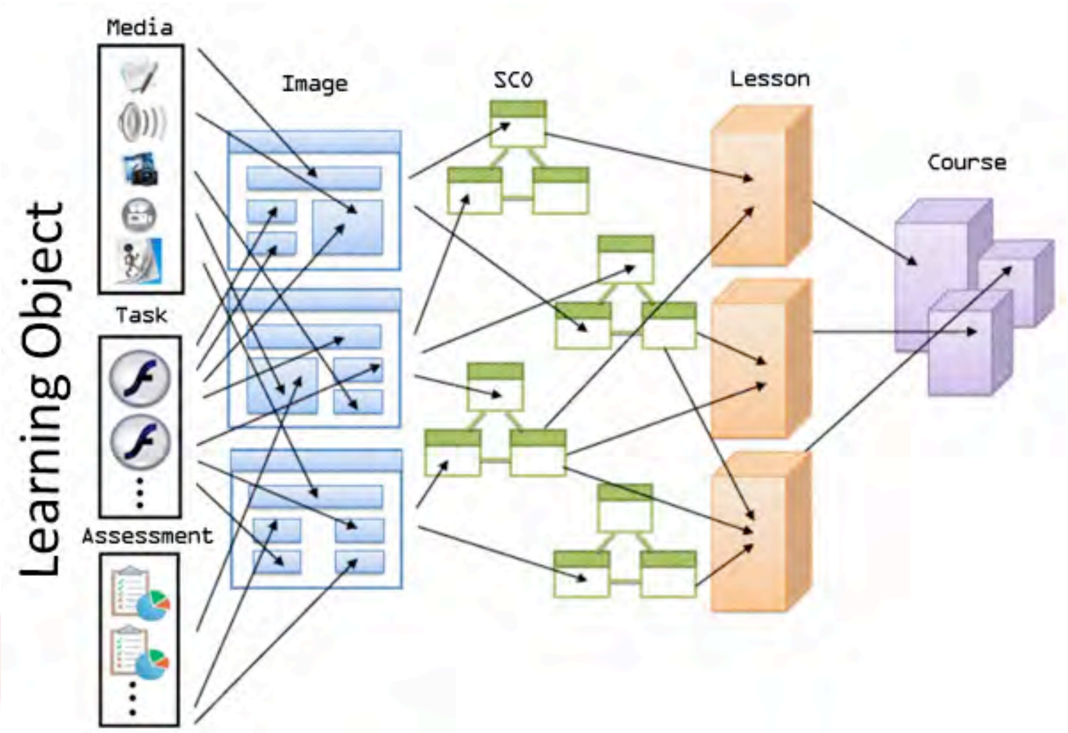

Figure 1. The Structure of the Content Constructor Engine

3. Language Learning Tasks in Our E-learning Content

Out of the language learning tasks available in our engine, we will focus on the following ones and the pedagogical objectives behind them (Livemocha, n.d.).

- **Crossword Puzzle:**
  This task consists of completing a crossword puzzle using clues given.

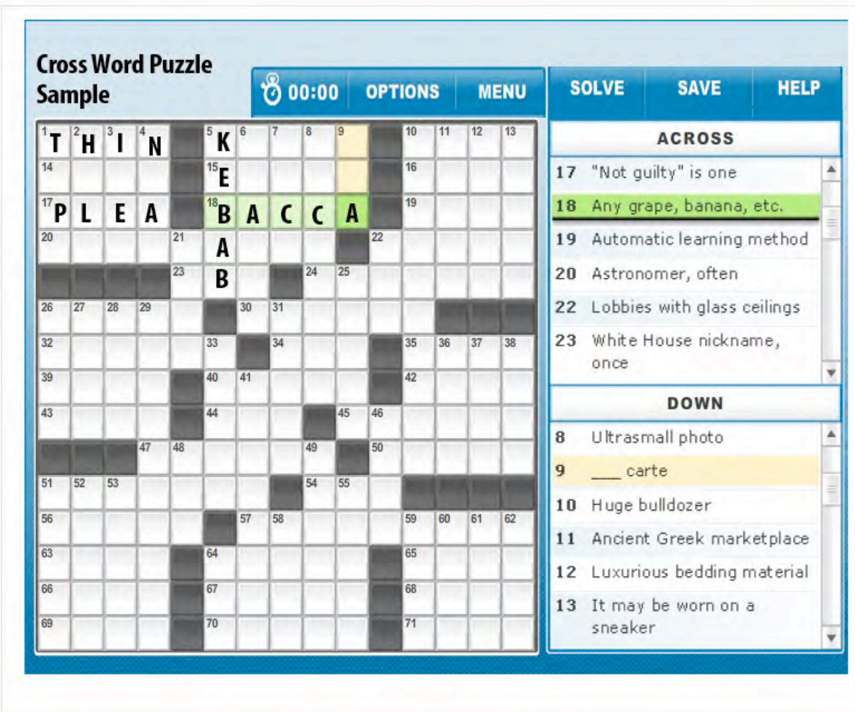

Figure 2. A Sample Crossword Puzzle

Figure 2 shows a sample task, namely a crossword puzzle, along with its options. For example, users could solve the puzzle by clicking on “solve”, and would have to make a choice between solving a given “letter” or “word”. Also, time constraints could be set, and the grid size could be adjusted.

Pedagogical Objectives:
1. Developing written production
2. Building vocabulary
3. Improving spelling skills

- **Fill in the blanks:**
This task consists of filling in an incomplete text with the missing words or groups of words.

Pedagogical Objectives:
1. Develop written comprehension
2. Building vocabulary and/or grammatical concepts
3. Become acquainted with a language's distinctive structures and idiomatic usage

- **Matching:**
In this task, you need to match the words or sentences in two columns. The goal is to associate items that have a logical connection, such as synonyms.

Pedagogical Objectives:
1. Developing written comprehension
2. Building vocabulary and grammatical concepts

- **Multiple-choice Questions:**
This task consists of completing a sentence with one of the words or groups of words proposed in a list.

Pedagogical Objectives:
1. Developing written comprehension
2. Building vocabulary and/or grammatical concepts

- **Mystery Word:**
This task consists of figuring out a keyword according to its definition or other clues.

Pedagogical Objectives:
1. Building vocabulary
2. Improving spelling skills

- **Picture / Word Association:**
This task consists of identifying the word or expression that corresponds to the image appearing on screen.

Pedagogical Objectives:
1. Developing written comprehension
2. Assimilating and building vocabulary

- **Role Play:**
  This is a video task that shows clips from authentic films and movies that have been selected for their linguistic and cultural authenticity of the communication situations portrayed. In this cultural immersion activity, students must take part in the exchange and identify with one of the characters by playing his or her part.

  Pedagogical Objectives:
  1. Developing listening and speaking skills
  2. Familiarizing yourself with the characteristics of the target language, including intonation, structures, and expressions
  3. Building and enriching vocabulary in context
  4. Becoming acquainted with the sociolinguistic and cultural aspects of the countries where the language being studied is spoken

- **Word Classification:**
  This task consists of classifying the words or expressions into the different lexical families proposed.

  Pedagogical Objectives:
  1. Developing written comprehension
  2. Building vocabulary

- **Word Order:**
  This task consists of arranging the scrambled words displayed on screen in the order needed to make a sentence. Each exercise asks you to reconstruct a sentence whose structure has already been introduced.

  Pedagogical Objectives:
  1. Developing written comprehension
  2. Become acquainted with a language's distinctive structures and idiomatic usage
  3. Building grammatical concepts

- **Word Search:**
  This task consists of finding words hidden in a grid. The words to find are either displayed on screen or given as a recording. They belong to the same lexical family.

  Pedagogical Objectives:
  1. Developing written production
  2. Developing oral comprehension
  3. Assimilating and building vocabulary

The above tasks all aim at assessing the four major skills, listening, speaking, reading, and writing. Iteration and increment are the two main features of these activities so that skill-based evaluations could be provided for those who are concerned. Furthermore, right learning paths would be introduced to users once we establish relationships among these task and the other learning objects.

4. How the engine is made intelligent

Learning objects, pages, SCOs, lessons, and courses are all described by metadata. Metadata are structured data which, based on specific fields, elaborately explain the details of the components making up e-learning contents. The fields for elaboration and description are provided by a standard named IEEE-LOM (Duval, n.d.). Our content constructor engine has employed this standard to specify fields for describing our learning objects called *tasks*. Our metadata is able to organize the input for the tasks based on the feedback received from the performance of users. In this way, the content is individualized for each user. It is worth mentioning that there are *part-of* and *inheriting* relationships among the all input for a given task. For instance, in crossword puzzles with the aim of learning vocabulary, the vocabulary items are dynamically presented in reference to the above relationships and also by considering the received feedback from previous performances. This feature, by itself, makes a learning path indicated by the content, one which takes into account the differences among individual learners' statuses (Keynejad, Mousavi Jabbari, & Musavi Jabbari, 2011).

5. Conclusion

Authoring tools should be able not only to produce general e-learning contents but also to generate intelligent contents with specific features. By intelligent, we mean contents where the computer can be a guide in the learning process. In this article, we attempted to introduce a content constructor engine developed by our own workgroup. This engine is capable of generating any type of content by establishing links among learning objects. It also enables users to index learning objects and assess their own performance. Moreover, the same engine can produce intelligent language learning contents, providing learners with tasks which are specific to this subject matter. Pursuing this line of research, we intend to figure out the relationships among the interactions of users with different tasks and other elements of the content by using pattern recognition algorithms in artificial intelligence. This will make it possible for us to provide users with more precise learning paths.

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Remotivating Kanji Study via Mobile Game Design

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Abstract:

Now that smartphones have become widely adopted, they have become the ideal platform for providing learning activities that can be used anytime and anywhere. Users can utilize spare moments in their days to get quick doses of practice which can accumulate to provide substantial gains in learning. Traditionally, flashcards have been the tool of choice for foreigners studying kanji, and are now a staple type of mobile app for studying discrete facts for any subject, with various benefits over paper-based flashcards in terms of convenience, organization and flexibility of use. While they have been shown to be effective for motivated learners, they can be a monotonous mode of study. By applying casual game design principles to the flashcard study approach, the 'Kanji Wordsearch' iPhone app makes for a much more motivating study experience. Moreover, the unique game mechanics can be shown to promote greater processing of kanji for meaning and readings than the usual matching or multiple choice types of activities.
Other key design mechanisms which are employed to hold the user's attention include the following: nested goals with clear feedback at each stage; game aesthetics which are colorful and musical; rewards of points for speed and accuracy; and interactive flow utilizing the mobile touch-screen functionality. Importantly, in order to be a genuine learning activity rather than merely entertaining, the app includes progress tracking, review and reference capabilities. Plans for improvements and future directions for the app will also be discussed.

The study of kanji is a great chore for many learners of Japanese, seeming to require huge amounts of uninspired rote learning with wordlists and flashcards. Flashcard applications for smartphone are now common for studying discrete facts for any subject, with various benefits over paper-based flashcards in terms of convenience, organization and flexibility of use. These programs can be useful for users to utilize spare moments in their days to get quick doses of practice which can accumulate to provide substantial gains in learning (Nakata, 2011).

However, while they have been shown to be effective for particularly motivated learners, they can be a monotonous mode of study. By applying casual game design principles to the flashcard study approach, the 'Kanji Wordsearch' iPhone app aims to ideally provide users with a ‘flow’ experience of study, the ideal state of focused but enjoyable concentration in games and learning (Franciosi, 2011). As well as ensuring that the user needs to process key features of the kanji while playing, the following key design mechanisms are employed to hold the user's attention: nested goals with clear feedback at each stage; game aesthetics which are colorful and musical; rewards of points for speed and accuracy; and interactive flow utilizing the mobile touch-screen functionality. Importantly, in order to be a genuine learning activity rather than just entertaining, the app includes progress tracking, review and reference capabilities. The individual screens of the application and their functions are as follows:

1) The Kanji Grid

This grid aims to give a quick overview of progress for all kanji in the current level, and access to their reference flashcards. Getting intuitive, continual and concrete feedback about progress is key to continued motivation, inspiring students to reach the next milestone.

Figure 1 - Screenshot of Kanji Grid

Note the following features:

a) Kanji are shaded blue to indicate progress (the darker it is the more of that kanji’s compound words have been completed).

b) Clicking on any kanji goes to the flashcard view, which gives meanings, readings and compounds for that kanji.

c) Above the grid is the current level, and colored stars indicating the number of words at each stage of progress, with green indicating completed words.

2) Flashcard View

The data included contains 6 'kyouiku kanji' levels with over 1000 kanji, equivalent to the elementary school levels. Listed under the kanji are over 6,000 common compound words, graded to only include kanji of the same or lower levels. Each kanji has its own flashcard displaying both the onyomi and kunyomi readings and the meaning.

Figure 2 - Screenshot of Flashcard View

a) Up to 20 common compounds are listed for each kanji, with their readings an meanings.

b) A colored star shows the current completion status of each compound, which can be manually adjusted with a tap.

c) The star for the individual header kanji can be tapped to change ratings for all its compounds at once – useful for checking off known kanji, or 'checking down' lesser-known kanji. NB Its color always reflects the lowest color rating out of all its compounds.

d) Tap on any kanji to jump to the flashcard for that kanji, using the back button to return if desired.

e) Swipe right or left to progress through flashcards.

3) The Game Screen

The game intensively focuses the user on the kanji form/meaning/reading relationships by presenting hints of one type which the user has to match with the target kanji compound or hiragana reading in the grid. Rather than providing a fully-formed word as in standard multiple choice exercises, the target word is made up of separated component elements in the grid. While still 'multiple choice' in a sense, it becomes a much more challenging task to find the answer due to the wealth of combinations in the grid. However, there are not so many options that it becomes difficult to actually find a word by scanning, if it is known to the user, unlike in a traditional wordsearch puzzle with a large grid.

Figure 3 - Screenshot of game, 'Find the Kanji' version

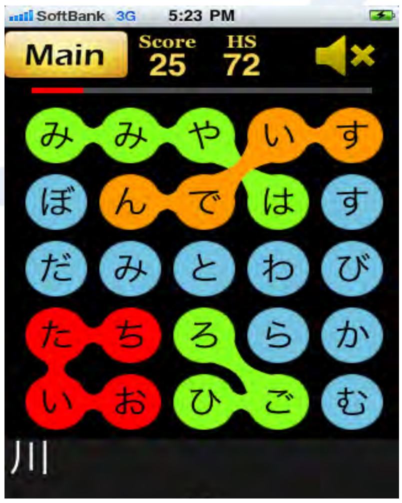

Figure 4 - Screenshot of game, 'Find the Reading' version

In each game, 5 words are hidden in the grid, going in any direction (not just straight lines). One cue is given below the game for the current word (either the reading or the meaning, depending on your setting). You find the word in the grid by touching the first circle, dragging and releasing on the last circle. If the circles selected are incorrect (ie not making the target word), the next cue is shown automatically. If you need another hint, you can press the cue box below and the next hint is revealed (either the reading or the meaning, depending on your setting). If you still don't know, pressing the cue box again shows the actual target word which you can then find in the grid. This design is supported by the principle of the 'retrieval effect', whereby a successful retrieval strengthens memory more effectively than simply another learning presentation (Ellis, 1995). Moreover, we can also feel intuitively that it is more fun and satisfying to guess correctly from a hint than to just be shown the answer.

With the 'Find the Kanji' version, the user is shown the hiragana reading as the first hint. From this hint the user needs to use their knowledge about the possible kanji representations for the reading given, or may be prompted to think about readings of kanji in the grid. Alternatively, the user may know the meaning of the word shown but have never seen the kanji before, in which case they are looking for kanji to match the meaning they are familiar with. The kinds of retrieval stimulated differ depending on the hint order, but we can imagine that this process yields an intensive networking of connections in the users' mental lexicon between the kanji, their readings, and meanings.

Note the following features of the game regarding scoring, game aesthetics and word ratings:

a) Getting a word correct having been shown only the first hint, means the word's completion status goes up one color rating. In contrast, its completion status goes down one color rating for each additional cue shown or mistake made. That is, if one extra cue was shown, the word's completion status goes down one color rating e.g. from yellow to orange.

b) The color of the selected circles indicates the current completion status of the word. If the word is now completed, it will go green. This gives immediate feedback on word ratings, and adds to the aesthetics of the game screen.

c) The score is based on word points plus timer points. If you get a word correct from only one cue shown, you get 10 points; if you get a word correct from two cues shown, you get 5 points; if all cues were shown you get 0 points. The points remaining on the timer at the end of the game, if any, are added to the word points to give you your final score. Note that the game does not end when the timer runs out, as it is important that the user be allowed to look at the kanji forms at their own pace – it does however provide motivation for players already familiar with the selected kanji set to improve their speed of recall.

d) A high score is shown that is renewed every Sunday so you can challenge yourself to get a weekly high score. Having the usual static high score would soon plateau with a single user, defeating the motivating purpose of this feature.

e) A relaxing single note plucked on a 'koto' (Japanese zither), randomly taken from the Japanese 'water scale', sound as you select each kanji circle, making an original kind of short melody with each selection. This adds to the atmosphere, heightens the sense of interaction, and lessens the repetitive nature of the game mechanic of selection. A bass note sounds if a mistake is made, and a harmonious chord when a word has been found correctly, giving immediate aural feedback on progress. n.b.These sounds can be turned off so that the user can listen to their own choice of music while playing the game if desired, by tapping the sound icon in the top right-hand corner.

4) End-of-Game Review List

In order to allow for actual learning of new items, and not just testing, after a game has finished a list of the five words from that game and their readings and meanings are shown.

a) The score is shown at the top, next to the high score.

b) The current completion status of the words are shown as colored stars. n.b. These stars' colors can be manually adjusted simply by tapping them to cycle through the colors. This is so you can either check words off (ie rate them green) if you don't feel a need to have that word appear in further games, or rate them lower if you feel you actually need more practice with a particular word.

c) Any kanji in any word can be tapped on to jump to a flashcard showing meanings, readings and compounds for that kanji.

5) Options

There are options to change the order of hints, which completely changes the focus of the practice. As previously described, either the kanji compound or hiragana reading may be set as the target word in the grid. Moreover, the meaning hint can be set to be shown first, rather than second.

a) Kanji Grade Levels - Choose the 'kyoiku' kanji level, 1006 kanji from grades 1 to 6 (covers almost all kanji from JLPT levels N5 to N2)

b) 5*5 Kanji Grid - Option of 4 x 4 or 5 x 5 grids for the 'kanji grid' mode (n.b. 'Find the reading' mode with hiragana in the grid is always 5 x 5 in order to fit all the words in as they are longer than the kanji compounds.)

c) Reset ratings of all words - You can reset all the words in the current level to a specified color. eg You can reset all the words back to yellow after finishing all the words to start again; or if you just want to practice certain words from a level, you can rate all the words green, then choose just the kanji you want to practice from the main grid and rate them down to yellow (or lower).

Conclusion

It can be hypothesized that the kinds of processing stimulated by the particular interaction design of this game not only increase their knowledge of specific vocabulary items studied, but also strengthen the users' broader knowledge of the component kanji and general kanji decoding skills. Even if a word is not known to the user, the game design stimulates the user to utilize their available level of knowledge to make educated guesses about the possible component kanji and meanings. In this way it is not just testing, but rather actually stimulating connections in a manner unique to this design and medium. This hypothesis needs to be tested with further research on users, ideally with a longitudinal comparative study to compare outcomes with use of traditional flashcards, in terms of both user motivation and retention of kanji and vocabulary knowledge.

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An Integrated System for Location-Aware Mobile Social Networks

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Abstract

Smart phones are becoming increasingly advanced and popular every day, with more diverse system features. Thus, we use smart phones as the development and implementation platform in this study. A web-integrated real-time sharing function provides cross-platform communication interfaces to users, which solve many of the common issues of visiting large-area exhibitions. Mobile services are more complete and convenient with the following 5 major features: map-based guided tour, friend-finder radar, lost and found, scene sharing, and a planting game. Using the 2010 Taipei International Flora Exposition as an example, an integrated web-based fairground guide system that combines a global positioning system (GPS), mobile phone photos, Facebook mobile social network, and gravity sensor (G-sensor) was designed. The goal of this system is to provide users with a convenient tour guide system, a photo sharing platform, a useful friend-finder radar system, a real-time lost and found search platform, and an interesting cross-platform planting game. This study combined multiple technologies to replace the prepared package tour itinerary and information from previous tour guide systems to provide location-specific and customized tour guide systems.

Keywords: Location-aware service, mobile social networks, smart phone, social game

1. Introduction

Smart phones are becoming increasingly advanced and popular year by year, with more powerful system performance (R. Ballagas, etc., 2006). Thus, we use smart phones as the development and implementation platform in this study to develop a location-aware customized mobile tour guide system. A web-integrated real-time sharing function provides cross-platform communication interfaces to users, offering solutions for tour guide when visiting multiple-area exhibitions to ensure that mobile services are more complete and convenient. For activities in internationalized theme parks, detailed planning and mobile information services are often required. Among them, a tour guide system is the information service most commonly used by visitors. Ensuring visitors enjoy the typically crowded and wide-spread exhibition ground is one issue facing mobile information system.

Traditional map guides only provide activity information to users in a single direction (Jen-Chi Huang, etc., 2009). If the activity schedules are too complex and the user demands are not properly considered, or if numerous useless messages are provided (e.g., advertisement messages), then it becomes a burden to users. The tour guide map developed in this study proactively offers activity information to users based on the global positioning system (GPS) and current time signals received from their mobile phones. A photo-sharing function is also integrated into the tour guide map. The photo files and the accompanying latitude/longitude data can be uploaded to the server immediately after the photo is taken using a Wi-Fi network. The server may automatically sort the photos based on the latitude/longitude information. Thus, scenic photos shared by users may be available through mobile phones and websites. This allows users to obtain related information before arriving at a specific exhibition area.

International exhibitions often attract numerous visitors. This study develops a crowd analysis system that uses mobile phones and websites. When a visitor starts the system in the exhibition ground, current visitor flow statistics can be downloaded using Wi-Fi. Dynamic route suggestions are provided to users to avoid the crowd. Personal messages can also be uploaded to the server. User data can then be integrated for statistics and records, allowing users to see the real-time visitor flow and visitor statistics when planning to visit the exhibition ground. Meeting friends in large exhibition grounds is not easy. We propose a service that uses the friend-finder radar application to locate a person. Users can import their friends from Facebook into the smart phone to enable the radar interface to track the locations of their social network friends in real-time.

2. System Architecture

The central concepts of this study are “location-aware services” and “mobile social network”. The tour guide system developed for the 2010 Taipei International Flora Exposition combined technologies such as smart phones, website systems, GPS, and social networks to interact with users. This system can be roughly divided into a smart phone side and a website. The system architecture is shown in Figure 1. The smart phone site primarily integrates smart phone and web page information, such as GPS, gravity sensors (G-sensors), and the web page database. Relevant tour guide information is offered to the user based on their location, travel speed, exhibition ground conditions, latitude/longitude information, and the current time (J. Freyne, etc, 2009 and C. Xin, 2009). For example, the tour guide map system provides information of activities in the surrounding area based on the user's current location and the time and enables users to check crowd status information for different areas. Additionally, we developed and implemented a mobile planting game that features various types of flower seeds depending on the user's location in the exhibition area; the seeds can be planted virtually in exchange for discount coupons. This game is not only educational, but it also provides commercial value as a mobile advertisement.

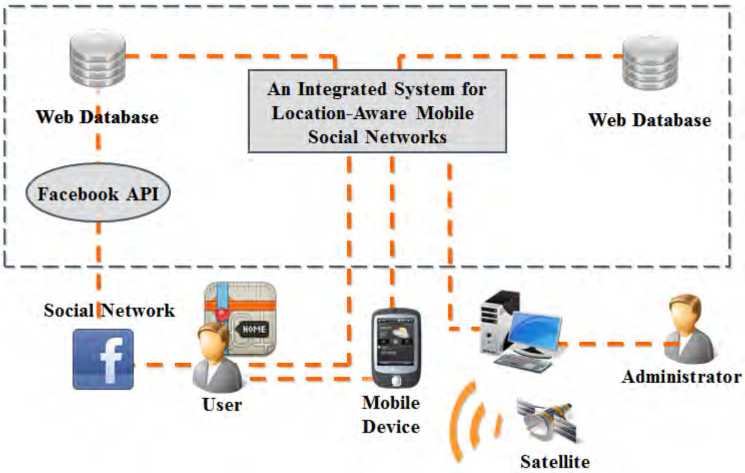

Figure 1. System Architecture

The primary task of the web page side is to integrate the activity information uploaded by the smart phone side, making user-uploaded information of each exhibition area available to view on the website. Examples include the social network export system, which imports a user's social network friends from the Facebook application programing interface (API). This enables users to locate their friends using the radar interface. The website of the planting game communicates with the database through technologies such as Flash and AMFPHP. Virtual seeds obtained in the flora exposition exhibition grounds can be planted on the web page in exchange for coupons.

3. Related Technologies

The main goal of this study is to analyze and integrate GPS information from the mobile phone site with the web page side database to provide various features to users, such as activity information, crowd analysis, and a tour guide map. The technical core of the system is introduced below.

3.1. GPS-Related Work

GPS is a positioning system for determining actual geographic locations developed in the U.S (N.D. Lane, etc., 2010). The values from multiple satellites are used to calculate the actual location of the receiver. Combining GPS information with maps or other geographic information systems provides features such as navigation systems (R. Cheng, Z. Yang, and F. Xia, 2010). The actual information provided by the satellites to the receiver can be classified into six satellite information categories, initialized with the "$" symbol, such as GPGGA, GPGLL, GPGSA, GPGSV, GPRMC, and GPVTG. These signals provide different information to the user. GPGGA (GPS fixed information), GPGSV (visible satellite status), and GPRMC (minimum navigation info) are the more commonly used and decoded data.

Here we explain the actual interaction between the system and GPS when using the friend-finder radar application. This function uploads the user's latitude/longitude information to the web-based database automatically using Wi-Fi. When the user checks the location of their friends, the system downloads the latitude/longitude location of their friend from the web-based database. Relative location is calculated by comparing a specific location with the user's current location and travel path. Figure 2 is an actual screen capture of the system; the round dots denote the locations of the user's Facebook friends.

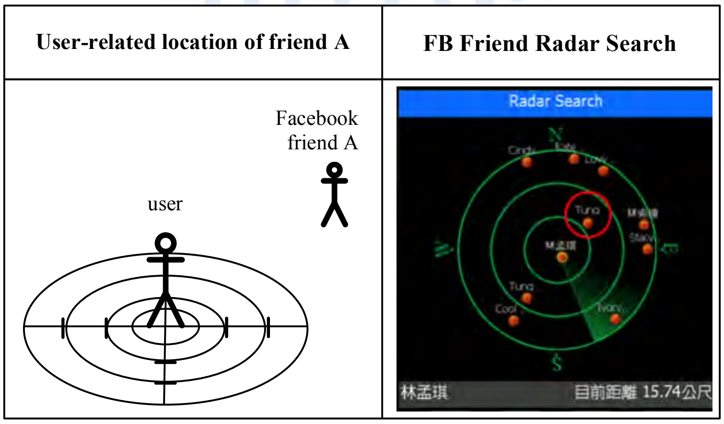

Figure 2. The Screen Capture of the Friend-Finder Radar System

3.2. Facebook API

Facebook is the largest social network in the world. Following forecasts of eMarketer, by the end of 2013 its audience will be more than 1 billion users. Over 350 million people visit Facebook using mobile devices every month. Still growing with exponential speed, Facebook's global advertisement budget has reached 4.05 billion USD. A diverse social network marketing service has also been created. Thus, the system developed in this study also uses a Facebook API to provide a personal mobile social network application. The technical process of importing social network friend data is shown in Figure 3. The two methods of setting the canvas page on the Facebook API are Facebook Markup Language (FBML) and iframe. FBML is the web page markup language provided by Facebook. The operation mode for FBML requires the user to develop a web page on their server using FBML and then configure a website path on the Facebook server side. Facebook then directs users to the web server of the developer. Once the server receives the FBML page from the developer, it converts the page into HTML for display in the user's browser.

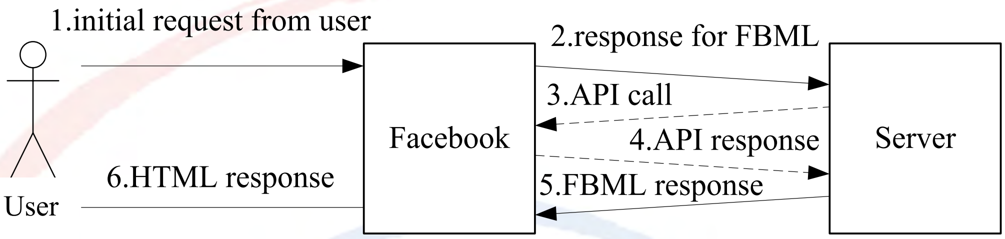

Figure 3. Flowchart of the FBML

Besides FBML, iframe can also be used for more intuitive embedded developments. iframe is a page mark from XHTML that embeds content from specific web pages. This means the developer embeds the web page into Facebook using the frame provided by Facebook. However, if iframe is used, the user's multimedia files cannot be cached by Facebook, causing the developer's server to receive service requests from the users directly, which is less secure. Additionally, the loading of the developer's server will increase. The advantage is the reduced degree of coupling with Facebook; numerous Flash games on Facebook use this method. This method enables an application to be run on platforms other than Facebook, thereby saving substantial recoding time.

3.3. G-sensors

To develop the smart phone application of a virtual planting game that generates coupons, we employed the G-sensor function for obtaining seeds. Users can obtain seeds by shaking the sensor, thereby enhancing the entertainment value of the game. This section describes the principles of G-sensors. G-sensors are also called accelerometers; they mainly provide information on speed and position changes. G-sensors measure minute changes in physical attributes, such as resistance, capacitance, stress, deformation, and shifting data. These changes are then represented by voltage signals, and the information is obtained through conversion by formulae. G-Sensors were initially used in portable CD-ROM players and hard drives. If the portable CD-ROM or hard drive experiences an impact, the rotation of the hard disk or CD-ROM can be stopped to prevent scratching. The most well-known application of G-sensors is the Nintendo Wii. This sensor has been gradually integrated into smart phones, providing more dynamic operation modes. The G-sensor mainly provides information on the amount of shifting in the x, y, and z axes. When the mobile phone is horizontal, the value of the x, y, and z axes are all zero. The x axis measures the shifts during horizontal turns, the y axis measures the shifts during forward and backward flips, and the z axis measures shifts during left and right flips, as shown in Figure 4.

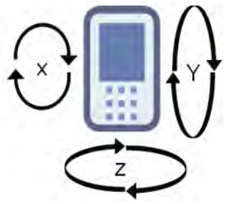

Figure 4. The Concept of G-sensor Technology

In this study, the planting game on the smart phone side is a technical application of a G-sensor. We use the instant change of acceleration to determine whether the smart phone is being shaken. Regarding the planting game, allowing users to shake their mobile phones to obtain seeds, and using latitude and longitude data to provide seeds that correspond to the flowers in the exhibition area, provides users with more dynamic interaction with the game besides simply clicking the screen.

3.4. Mobile Advertising

The rapid developments to smart phones in recent years have made them more than simply tools for telephone calls and sending/receiving short messaging services (SMS). Because wireless network technologies have matured with 3G, Wi-Fi, and Wi-Max, the traditional SMS messages have become multimedia advertisement messages that can include video. Mobile phones are now an important media and system application platform. Mobile advertising is becoming increasingly important. ABI research reported that the compound growth rate for mobile data services is approximately 18% per annum. Mobile advertisements differ from traditional SMS messages (Wei-Ting Chen, Chao-Ming Wang, and Wen-Shou Chou, 2008 and Wei-Cong Hong, 2010). With advancements in portable networks, mobile advertisements can now include multimedia message service (MMS) messages. In addition to the substantial enhancements of service content, most smart phones include GPS chips, which enable mobile advertisements through location-based services (LBS). Thus, advertisements are shown to target audiences at the appropriate locations and times in the effective area. This characteristic makes mobile advertisements a limitless business opportunity in the mobile service market (Ai-Ging Tsai, 2009).

Multimedia mobile advertisements are generally classified by characteristics such as informativeness, entertainment, and irritation (Xin-Xin Yu, 2007). This study conducted a survey of 680 people. Of the participants, 94.7% had an educational background of college or above; 366 were male and 314 were female; and within the population bracket that most used SMS messaging, 87.8% were under the age of 30. The survey results showed that the participants considered “informativeness” the most important factor for evaluating the “value of multimedia mobile advertisements.” This means that the information provided by multimedia mobile advertisements is an important factor. The second most important factor was "media characteristics." Multimedia mobile devices are personal devices carried by a person, which can provide GPS data and receive real-time information; these characteristics provide real-time, location-aware, and personalized advertisements that are closer to users' needs. Thus, the media characteristics of mobile media devices are also important factors influencing the advertisement value.

These results indicate that the required characteristics of mobile advertisements are informativeness and media characteristics. When a user visits exhibition grounds, the tour guide system knows their location using GPS information. Location information includes latitude/longitude, time, travel direction, and speed. The tour guide system automatically searches the activity database and provides real-time mobile advertisements that are appropriate for the area where the user is located. This enables mobile advertisements to achieve the required informativeness and media characteristics, increasing user acceptance of mobile advertisements, thereby increasing the advertisement benefits.

4. Implementation Results

This study integrates social network services with the current time and location of the user in an area-specific, location-aware, and customized system. Using the Flora Exposition showground guide as an example, this section details the results of implementing the system developed by this study. The main function of the website is to integrate and display data from the mobile phone site on the web page. Examples of data include crowd analysis, scenery sharing, and the planting game, which are all integrated in the website. The website emphasizes the immediacy of the data; photos and text uploaded by users can be displayed on web pages in real-time. The main features are described below.

(a) (b) (c)

Figure 5. System Prototypes of Smart Phone: (a) Crowd Analysis
(b) Friend-Finder Radar (c) Scene-Sharing

Crowd analysis can display the number of people in all exhibition areas, and dynamically arrange tour routes to avoid areas with excessive crowding and disperse people, as shown in

Figure 5(a). The friend-finder radar application obtains users' friend list information from social network websites, and identifies the location of their friends on the friend radar to facilitate users locating their friends, as shown in Figure 5(b). The scenery sharing application integrates Wi-Fi and GPS locating technologies. The photos taken by users can be uploaded to servers for real-time sharing of the beautiful scenery at the Flora Exposition, as shown in Figure 5(c).

(a) (b)

(c)

Figure 6. System Prototypes of Website: (a) Crowd Analysis
(b) Scene-Sharing (c) Lost and Found

The crowd analysis feature in the web page can provide classified statistics of the number of online users per month, users' location, and user gender. Tables displaying the number of visitors per month can be shown on the web page for reference by visitors and merchants, as shown in Figure 6(a). As shown in Figure 6(b), the scenery sharing function shows the photos uploaded by users in real-time, organized into specific exposition areas according to location latitude/longitude for ease of viewing. As shown in Figure 6(c), the lost and found feature allows users to upload photos of lost objects they find. The area, time, and location where the item was found can be displayed on the web page, enabling the owner to retrieve their missing item.

(a) (b)

Figure 7. System Prototype of Planting Game: (a) Smart Phone (b) Website

The planting game is a Flash mini game developed for advertising and social network interaction. The game play involves planting the flower seeds obtained at the exhibition. Users must walk around the exposition grounds to obtain the seeds to plant, as shown in

Figures 7(a) and 7(b). AMFPHP technology allows Flash to communicate with databases to increase user willingness to collect flowers in exchange for mobile coupons. An introduction and description of the flowers can be included in the future to increase the educational value of this game.

5. Conclusions

This study is based around the concept of LBS. We developed an exhibition area tour guide system that integrates GPS, a social network website, G-sensors, and mobile advertisements. On the mobile phone site, in addition to the traditional area guide, numerous additional functions were also included, such as dynamic route suggestion, scenery sharing, friend-finder radar, a lost and found application, a planting game, and mobile advertisements. According to the time and current location of the user, appropriate location-specific services are customized and provided. On the website, users can access the mobile phone-based applications, such as crowd analysis, scenery sharing, or the planting game. This study developed a tour guide system that was not simply a one-direction information provider, but also provided interactive information.

6. Acknowledgements

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Investigating online peer discourse in a writing classroom of Hong Kong

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Abstract:

This paper attempts to explore the interaction discourse of L2 undergraduate learners in the online peer review process of a writing classroom in Hong Kong. Specifically, the writer would like to investigate the types of online discourse learners have in the peer discussions on their writing and examine the role of explicit instructions and training for producing quality online peer discourses. Finally, she would like to understand how instructors can support and facilitate effective online discourse in peer reviews. As the ongoing developments in the higher education of Hong Kong call for the implementation of more innovative technology-assisted methods of teaching that emphasizes learner autonomy, this study examines the online discourse that occur in the peer review process of a writing class which learners help one another to revise their writing online. The study was conducted on a group of first year part-time undergraduate students of an Early Childhood Education program in Hong Kong. In this paper, the online peer discourse is assessed through examining the types of comments students made for their peers' in the writing class in two writing tasks: one group and one individual. To facilitate the analyses of peer responses, a coding scheme developed by Liang (2008) was used. Results show that students tended to give more positive revision-related comments and that explicit instructions and training had an impact on the quality and quantity of online discourse. The writer then concludes with the identification of some essential elements for facilitating online peer response groups.

Introduction

In response to the call for the use of information technology in education and the emphasis on learner-centered paradigm, there has been an increasing use of technology in higher education. This mode of teaching has become “an imperative” in many areas of education (Warschauer 2002, p. 455). In the context of language education, numerous studies have discovered the benefits of the use of technology on teaching writing (Ciekanski & Chanier 2008; Ho & Savignon 2007; Shang 2007; Warschuer & Ware 2006). Among the numerous benefits, the major one is that it can facilitate interaction between learners and learners. Research has been designed to explore the effective uses of online peer reviews (Hansen & Liu 2005). However, relatively only a few research has been done on the nature of ESL interaction in online peer reviews. Since the process approach is adopted for teaching in writing and Blackboard learning platform is available in the institute of this study, this paper investigates the types of discourse occur in the online peer reviews of a writing classroom and examines if explicit instructions and training is helpful for learners to produce quality peer discourses that can lead to ESL writing revision. Finally, elements for facilitating online peer response groups will then be identified.

Online Peer review and Discourse

With the increasing application of technology to the education field, the times of e-learning have arrived, which definitely brings new insights into English writing instruction. Online peer review is one of techniques that has been widely adopted for improving the efficacy of L2 writing. Literature has suggested that the conventional face-to-face peer review is an essential element of writing classes and the response and revising process has played a key role in improving the writing of the student writer and developing their critical thinking (Rollinson 2005; Wooley 2007). However, despite the potential merits of peer review, the traditional face-to-face format is time consuming and the student writers “from certain cultures may feel uncomfortable with … the social interaction demanded by peer review” (Rollinson 2005, p. 26). Hence, the emergence of digital technologies can help to alleviate these concerns by changing the face-to-face peer review to an online one.

There is an extensive literature showing that the online use of peer review is more beneficial to student writers than the conventional peer review. To cite a few, DiGiovanni & Nagaswami (2001) have found from their study, which was conducted in two pre-college ESL writing classes at the Community College of Philadelphia, that there are a number of advantages of using online peer review. First, students became more committed and involved in the peer review tasks. Also, it is easier for teachers to monitor the peer review process if it is done online. Further, unlike the conventional face-to-face peer review, both student writers and the teacher can refer to the printouts for the comments of peer reviewers and assess the usefulness of peer comments more easily. Some researchers (Figal et al. 2006; Guiller, Durndell & Ross 2008; Schultz (as cited in Warschauer & Kern 2000)) have also given their support for the use of peer review in an online format. For instance, Figel et al. (2006) have pointed out that the digital peer review format helps "tapping the full potential of the online version and benefiting from rich discussions among teams (p.12). As for the improvement of writing, Schultz (as cited in Warschauer & Kern 2000) maintains that online peer interaction is generally found to be more useful and helpful. This view is shared by Guiller, Durndell & Ross (2008), who compared the transcripts of online and face-to-face discussion and indicated that the online mode facilitates the development of critical thinking and students like this mode of discussion more. Another study done by Liu (2005) comparing the performances of student writers in a pre-writing group using both the traditional and online communication modes shows that there is a more equal participation of student writers if the online communication mode is used.

As the merits of using online peer review have been further shown by research, online peer feedback is widely seen as a very essential feature in the field of L2 writing. This type of feedback can be extremely useful for fostering independent learning skills and improving writing (Milton 2004; Hyland & Hyland 2006). Furthermore, the conversational type of peer feedback can help to cultivate a "sense of community" and develop support systems (Hyland 2000), encourage collaborative learning (Tsui & Ng 2000) as there are more interactions between students and students (Warschauer 2002). Online peer feedback can also result in better writing as it promotes revision (Min 2008) and sense of audiences (Ware 2004).

Liang (2008) developed a framework specific to the online writing context to examine the interaction discourse of 35 students from a "Freshman English" course in a university in Taiwan. The students were asked to comment on the summaries and revisions of one another in weblogs and then two raters coded the peer comments using the six types of online interaction identified from the framework. They are 1. Meaning negotiation, 2. Content discussion, 3. Error correction, 4. Task management, 5. Social talk, and 6. Technical study. The study found that most of the online discourse was about social talk and irrelevant discussion. Constructive negotiations and revisions seldom appeared.

As shown from the above research, online peer feedback has been useful for student writers in many aspects. It is thus worth investigating the discourses involved in the process so as to enhance the effectiveness of the use of online peer review.

Research Methodology

In this section, the research questions pursued in the study, the background of the participants,
the procedures adopted, the data collection and analysis methods used are presented.

Research questions

The study aimed to address three specific research questions:

1. What are the types of online discourse appeared in the peer review process of a writing classroom with HK ESL undergraduates?
2. What is the role of explicit instructions and training for producing quality online peer discourses?
3. What are the important elements that facilitate the production of quality online peer discourses?

Participants

The participants were 27 students, all female, enrolled in a Three-Year Bachelor of Education Programme in Early Childhood Education, Year 1, at the Institute of Education of Hong Kong. All of them are serving full-time kindergarten teachers (one of them is a kindergarten principal) of Hong Kong and they are doing the course on a part-time basis. The participants were students taking a 10-week course entitled "English for Early Childhood Education" taught by the writer of the study. The course consisted of three contact hours per week over a ten-week term in a language laboratory.

Procedures

A. Tasks

In the writing course, students received process writing instructions and participated in drafting and revising. Wiki embedded in the Blackboard was used for posting students' work and getting peer comments on the work. Wiki is a web-based collaborative publication platform oriented to the production of user-written articles. There were two writing tasks for the study: group and individual writing tasks. The group writing task was conducted first and with two purposes. 1. To familiarize students with the drafting and revising process using Wiki in the Blackboard system; 2. To act as an experimental task, examining if there are differences in the types and quality of peer comments after training for giving peer comments was given.

A1. Group Task

In the third session of the class, students were presented an article from the South China Morning Post titled "Obsessions that kills child's quality of life". They were then divided into groups of three to five. Each group was asked to make a 300 to 350-word reaction on the article and post it online. This became the group's first draft. A total of 7 group reports were received.

A week later, students were told briefly to comment on their peers' first drafts. They were told generally to comment on the content, rather than on grammar to help their peers rewrite their first drafts. By the fifth session, each group had to submit a second draft based on the comments of their peers. In the following week, the teacher commented on their second draft. By the sixth session, each group submitted a final draft based on the teacher's comments.

A2. Individual Task

In the seventh session of the course, students were presented a parent's sharing on a blog titled "Kindergarten Admission Process & the Interview". Each student was asked to write a reaction on the article and submitted it online before the end of the week. This became the individual's first draft.

In the eighth session, students were then shown sample comments and an editing checklist (Appendix A). There was a class discussion on the samples and what made a quality comment. Students were then explicitly instructed to make three comments on the content, two comments on the organization and then they were free to comment on grammar and style of their peers' work. Some time was allotted in class to make these specific comments online. They had the following three to four days to finish this task.

Each student wrote their second draft based on their classmates' comments and submitted it by the ninth session. In the following week, the teacher commented on their second draft online. Based on these comments, students rewrote them into a final draft to be submitted in the last session.

B. Training and provision of explicit instructions for the peer review process

The training for giving peer reviews, which was provided for students in the individual writing task, focused on developing an awareness of text revision by asking them to pay more attention to the content and organization of their peers' work since students tended to work on surface-level revision. To enhance students' awareness of the macro aspects of revision, which are content and organization, a training practice and explicit instructions for the number of responses on these two areas were given. The training practice was done in half of a lesson through class discussion between teachers and students on what quality comments were and an exercise on distinguishing useful comments from the given samples was used as a reinforcement exercise.

When reviewing their peers' individual writing drafts, the students were asked to provide comments for at least 3 pieces of work from the peers in their class. They made their own choices and did alone. A revision guideline was given as a reference on what student reviewers should do and teacher gave explicit instructions on what student reviewers were required to do in terms of the types and numbers of comments. They were reminded that the quality of their comments would be graded and included as part of their scores. The students were given one lesson to start revising the work of their peers and the teacher then acted as a guide in the lesson to check if they understood the process and to answer any questions they had in the process. At the end of the revision session, they were given three more days to continue commenting on their peers' drafts and post their comments in the Blackboard system. Every student writer could then access their peer comments and revise their draft based on the useful comments. The revised draft (namely second draft) was then submitted online to the Blackboard system before the next lesson in Week 7.

Procedures of data analysis

Peers' comments collected in this study were analysed by content analysis. Four stages of content analysis were conducted in this study: coding, categorization, description and interpretation. A coding system developed by Liang (2008) was adopted and modified for use in this study. 9 categories were identified for the types of discourse that would occur in peer interactions:

1. Meaning negotiation
2. Constructive content discussion
3. Organization
4. Error correction
5. Social remarks
6. Irrelevant opinion/information
7. Regurgitation
8. General evaluation
9. Unclassified

#3, #6 to #9 were additional codes included in this study. #3 was used to accommodate the comments relating to the improvement of organization of ideas of the writing as it was the focal point of learning in the writing lessons. #6 to #9 were added to accommodate all comments which were not directly related to the writing revisions. Definitions and examples of each coding are presented in Appendix B. The unit of analysis for the online discourses is referred to "segment" in this study. Using the modified coding system, the researcher and a trained research assistant coded 3 pieces of comments from the participants independently and then reviewed all cases of disagreement and resolved the differences together. Finally, the research assistant helped to code all the comments. Almost all the segments included one type of interaction, but a few segments (less than 5 per cent) included two types of interactions which were counted as two segments then.

A post-course questionnaire was administered at the end of the course to explore the attitudes towards the use of peer review. However, not all data acquired through the questionnaire are relevant to the present discussion, as my main focus is on the online discourse learners had in the peer review process. Hence only the responses of two questions regarding the usefulness of explicit instructions and training for the use of peer review were used in this study.

Results

The focus of this study was the learners' interaction discourse in the peer review process. Specifically, the discourse types appeared in the discussion of group and individual tasks were examined. The results were then compared to determine if the explicit instructions and training given by the instructor were helpful in producing better quality or quantity of responses. Table 1 provides a summary of the types of discourse from both group and individual tasks.

Table 1: Types of online discourse

Types	**Group**		**Individual**	
	No. of occurrence	Percentage	No. of occurrence	percentage
Meaning negotiation	9	3%	20	5%
Constructive content discussion	53	16%	135	33%
Organization	19	6%	18	4%
Error correction	3	1%	42	10%
Social remarks	50	15%	29	7%
Irrelevant opinion/information	39	12%	7	2%
Regurgitation	40	12%	42	10%
General evaluation	113	34%	99	24%
Unclassified	10	3%	18	4%
Total	**336**	**100%**	**410**	**100%**

As seen in Table 1, the participants showed a greater awareness of making quality comments than they did prior to taking the training and instructions on peer review. However, it needs to be pointed out that non-revision related comments were still a lot in both the responses for group and individual tasks.

Responses for group task

In making the responses for the group task, some of the participants had taken into account the "content" issue when commenting on the others' work as there were 16% and 3% for "constructive content discussion" and "meaning negotiation" respectively. However, they comparatively tended to give more "general evaluation" (34%), such as praises and comments which were not very useful for revision. In addition, the participants also made a lot of "social remarks" (15%) in their responses. "Regurgitation" and "irrelevant information/opinion" accounted for 12% each in the total responses.

Responses for individual task

Different from the responses for the group task, the responses for the individual task mainly concentrated on "constructive content discussion" (33%). There were still a fair number of responses on "general comments" (24%), but the percentage had dropped from 34% to 24%. The responses on "social remarks" and "irrelevant comments and opinions" also decreased significantly from 15% to 7% and 12% to 2% respectively. However, the appearance of "regurgitations" seemed almost the same (12% to 10%) in the two tasks. Another notable change is the number of responses on "error grammar", which changed from 1% in the group task to 10% in the individual task.

Influences of explicit instructions and training on the types of peer discourse

In order to determine if explicit instructions and training are useful for making responses in better quality and quantity, the 9 discourse types were categorized into constructive and non-constructive comments and were examined in both group and individual tasks (see Table 2). Types 1-4 were considered as constructive comments as they were about meaning, content, organization and error correction, which were important for making a good piece of writing work. Types 5-9 were regarded as non-constructive comments as they were about social remarks, irrelevant information/opinion, regurgitation, general evaluation and unclassified information.

Table 2: Constructive and non-constructive comments in group and individual tasks

Types	**Group**		**Individual**	
Constructive (Types 1-4)	84	25%	215	52%
Non-constructive (Types 5-9)	252	75%	195	48%
Total	**336**	**100%**	**410**	**100%**

From the result, when comparing the responses for group and individual tasks, it was found that constructive comments increased more than a double (from 25% to 52%) while non-constructive comments decreased by more than one-third (from 75% to 48%) in the responses of the individual task.

In addition, the ratio of constructive to non-constructive comments shifted from 1: 3 to 1: 0.9 (84: 252 to 215: 195) in the responses for the group task to the ones for the individual task. This shows that in the group task, for every constructive comment, there were 3 non-constructive comments. However, in the individual task, for each constructive comment, there were only 0.9 non-constructive comments.

Hence, there were more constructive comments from the responses of the individual task. Among them, 33% were on content discussion and 10% were on error correction. It appears that the explicit instructions and training given by the instructor in the peer review session for the individual writing task was useful for helping learners to give responses in good quality and quantity. This finding is further confirmed by the responses of the learners to a post-course questionnaire on the use of peer review, as shown in Table 3. Two questions in the questionnaire asked about the usefulness of training and class instructions on giving peer review. Although there were 11 responses only, generally positive opinions were found among the participants.

Table 3: Learners' responses on the use of explicit instructions and training from post-course questionnaire

Question	**Strongly disagree**	**Disagree**	**Neither disagree nor agree**	**Agree**	**Strongly agree**
The instructions given by the teacher in giving the types of peer comments were useful.	0%	0%	27%	55%	18%
The class discussion on "what a quality peer comment" was useful.	0%	0%	36%	55%	9%

Discussion and implications

Results of the study are discussed with respect to the three research questions that guided this investigation.

Types of online discourse in the peer review process

This study explored the types of online peer discourse in a writing class supported by the Wiki function of Blackboard system. Nine different types of online discourse were examined in this study. The types of discourse occurred in the tasks represented the understanding of learners on peer review. As described in the data presentation, the interactions amongst participants can mainly be found in "general evaluation", which were basically useless for making revision. Some of them commented on "content", but a majority of responses was on "social remarks, regurgitations and irrelevant opinions", which were categorized as non-constructive comments. Although the participants gave more constructive comments after receiving the training or instructions about what to do in the peer review process of the group task, a considerable amount of comments was still non-revision, which means useless for making revisions. The frequent occurrence of these types of discourse can be mainly explained in relationship to the characteristics of Chinese students and the competency level of reviewers.

Characteristics of Chinese students

As we described earlier, it is meaningful to consider the nature of Chinese students in examining discourse generated via online discussion. Understanding the characteristics of Chinese students helps to guide us in deciding the best way of implementation of peer review in a Chinese context. A study done by Carson and Nelson (1996) shows that Chinese learners were inclined to maintain the social harmony in groups, thus they were very careful in making comments and avoided making strong criticisms and disagreements. As a result, these kinds of characteristics affected the types of interactions they had in their peer discussions. Cotterall (1995) also finds that Chinese learners are used to traditional teaching method which the teacher will direct all the things and students are supposed to follow the instructions. Thus they do not know what to do if they are given the autonomy and would only trust their teacher's comments. Roskams (1999) agrees that "cultural" issue should be taken into consideration when planning collaborative learning activities, such as peer reviews as some of the cultures do not allow "public disagreement". The Chinese culture is one that teaches people not to provoke conflicts by giving disagreements or negative criticisms openly.

Competency of reviewers

The investigation results showed that a large amount of the comments from both individual and group tasks was about "general evaluation", such as praises, others fell on "social remarks" and irrelevant comments. This raises a question on the value of peer comments, which researchers (Leki 1990; Nelson & Carson 1998) believe that there is a strong relationship between it and reviewers' competence level. The comments from a high competent peer might be perceived similarly as feedback by a teacher (Tsui & Ng 2000). Thus, if students are more competent reviewers, they are able to produce revision-related comments which are deemed as constructive and useful. On the other hand, if students are not competent, they may not have processed the abilities to make useful comments on content development, organization of ideas and use of grammar. Hence, the value of feedback content correlates with the competence level of a peer. The competency of reviewers refers to the knowledge of the target language. As researchers (Nelson and Murphy 1993; Zhu 2001) point out, L2 learners may not have sufficient knowledge to find out the errors made by their peers in their writings and provide useful comments for making revisions as they are still in the process of learning the target language. Thus they will be put in a difficult situation if they are asked to give comments on the others' writing.

Role of explicit instructions and training for producing quality online peer discourses

From the results, it was found that students made more constructive and useful comments in the peer reviews of the individual tasks. This finding shows that explicit instructions and training have a positive impact on the quality of reviewers' comments. Similar findings have been reported on the usefulness of instructions and training to participants in a number of recent studies (Min 2006; Rollinson 2005). All these support the role of instruction (Van Steendam, Rijlaarsdam, Sercu, & Van den Bergh 2010) on peer-feedback quality. Nevertheless, only one attempt was used in the study to try out explicit instructions and training, there were still a lot of non-constructive comments in the peer reviews of the individual tasks. In this regard, it seems to be helpful if more explicit instructions and training were given to peer reviewers repeatedly as training practices. Apparently, with more guidance and training, they could be more competent reviewers. The guidance and training could be compensatory mechanisms that mediate between peer comment content and reviewers' competence level. The primary objective of guidance and training is to maximize the effectiveness of the peer review activity (Rollinson 1998). By means of informal discussions of sample peer comments, as well as in-class evaluation practices on peers' writing which require participants to note the types of comments that will be useful for student writers, the teacher can help build up the competency of peer reviewers. The teacher is in a position to bring out the quality of online peer discourse.

Elements facilitating the online peer response groups

Despite the support given by the literature on the use of peer review in L2 writing instruction, which suggests that it can be a potential tool in teaching learners a wide range of skills important in the development of language learning and writing ability (Hu 2005; Kamimura 2006;. Lundstorm & Baker 2009), there are also criticisms on its usage when it has been tested more experimentally. Thus it is essential for us to identify the elements that can facilitate the online peer response groups based on the findings of this study.

Training

One of the aspects that receive most of the criticisms is the inability of learners in producing quality comments. My study and the other research find that peer reviewers tended to give very general evaluations. Training reviewers could be a possible way to improve peer review. Reviewers can learn either by trial and error or by working with experienced reviewers in the training session (Sluijsmans et al. 2004; Zundert, Sluijsmans & Merriënboer 2010) as it is found that training positively influenced their motivation and writing skills. According to Hu (2005), training sessions must be able to provide students with adequate understandings of the peer review process and its potential benefits. Peer review training can be started with a class discussion of the potential advantages and problems of peer review. Explanation of how peer review can be carried out and teacher's expectations during and after peer review should be made clear to learners. Provision and explanation of response guidelines before each peer review assignment is a must. Training sessions can be grouped according to aims and functions. Awareness-raising activities should be added if learners are from Asian countries whose cultural norms may not comply with the pedagogical principles underlying peer review. Actual examples of good and poor peer comments should be provided to develop an understanding of how peer response might work. Sample written peer comments on excerpts of essays written by previous students can be discussed. Learners can also be asked to examine the revisions made by the previous students in response to the peer comments. To be effective, training activities should be done continuously for several times until learners are completely ready for the review process. Enabling ongoing communication between the teacher and learners and building a trustful environment in the training sessions are crucial for the success of the process.

Grading peer comments

Another possible technique which may help to enhance the effects of peer reviews is grading peer review comments. Reviewers will be more motivated to spend time in their peer review process if they know that their instructors will assess or even grade their comments. This is not only a way of increasing their accountability, but it is a method that can promote the production of more quality comments as most of the learners would strive to obtain a higher grade during their review process. "Effective [g]rading . . . presents suggestions for making classroom grading more fair, more time-efficient, and more conducive to learning" (Walvoord & Anderson 2010, p. xvi).The impact of such an instructional technique has been shown in this study as the amount of quality comments appeared more after explicit instructions on the types and numbers of comments required were given. Similar to other types of assignments, the instructor should present clearly to learners the task, his/her requirements and grading rubrics for the peer feedback. The instructor should not check "accuracy of grammar" only, instead he or she should focus on the "usefulness" of peer comments for student-writers. When learners know that the useful comments will result in higher scores, they will pay more effort in their peer review work.

Having enough set-up preparation

As Rollinson (2004) states, peer review could be run more smoothly if the instructor can "properly [set] up the groups and [establish] effective procedures. The instructor should make decisions on the setting up of groups: self or teacher-selected; number of learners. Learners are different in terms of ability and cultures in different classes (even in the same class). There could be mixed-ability or same-ability groups or groups of four or five. The instructor has to help in the formation of groups that can maximize their effectiveness of learning and that they can work in a comfortable environment. As for procedures, issues to be considered will include: number of drafts to be done; the level of involvement of the instructor in the process; will feedback be graded by the teacher; guidance to be provided to learners on the peer review process. Additionally, decisions will need to be made about how the peer review sessions are to be organized. Do readers provide feedback independently, or do they form groups, and to what extent will groups be monitored? The instructor will have to consider all the above before the process starts.

Conclusion

Three main conclusions were drawn from this study. Firstly, non-constructive peer discourse dominates the online interaction of the L2 students of my study. Though the situation becomes better after explicit instructions and training were given, quite a considerable amount of the peer feedback is still useless which cannot lead to successful revisions in most cases.

Second, the impact of explicit instructions and training is positive. More instructions and training should be incorporated in the peer review process to lead to greater improvement. After the guidance and training, peer feedback appears to bring about a higher percentage of meaning-change revision. At the same time, students also find them useful in helping them to give more constructive comments.

Lastly, peer feedback does lead to improvements and appears to encourage student autonomy, so it can be seen as a useful adjunct to teacher feedback by incorporating the following elements into the process: continuous training, grading and good set-up preparation.

As the advancement of technology continues and it becomes more prevalent in our lives, the exploration of a variety of methods for studying the use of technology in different aspects will continue to increase. Further, I would very much like to see new teaching and learning strategies to fully engage the capabilities of the new devices. Continuing exploration of the technology in enhancing the effectiveness of learning is vital if we are to realize its full potential.

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