



ASIA-PACIFIC SOCIETY FOR  
COMPUTERS IN EDUCATION

# Doctoral Student Consortium Proceedings of the 18th International Conference on Computers in Education ICCE 2010

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FOR COMPUTERS IN EDUCATION

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THE FACULTY OF EDUCATIONAL STUDIES  
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the 18<sup>th</sup> International Conference on  
Computers in Education  
ICCE 2010

November 29, 2010 - December 3, 2010  
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## **Preface**

This volume contains the Doctoral Student Consortium Proceedings of the 18th International Conference on Computers in Education (ICCE 2010). For this year, the Doctoral Student Consortium (DSC) brings together PhD students working in the broad research areas of computers in education in the following six sub-themes: Artificial Intelligence in Education/Intelligent Tutoring System and Adaptive Learning (AIED/ITS/AL); Computer-supported Collaborative Learning and Learning Sciences (CSCL/LS); Advanced Learning Technologies, Open Contents, and Standards (ALT/OC/S); Classroom, Ubiquitous, and Mobile Technologies Enhanced Learning (CUMTEL); Game and Toy Enhanced Learning and Society (GTEL&S); and Technology, Pedagogy and Education (TPE).

The DSC aims to provide an opportunity for a selected number of PhD students to present, discuss and receive feedbacks on their dissertation work-in-progress from a panel of established researchers with expertise in the same research areas. The DSC is meant for students to shape their research methodologies and analysis at the early stage of their PhD research with comments from invited mentors and guidance for future research directions. The DSC also hopes to nurture a supportive learning community and promote interactions among young researchers from various institutions and across different countries in the Asia-Pacific region and beyond. It also provides opportunities for theme-based forums to discuss methodological and theoretical issues of central importance. The DSC and the related social events are financially supported by the Asia-Pacific Society for Computers in Education (APSCE).

A group of senior PhD students (Sagaya SABESTINAL, Jason LEE, Yun WEN, Yuki HAYASHI, Bian WU, Benjamin, M.C. LIU, Mengmeng LI, Jen-Hang WANG, Shih-Hsun HSU, Boon See TAN, and Wai Ying KWOK) who were highly recommended by the APSCE Special Interest Group Chairs (SIG) Chairs/Co-Chairs were invited to be the organizers of this prestigious event. This group of senior PhD students were guided by the DSC Chairs (Hiroaki OGATA, Chen-Chung LIU, Kinshuk, Gautam BISWAS, Yam San CHEE, and Fu-Yun YU). The DSC chairs helped oversee the whole process of organizing

the DSC and provided guidance along the way. With a strong sense of responsibility and enthusiasm, this highly dynamic group has been successful in organizing the DSC. It is clear that by entrusting this group of senior PhD students with the responsibility of organizing this important event and editing the DSC Proceedings, they were able to form a vibrant and supportive research community within a short period of time; which is one of the main goals of the APSCE.

This year we received a total of 12 submissions where 10 papers were finally selected and included in the Proceedings. Each selected paper went through a rigorous blind review by independent peer reviewers to ensure high quality work. We hope that the papers in this proceedings on various research topics will stimulate more research ideas and discussions among the young researchers.

We would like to thank the invited mentors (keynote and invited theme-based speakers) and the APSCE SIGChairs/Co-Chairs, Tsukasa HIRASHIMA(AIED/ITS/AL), Chee-Kit LOOI and Carol CHAN (CSCL/LS), Kiyoshi NAKABAYASHI ( ALT/OC/S), Chen Chung LIU (CUMTEL), Tak-Wai CHAN and Ben CHANG (GTEL&S), Su Luan WONG and Siu Cheung KONG (TPED) in making this year's DSC a highly successful event. Finally, we would like to take this opportunity to record our sincerest appreciation to Dr. Tak-Wai CHAN, Dr. Fu Yun YU and Dr. Su Luan WONG for their valuable suggestions at the early stages of organizing the DSC.

On behalf of the editors

**Hiroaki OGATA**



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# Towards a Framework for Embedded ITSs

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**Abstract:** Although Intelligent Tutoring Systems (ITSs) have proven their effectiveness, very few attempts have been made to embed ITSs into existing applications. In this paper, we describe the research, design and progressive development of DM-Tutor (Decision-Making Tutor), the first constraint-based tutor (CBT) to be embedded within an existing system, the Management Information System (MIS) for palm oil plantation management currently being used in Malaysia. We discuss the research and development of DM-Tutor with the help of ASPIRE, an authoring system for CBTs. We also include future work planned for DM-Tutor.

**Keywords:** embedded intelligent tutoring systems, decision making training, management information system

## Introduction

Intelligent Tutoring Systems (ITSs) provide benefits of one-on-one teaching to any number of students automatically and cost effectively through highly interactive environments [3]. Over the years many ITSs including LISP tutor [1], Andes-Physics Tutor [14], PUMP Algebra Tutor [4] and others have been effectively used in many teaching and learning domains. SQL-Tutor [6] and KERMIT [13] are among the many constraint-based tutors (CBT) [7] that have been developed and successfully implemented by the Intelligent Computer Tutoring Group (ICTG). Even though ITSs have been proven as effective teaching tools there have been very few attempts to embed them with other systems, Embedded Training System (ETS) [2], Excel Tutor [5] and Personal Access Tutor (PAT) [11]. Will ITSs embedded within existing systems provide effective instructions? Through this effort we hope to answer that important research question. With this research we aim to make several significant contributions. This will be the first attempt to embed a CBT with an existing system. We also aim to research the significant benefits of providing training through this integration. We aim to develop a framework for embedded ITSs and prove its research contribution through the development of DM-Tutor and its integration with the MIS for palm oil.

This paper presents the research, design and on-going development of DM-Tutor (Decision-Making Tutor), an ITS to train on plantation decision making for the palm oil domain. DM-Tutor will be embedded with a Management Information System (MIS) [10] currently being used to manage palm oil plantations in Malaysia and Indonesia. The MIS for palm oil contains operational data of yield records and plantation cultivation details. As the information contained is highly domain specific, managers who are new to the domain or to the MIS face difficulties in making accurate operational analyses and this affects the decisions they make at the palm oil plantations. When DM-Tutor is embedded with the MIS for palm oil, students will be able to practice plantation decision making using real life operational data from the MIS. The goal of DM-Tutor is to help students and managers

apply theoretical concepts of plantation analyses into real-life plantation decision making. This paper is organized as follows. In the next section we describe DM-Tutor. Section two describes the development of DM-Tutor in ASPIRE [8], an authoring system for CBTs. Section three describes future work planned for DM-Tutor and conclusions.

## 1. DM-Tutor

To the best of our knowledge there has not been an ITS for plantation decision making, DM-Tutor is novel in that respect. Figure 1 presents the overall architecture of DM-Tutor. Our plan is to make DM-Tutor accessible through the MIS interface. The MIS by itself is a web based system and is accessed via a web browser. Students log in to the MIS and then access DM-Tutor through the MIS.

*Student model* contains information of student's knowledge of the domain and is updated every time the student uses DM-Tutor. Constraint based modeling (CBM) [9] is used to model the domain and the student. Student is modeled by looking through her/his solution and comparing it to the ideal solution in DM-Tutor. *Pedagogical module* selects instructions relevant to the scenario-based problem solving strategy used. It also has the role of providing helpful feedback to students when they submit an incorrect solution.

*Interface module* presents the student interface of DM-Tutor. The *problems* and *solutions* component focuses on *Yield Gap Analysis*, *Fertilizer Management* and *Yield Forecasting*, three main analyses of palm oil plantation management. In order to solve problems presented in DM-Tutor, students will have to access relevant reports from the MIS. DM-Tutor would also log information on the MIS reports that students accessed. This will enable DM-Tutor to provide helpful feedback when the student fails to provide correct solution to the problem.

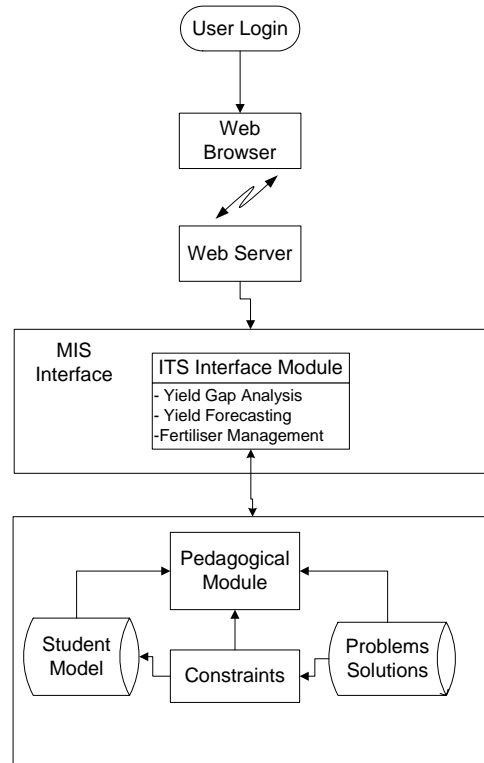


Figure 1: DM-Tutor Architecture

## 2. Development of DM-Tutor

DM-Tutor has been developed using ASPIRE, an authoring system for constraint-based tutors. In the first development stage, we identified domain characteristics and problem solving steps required for DM-Tutor. To identify characteristics of the domain, we needed to determine the domain knowledge that we are teaching and the appropriate teaching strategy to be used. We divided the domain into three procedural tasks: *yield gap analysis*, *fertilizer management* and *yield forecasting*. In the next stage we developed ontologies for each separate task. Developing domain ontologies was a crucial step in DM-Tutor authoring process as this contributed to building of syntax constraints in the later development stage. In the domain ontologies we identified important concepts for each task and the relationship between these concepts using a hierarchical structure. Each concept could have

super-concepts, sub-concepts, properties and relationships with other concepts. Concepts we created in the ontologies are present in the solution structures. By developing the ontologies we were able to study each task within the domain in greater detail and this helped in the development of accurate constraint bases.

In the third step we modeled the problem and solution structures for each task within the domain. For procedural tasks, problem solving is divided into several steps and student's solution is evaluated at every step. Students will not be able to continue to the next problem solving step before submitting the correct solution for the present step. Each solution component comes from the ontology of each task. In the next stage, ASPIRE developed the interface for DM-Tutor. Figure 2 presents the student interface for DM-Tutor. DM-Tutor's student interface is divided into three parts. The top pane is where the problem statement is placed, so that students always know the problem they are attempting. The bottom pane presents the solution workspace where students need to work on their solutions to the problems and the side pane is used to provide feedback to the students on the problems they are attempting. The interface design for DM-Tutor is aimed at reducing memory load of the students. We have planned to replace the current textual interface of DM-Tutor with java applets.

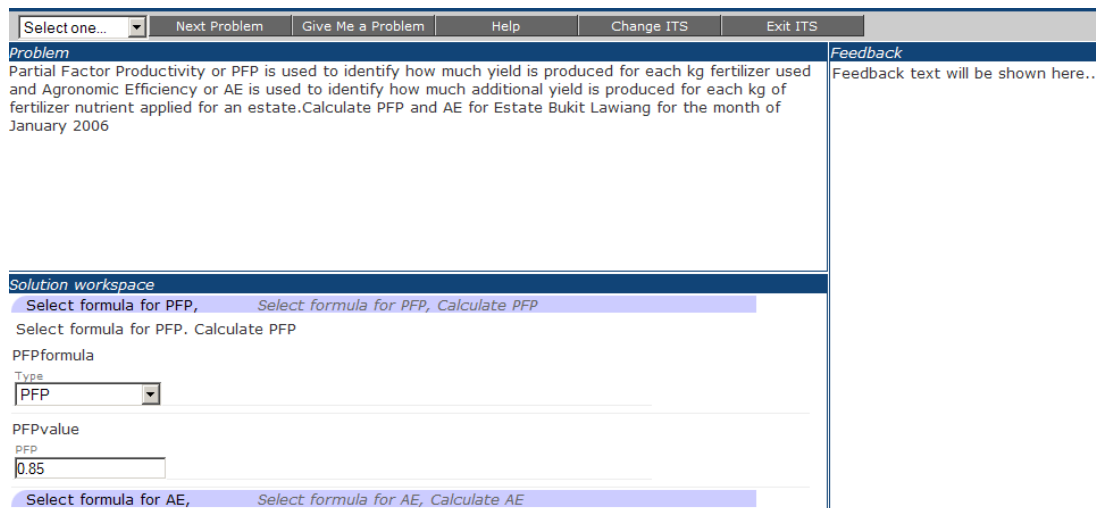


Figure 2: Student interface for DM-Tutor

In the next stage, ASPIRE helped to generate constraints for DM-Tutor. For CBM, knowledge of the domain is expressed as a set of constraints on correct solutions. ASPIRE generated syntax constraints and semantic constraints. Syntax constraints check whether the student's solution follows the syntactic rules of the domain. Syntax constraints were generated based on the concepts found in the ontologies. From the ontologies, there were 21 concepts in *yield gap analysis* task, 30 concepts in *fertilizer management* task and 26 concepts in *yield forecasting* task. Semantic constraints were generated based on the ideal solution for each problem. Semantic constraints checked whether student's solution matched the ideal solution. For DM-Tutor, ASPIRE generated 89 syntax constraints and 127 semantic constraints in total. After ensuring that all the information supplied for DM-Tutor was complete and consistent, we deployed DM-Tutor as an ITS.

### 3. Future Work and Conclusion.

At present we are researching possible ways to make an effective integration between DM-Tutor and the MIS. DM-Tutor will be accessed through the MIS. Students log in to MIS to attempt problems within DM-Tutor. For every problem in DM-Tutor, students would need to obtain relevant information from the MIS as part of their solution. We have planned to make information on the type of reports students looked at in the MIS to be send to DM-Tutor directly. This is to be done so that concise and specific feedback is provided to students when they submit an incorrect solution to a given problem. Currently I'm researching the efforts of Ritter and Koedinger [12], Cheikes, et al [2] and others to further understand and develop the most suitable architecture for embedding ITSs with existing systems.

Upon completion DM-Tutor will be evaluated by different user groups. We have planned for DM-Tutor to be evaluated by the Forestry Department, University of Canterbury. They will be looking at DM-Tutor as novice users. DM-Tutor will also be evaluated by plantation managers and trainee managers from TH Plantations, Malaysia and REAK Plantations, Indonesia. These users would be categorized as expert users for DM-Tutor. Through these evaluations we will be able to analyze how effective DM-Tutor is as a training tool. More importantly we would be able to analyze the benefits of embedding ITSs with existing systems in providing effective trainings.

### Acknowledgements

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# Assessing Students' Readiness for CSCL

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**Abstract:** This paper is based on the work of the author's master thesis, aiming at conceptualizing and assessing students' readiness for CSCL. We designed a framework for assessing students' readiness for CSCL and will conduct questionnaire surveys using this framework. Since the survey data are yet collected at this point, only the theoretical and methodological approaches are reported in this paper.

**Keywords:** Readiness, CSCL

## Introduction

Computer supported collaborative learning (CSCL) is an emerging paradigm in instructional technology concerning with studying how people learn together with the help of computers [4]. Basically, CSCL is the combination of the two ideas of "computer supported" and "collaborative learning".

A great deal of research has been done to figure out what parameters affect the productivity and effectiveness of the CSCL activities [1] [8]. Within those studies, researchers tried to investigate what factors related to students' participation, collaboration satisfaction, and collaboration outcomes .etc, and how those factors related to each other. However, according to an intensive review about the measurements in CSCL, it was pointed out that there was a lack of measurements "before collaboration" as measurements were done dominantly "during collaboration" or "after collaboration" [3]. We may ask "are the students ready for collaboration" before they are engaged in collaborative activities.

Currently, there are a few studies that have investigated students' readiness for online learning [5] [7], whereby technical and self-regulated factors were the main concerns. But regarding learners' readiness for collaboration, what they examined was students' comfort level for electronic communication. This is considered to be not enough to assess a learner's readiness for collaboration in CSCL settings as Stahl [9] pointed out CSCL is different from pure online learning in terms of a larger motivational and interactive context and even face-to-face form of interactions in CSCL settings. Therefore, the criteria for evaluating learners' readiness cannot be generated from online learning to CSCL settings. Since few studies have investigated students' readiness to collaborate in the CSCL context [3], there is a need for the proposed research in this paper, for conceptualizing and assessing students' readiness for CSCL.

As the thesis work is still at the beginning point, only the theoretical and methodological approaches are reported in the following parts. There are three sections in this paper: the first part is the statement of research questions; the second part is to elaborate the theoretical background for this research; and the last part is methodology.

## 1. Research Questions

Collaboration readiness is a complex concept and may be evolving during the collaborative processes. In this study, we intend to focus on students' readiness before collaborative process in order to get a preliminary understanding. As the measurement will be based on self-reported survey, students' readiness to be measured is actually individual self-perceived readiness for CSCL.

The research questions are as follows: (1) what constructs build on students' perceived readiness for CSCL? (2) How are these constructs related to each other? And (3) whether and how are the demographic and past CSCL experience factors related to students' readiness to collaborate?

The results of this study will help to fill the gap in the understanding of students' readiness for CSCL and providing guidelines for measuring the state of this readiness. It will also assist instructors in designing more appropriate CSCL activities.

## **2. Theoretical Background**

Some studies mainly investigated students' readiness in online learning context [5] [7] [12]. The instruments used in those studies provided a lot of guidelines to assess online learners' readiness, which were mainly from three aspects: (a) technical factors (such as technical access to online resource and technological skills for online communication) [5] [12], (b) self perspectives towards online learning (such as preference and comfort with online learning) [7], and (c) motivational factors (such as self-regulation skills and perceived value of online learning) [5] [12].

Drawing on the previous studies about online learners' readiness, we adapted the technological factors and motivational factors in constructing the readiness for CSCL. Additionally, the collaborative knowledge, skills and abilities (KSAs) were stressed because researchers believe these are the factors important for a successful collaboration to happen [10]. In the following part, these three dimensions (technological readiness, collaboration KSAs readiness and motivational readiness) will be discussed respectively.

### *2.1 Motivational Readiness*

Literature suggests learners' motivation is a powerful predictor for their engagement and achievement in collaborative activities [2] [13]. Motivational readiness is considered as a critical scale to evaluate learners' readiness for CSCL in this study. It provides a method to identify whether learners are psychologically ready for the collaborative activities.

Based on the motivation theories, such as self-efficacy theory, expectancy-value theory and self-determination theory, three dimensions were extracted, self, task and reinforcement [2]. "Self" dimension includes self confidence and interest for collaborative activities; "task" dimension refers to perceived value of collaboration; and "reinforcement" dimension is mainly about external awards or punishments of doing or not doing something.

### *2.2 Knowledge, Skills and Abilities (KSAs) for Collaboration*

The concept of KSAs for collaboration is originally from the work of teamwork KSAs by Stevens and Campion [10] [11]. In 1994, Stevens and Campion proposed a list of criteria to identify participants' levels of teamwork capacities [10]. Mainly drawing on extensive literature on group studies in social psychology, they synthesized 14 specific individual-level KSAs which they believed could identify participants' capacities for



teamwork [10]. Those KSAs were in two major categories, with 5 subcategories [10], which are “conflict resolution KSAs”, “collaborative problem solving KSAs” and “communication KSAs” in the dimension of “interpersonal KSAs”, and “goal setting and performance management KSAs” and “planning and task coordination KSAs” in the dimension of “self-management KSAs” [11].

This five-factor framework was validated in their follow-up studies, results showing the teamwork KSAs was significantly related to team performance [11]. It was suggested that the teamwork KSAs had both conceptual and practical value in the staffing of teams [11].

KSAs for collaboration is an important construct to evaluate learners’ readiness for CSCL, which provides criteria to identify learners’ capacities to collaborate through assessing learners’ skills of conflict solving, problem solving, communication, goal setting and coordination.

### 2.3 Technological Readiness

As computer is an inevitable component in CSCL, students should have the abilities and willingness to use it and learn collaboratively with it. Technological readiness was tested in the context of online learning, which focused on three aspects [5] [12]: technological access, basic computer literacy and electronic communication skills. In the context of CSCL, learners’ technological efficacy was pointed out to have influences on their collaborative behaviors [6].

In this study, willingness to use ICTs in collaborative learning is added besides general ICT skills to construct students’ technological readiness for CSCL, as we believe learners’ attitudes towards ICTs are important as well.

Figure 1 describes the constructs of readiness for CSCL. The instruments will be developed based on the framework and the factors included in the framework will be tested out in the next step.

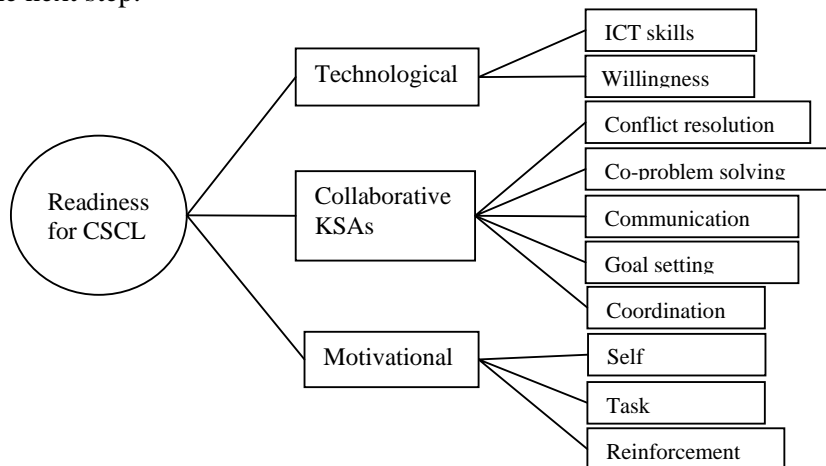


Figure 1. Constructs of Students’ Readiness for CSCL

## 3. Methodology

### 3.1 Instrument Development Procedures

The instrument development will be carried out in four stages. Item creation is the first stage. The purpose of item creation is to generate items based on the theoretical framework. The second stage is expert validation, whose purpose is to refine the instrument based on experts' views. The third stage is pilot study for validating the instrument statistically. And the main study is the final stage to validate the instrument and test the relationship between factors.

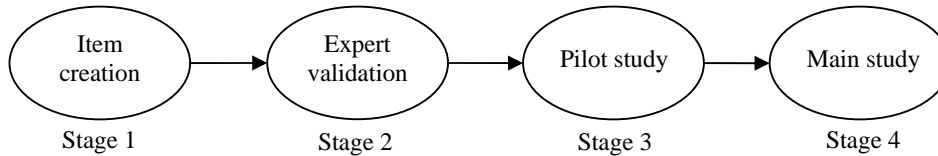


Figure 2. Instrument Development Processes

### 3.2 Data Analysis Procedures

In the stage of expert validation, comments from experts will be collected and appropriate changes will be made on the instrument based on the comments. Confirmative factor analysis will be conducted for the data collected from pilot study to test the validity of the instrument. In order to check the reliability, internal consistency will be tested as well. Based on the analysis results, questionnaire items will be revised. For the data collected from main study, confirmative factor analysis will be conducted again. In addition, correlation analyses will be conducted to evaluate the relationship between different factors. Analyses of variance will be carried out to test the mean different for different group of students, separated by gender, age or other traits. Based on the analysis results, guidelines will be proposed for evaluation of students' readiness for CSCL.

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# Virtual Pair Programming for C++ Programming E-Learning

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**Abstract:** This paper reports a brief research proposal that designs and develops an e-learning system that applies the concept of virtual pair programming (VPP) to support object-oriented programming learning with C++ programming language. The proposed system implements artificial intelligence (AI) using fuzzy logic method in programming tasks to accommodate students' programming capabilities. This interactive learning environment aids students in learning to program with C++, as an enhancement and addition to the conventional way of learning, which is face-to-face learning in classrooms.

**Keywords:** Pair programming, virtual pair programming, e-learning, C++ programming, object-oriented programming, artificial intelligence, fuzzy logic

## Introduction

For undergraduate university students who are majoring in engineering, computer science and information technology, computer programming course is one of the core subjects which are compulsory in the first year of their studies. Programming is not an easy subject, whether it is to be learnt or to be taught.

### 1. Problems in Programming Learning

As Kollmann and Goedicke had mentioned in 2008 [1], learning to use a programming language is one of the most difficult steps in software engineering. Many students are facing problems in learning programming language.

One of the reasons is the course contents are quite difficult. Programming learning requires theoretical understanding and a lot of practical learning. Since the size of the student groups are usually large, there are limitations in terms of resources and instructors. Even though most institutions provide computer facilities for students to practice their programming skills, the computers available are insufficient to accommodate them. Some students are required to share the computers in small groups, which give them limited time to think, concentrate and do hands-on work on the programming task individually. This problem leads to difficulty in understanding the concept of programming. In addition, the low number of instructors causes the students to suffer from a lack of personal instruction. Learning takes place when the learning situations and materials are more practical and concrete [2].

Many researchers have proposed solutions to overcome the problems in programming learning. However, none of these approaches have efficiently solved these difficulties [3].

## **2. The Concept of Pair Programming**

### *2.1 Pair Programming*

An approach that has been accepted in programming learning is the concept of pair programming. Pair programming is a software development practice in which two programmers work together at one computer on the same programming task.

Side-by-side, a programmer (the driver) types in the programming source code while the other programmer (the observer or navigator) reviews each line of code and checks for potential errors or mistakes. The two roles are switched between them until the end of the programming session. The observer gives comments and thinks of ideas to solve the current programming assignment, enabling the driver to focus on the typing in the programming code. An instructor or tutor would be assigned to guide each pair and observe their performance.

The learning process takes place between the students as well as between the students and the instructor. Studies have shown that application of pair programming have managed to increase the students' enjoyment and confidence in practicing their programming skills [4]. It has been proven that pair programming is effective in solving difficult programming problems [5]. Other significant benefits of this practice are that programmers gain more knowledge in software development, take less time to perform programming tasks and design more efficient programs [6].

### *2.2 Virtual Pair Programming*

As e-learning is the popular mode to acquire knowledge these days, another implementation of pair programming called virtual pair programming has been introduced. The concept of VPP is the same as pair programming, with the exception of the location of the two programmers.

The programmers would be working on the same programming task from their own computers at their own locations. This collaborative environment would apply various e-learning tools such as e-mail, online forum and online chat room to enable them to share the roles and ideas during the program development.

VPP is flexible and convenient as the learning process could be done at any place, time and at student's own pace. It is a practical option for those who have other commitments such as work and family. There will be no need to travel to and from the computer lab, thus provide benefits in terms of transportation, time and cost. Teague and Roe have agreed that this approach has the potential to effectively increase the students' programming skills [7].

## **3. E-Learning for C++ Programming Learning**

The objective of this research is to propose and develop a prototype of an e-learning system that applies the concept of VPP for undergraduate students to learn computer programming. The scope of the proposed system is object-oriented programming, focusing on C++ programming language. AI will be used to adapt programming tasks and exercises via fuzzy logic method in order to accommodate students' programming capabilities.

Through series of selected questions, students' knowledge will be reviewed to determine their level of studies and programming skills. The course contents will be based on the students' current level of studies. In pairs, students will be given programming tasks

which need to be done by applying VPP. Towards the end, students' performance will be assessed to evaluate their understanding on the particular topic. The flow of the proposed system is shown in Figure 1. Accordingly, the difficulties of the programming tasks and exercises will increase as the students improve their skills. The system would be able to identify the weak topics and problems encountered by the students to assist the instructors to emphasize these specific topics.

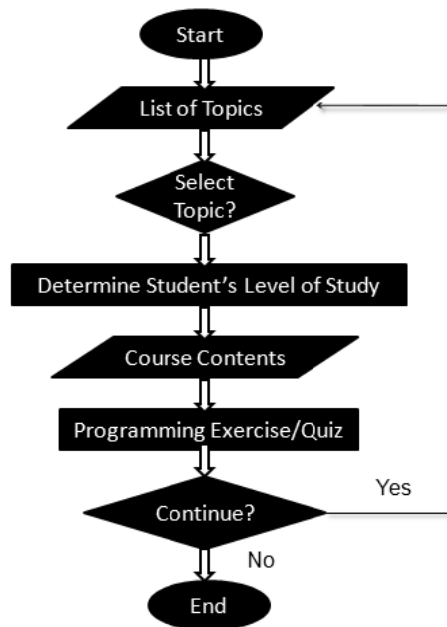


Figure 1: Proposed System Flowchart

#### 4. Conclusion

This research proposes an e-learning system that applies VPP to support computer programming learning. The proposed system provides an interactive learning environment to assist students in learning to program with C++ programming language, which acts as an enhancement and addition to the conventional way of learning.

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# Sustainable Development and Maintenance of e-Learning Materials

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**Abstract:** This paper discusses sustainability in Web-based education from the viewpoint of both development and maintenance of e-Learning materials. Based on the examination on the conversional model in our e-Learning system, we proposed a new project-based learning model for sustainable contents development and maintenance, where two types of student functions cooperate under a hierarchical organizational structure. This 4-year case study explores the effectiveness of our approach.

**Keywords:** development and maintenance of materials, project-based learning, e-Learning

## Introduction

Recently, lack of manpower for development and maintenance of web-based educational systems and/or their contents has become an issue in most Japanese universities. For effective deployment of web-based educational systems, a management system, which enables sustainable development and maintenance of the contents, is indispensable. From the educational point of view, a project-based management system based on the collaboration between students, highly-skilled staff and teachers is the most effective. In Japan, however, there have been little case studies on this topic. This paper describes our proposal for project-based learning by means of contents making and maintenance as a solution for desirable sustainable management system of web-based educational systems. Our approach has been experimentally introduced into several of our undergraduate subjects. Results of an evaluation through 4-years of operation are also described.

## 1. Overview of our e-Learning

This chapter describes the outline of the learning management system (LMS) and materials of the e-Learning system in CIST (Chitose Institute of Science and Technology). Our e-Learning system has been used in various educational situations such as for homework and blended learning both in lectures and exercises. Over 5,000 textbooks and 13,000 exercises are introduced in the e-Learning system. All materials are created by staff and students in our university. Most contents are developed using the Adobe Shock Wave Flash (SWF) format. The exercise material consists of 3 frames: a problem description, hints, and an answer box as shown in Fig. 1. The hints frame allows users to view 3 hints, which appear step by step at the user's request. The textbook material has 2 frames: an animation and an explanation related to the context of the animation appearing step by step at the user's request. The LMS was constructed under the original specification of CIST. The LMS has as its key function the management of the learner's detailed learning records including hint information.

## **2. Conventional model of contents making**

### *2.1 Contents making processes*

Figure 2 illustrates the use case for the project-based contents making process, which represents our conventional management system introduced from the beginning of our e-Learning system. We designate 4 roles in the use cases: A teacher making the draft for materials, a staff member providing templates for materials, a developer making the contents of the material by using the template along with the teacher's draft or scenario, and learners using the materials for their study in the e-Learning system. Note that, in our use case, the developer is appointed from among the students who specialize in information technology.

A draft image of the material is provided by the teacher to explain the e-Learning course in his/her lecture. The draft image is drawn either on paper or in electronic format. On the other hand, templates are provided by the staff to maintain the uniformity and the quality of materials. We define 19 different kinds of templates in accordance with the instruction design. Figure 3 shows an example of the exercise template. It has components of a question text, answer boxes (textbox, drop-down list, etc), and some hints. Student developers can make materials by simply editing those components. For a student with basic skills of SWF, it is estimated about 6 hours to make 12 exercises, compared to 18 hours to make similar exercises without templates.

### *2.2 Problems in the conventional model*

To maintain a sufficient level of education, it is very important to guarantee a supply of new and/or updated versions of content materials to all users in a timely manner. Therefore, sustainable development and maintenance systems must inevitably keep the web-based education system effective. However, our conventional model has two major problems in this sense. One is the skill development of the contents developer. The other is the maintenance of the contents. Even though the developers have specialized in information technology, they are not trained to work with customers to satisfy their needs. Furthermore, since the developers change every year, it is difficult to make modification to the originals later. This leads to the materials becoming obsolete and insufficient.

## **3. Proposed model of contents making and maintenance**

### *3.1 Approach to Sustainable Model based on Project-Based Learning.*

This chapter describes our proposal for a model of sustainable development and maintenance of the content materials. Figure 4 shows the use case of the proposed model. The main feature of the use case is project-based learning that is introduced in the course of a career development program for sophomores at CIST in the information science area. A learner who joins the project-based learning is referred to as "project members". Project members are divided into several teams. The average number of the students in a team is 5. Throughout the material development process, project members learn skills not only in software technology but also in dealing with customers' demands from senior students called "media consultants". The media consultants act as advisors to the project members,



and simultaneously they are part-time workers for the maintenance of the material. They are appointed from among students who have experience as a project member. Media consultants not only give training in SWF skills but also encourage the project members to communicate with the teacher, who is the customer of the output from the project. All projects are supervised by a teacher specializing in information and communication technology. He takes responsibility of the whole project-based learning. The teacher, media consultants, and project members work together to fulfill their objective. Continuing this activity helps the progress of students' knowledge and software skills, and consequently leads to successful construction of the system for sustainable maintenance and development of the e-Learning materials.

### 3.2 Case study

The proposed model has realized the organization of over 90 members in project-based learning every year. The hierarchical training structure explained in the previous section has been well managed to develop and maintain the materials. We evaluated the degree of sustainability on the basis of the number of developed and maintained materials from 2005 to 2008, as shown in Fig. 5. Developed materials are over 2,000 every year from 2005 to 2007. Our project was selected as a Good Practice of Learning in Japan supported by the Ministry of Education, Culture, Sports, Science and Technology for the 3-year term from 2005 to 2007. In this period, since the teachers participating in the project actively used the e-Learning system in their lectures, demands for new materials were quite high. After the project was completed, the number of revised materials increased. These results indicate that the hierarchical organizational structure, namely the project manager, media consultants and project members, works quite effectively for the sustainability of the contents development and maintenance.

## 4. Conclusions

We have proposed a project-based learning model for the sustainable development and maintenance of e-Learning materials. From the case-study for 4 years from 2005 to 2008, it was shown hierarchical organizational structure (project manager, media consultants and project members) in the proposed model worked quite effective for the sustainability.

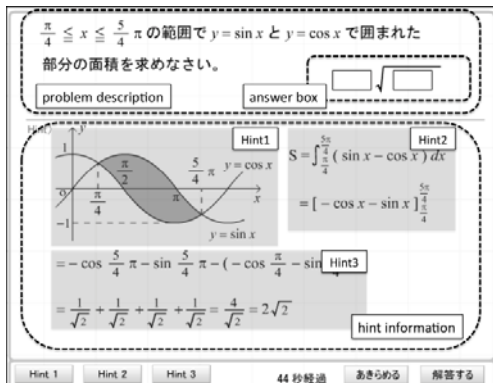


Figure 1: Screen image of exercise

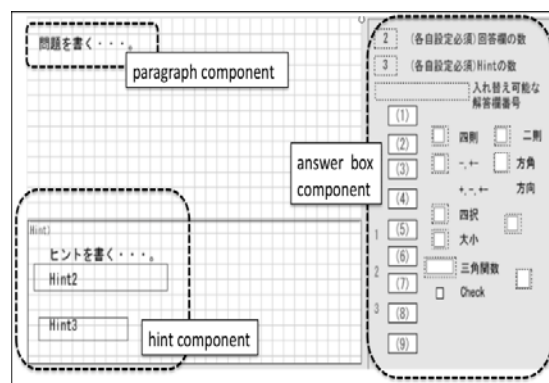


Figure 3: Example of exercise template

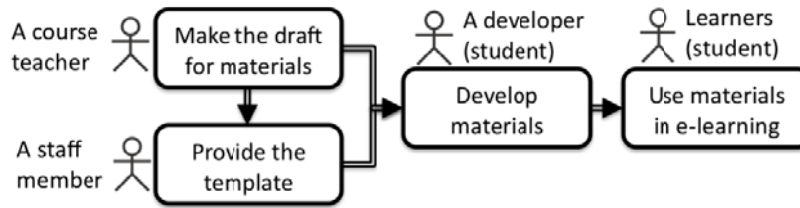


Figure 2: Use case in conventional model.

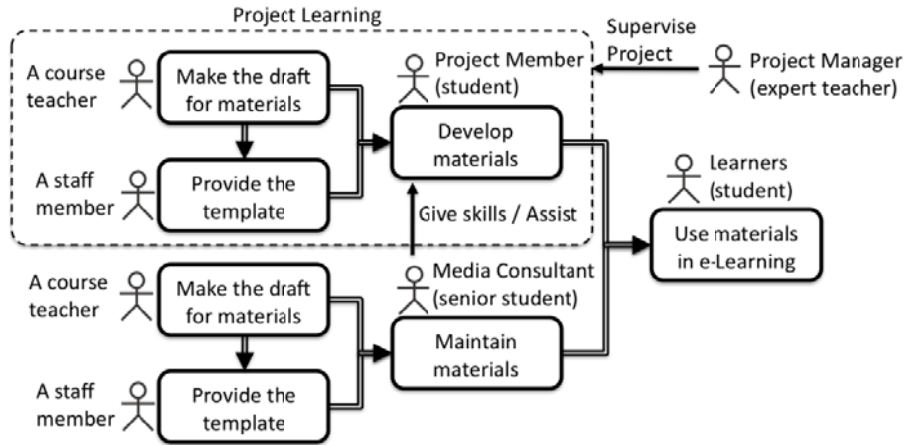


Figure 4: Use case of proposed model.

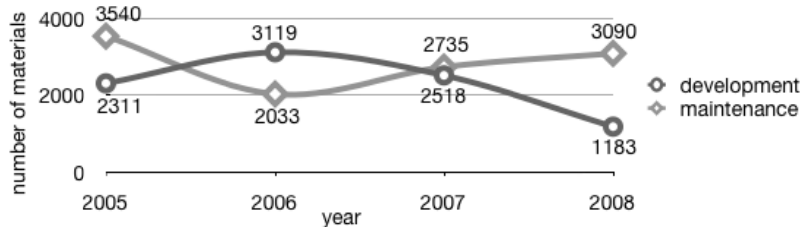


Figure 5: Number of developed and maintained materials from 2005 to 2008

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# The Development of a Mobile Reading Assistance System Based on Chinese Words for Students in Elementary Schools

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**Abstract:** The aim of this study was to develop a Mobile Reading Assistance System Based on Chinese Words for students in elementary schools. This paper presents a system which is called Reading Assistance for the elementary school students to learn anytime and anywhere by using personal mobile devices (PDA) and the Wireless Network. In this system, instructors would be required to upload the text content to the system and instructors can view the learning record of students. On the other hand, learner can read the text content and learn Chinese words by using this system. To sum up, the characters of this system are easy reading, easy learning, easy conduct, and high supportive which support for student Assistance of Reading. In the future, researchers will use tests to assess the system.

**Keywords:** Reading Assistance, Chinese Words, M-Learning, Chinese word segmentation

## Introduction

In recent years, Internet technology and Equipment were growing so fast. With this gigantic revolution, the way of transferring knowledge was not only publication, but also transmitted through other multimedia devices such as website, e-books, and Mobile devices. Those things can make dissemination of knowledge acceleration. In this time, a person how to get and use knowledge they need has become an important issue. When author reviewed the current elementary school education, author tried to discover how to help children to have the ability to browse information and to gain knowledge. Those things have become important issues for the discussion. Reading ability means that readers' ability to obtain information from article [1]. In order to strengthen reading ability, it can be divided into: 1. word recognition; 2. the understanding of the article. In the current elementary school education, 1-2 grade students are reading by learning. It means that word recognition is important for them. But the other grade students are learning by reading [1]. Hence, the core of Learning is students' understanding of the article. This shows if people want to strengthen elementary school students reading ability, they have to build up the ability of students' word recognition. Therefore, in this study researchers incorporate online language dictionaries [2], Chinese word segmentation [3], and the advantages of M-Learning to development of a Mobile Reading Assistance System Based on Chinese words. This system can be used to assist elementary school students using wireless network and mobile devices to brows articles provided by teachers through online. The system also provides a link function dictionary which will help students obtain real-time interpretation of the word.

Hence, using this system to supporting reading activities for elementary school students should be helpful.

## 1. Literature review

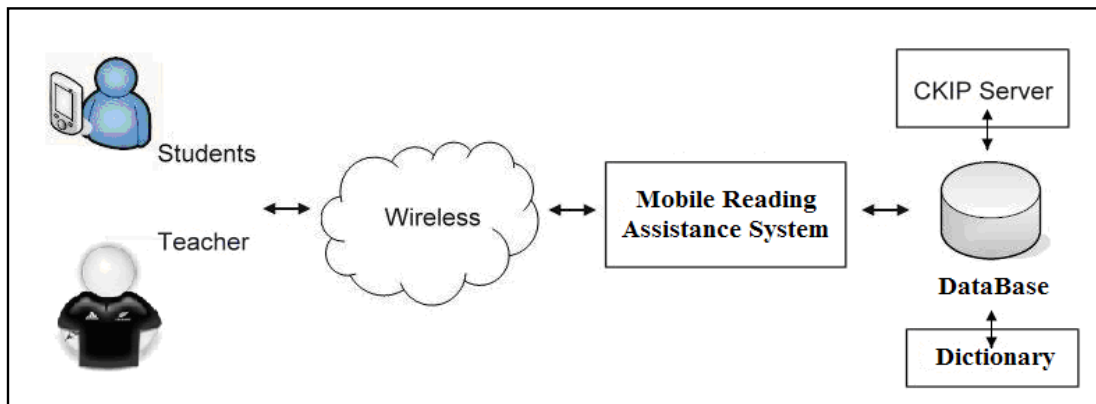
Several researchers [4-7] to combine mobile learning theories with language teaching courses, and some researches had positive results on improving students' learning effectiveness. However, researches of this field in the past just focused on composition teaching [6] and word teaching [4-5], but rarely focused on the reading of assistance for Primary Student. In this paper, the researcher suggested a framework of Mobile Reading Assistance System, and then development a mobile reading assistance system based on Chinese words for primary student. This system will help to assist reading for primary student.

## 2. System Overview

In this system, the Framework of Mobile Reading Assistance System equipped with server, personal mobile devices (PDA), and wireless network. The development environment and tools including:

1. Operating System: FreeBSD 7.3 Stable
2. Programming Language: PHP, Bourne Shell Script
3. Web Service: Apache2.2
4. Chinese Word Segmentation: CKIP Chinese Word Segmentation System
5. Dictionary Service: On-line Chinese Dictionary (MOE., R.O.C)

Figure 1 shows a framework of the Mobile Reading Assistance System enables students to utilize mobile technologies with wireless network to learn anytime and anywhere. And Instructors can upload the text content to the system, and view learning record of students.



**Figure 1. The Framework of Mobile Reading Assistance System**

Figure 2 is teacher's main menu. This menu includes two functions: 1. Article Management; 2. Learning Record. In the first function (Article Management) is support the teacher to edit the article title and upload the text content to the system. In the second function (Learning Record), this option is to support the teacher to view the learning record of student. Figure 3 and Figure 4 show a function of upload the text content to system.



Figure 2. Main Menu (Teacher's)

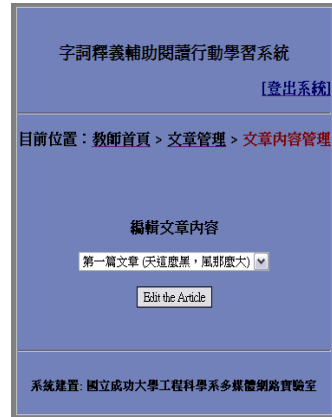


Figure 3. Select the text content

Figure 5 shows a function of edit the Article title. This function is to support the teacher to add, edit, and delete the Article title.

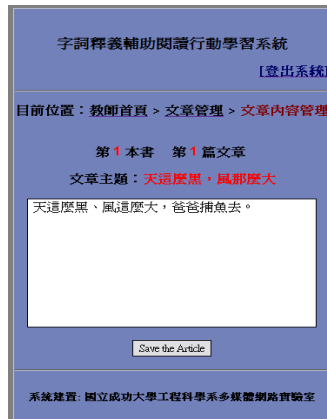


Figure 4. Edit the Article

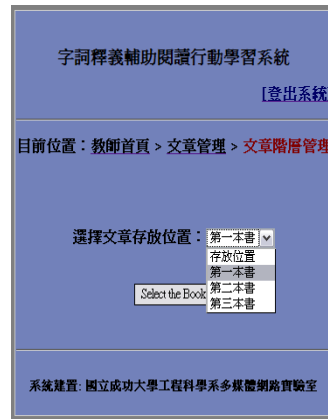


Figure 5. Edit the Article title

Figure 6 is student's main menu. This menu includes two functions: 1. Article Read; 2. Personal Chinese Words Database. In the first function(Article Read) is support the student to read the article, use dictionary service, and add the annotation of chinese word. In the second function(Personal Chinese Words Database), this function is to support the student to view and edit the annotation of chinese words (as Figure 7 shows).



Figure 6. Main Menu (Student's)

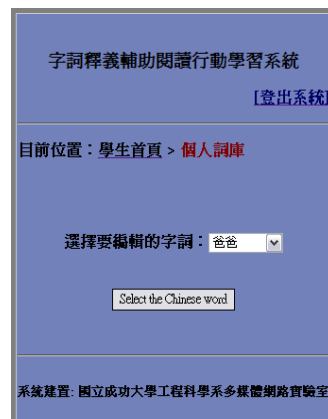


Figure 7. Select the Chinese word

Figure 8 show the function of article read. In this function, if the Chinese word is noun, then those words-loaded would automatically be word-oriented to On-line Chinese Dictionary. Figure 9 show the hyperlinks of Chinese words (link to On-line Chinese Dictionary), and student can add the annotation into personal database.

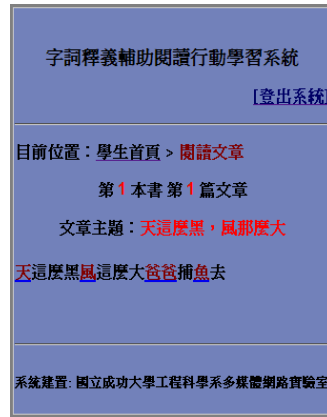


Figure 8. Read the Article

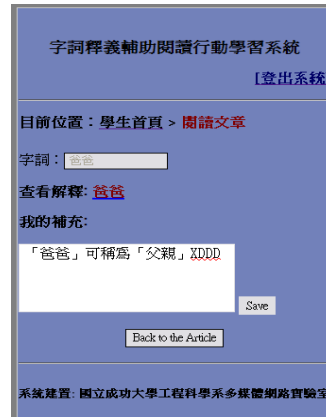


Figure 9. Read and Edit the word

### 3. Conclusion

In this study, the researcher suggests a Mobile Reading Assistance System Based on Chinese Words for Primary Student. This system will help to assist reading for primary student. To summarize, the characteristics of this system were easy reading, easy learning, easy conduct, and high supportive which support for student Assistance of Reading. In the future, the researchers will use examine to assess the system.

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# Seamless Vocabulary Learning in English Course Using Mobile Devices

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**Abstract:** In this paper, we propose mobile-assisted vocabulary learning and present learning scenarios seeking smooth and seamless transitions between learning in-class and outside-class, incorporating students' self-learning into classroom activities, which is expected to result in effective vocabulary learning. Two experiments using mobile devices are proposed to find out some answers to the following questions: (1) Does the use of mobile devices support seamless English vocabulary learning? (2) Can the additional adaptive contents recommended by the system help vocabulary learning?

**Keywords:** Seamless Learning, MALL (Mobile Assisted Language Learning), Vocabulary Learning, EFL

## Introduction

English has become the lingua franca of the world due to globalization and internationalization in recent decades [1]. Therefore ESL (English as a Second Language) education is inevitable for non-English speaking countries including Japan. It has been pointed out that Japanese learners of English are in lack of vocabulary though it is an essential component in language learning, and it is evident that with more unknown words, more difficulty the learners face in understanding English [2]. Therefore it is very important to build up vocabulary to improve one's language skill. But at the same time vocabulary teaching/learning methods are considered boring [3]. Then the following question occurs: 1) What if technology can support effective/enjoyable vocabulary learning for ESL learners? If such a system were successfully implemented, its contribution to vocabulary learning or furthermore, language education in general, would be immeasurable.

## 1. Theoretical Background

### 1.1 Seamless Learning

Recent progress of mobile and wireless technologies offers us the potential for a new learning environment, namely "seamless learning". It has been gaining quite a few researchers' attention as a new learning environment [4] [5] [6] [7]. "Seamless learning" means to describe the situations where students can learn whenever they want to in a variety of scenarios and that they can switch from one scenario to another easily and quickly using one device or more per student ("one-to-one") as a mediator [4]. In this paper, by seamless learning, we mean learning which occurs with seamless transitions between in-class and outside-class learning, between handheld use outside-class and desktop use inside-class. Seamless learning can be depicted in a two-dimensional way 1) in-class and outside-class learning and 2) planned and unplanned learning [5]. And if the technology could help these

four types of learning interact each other and help them incorporated into one continuous learning beyond time and space, learning would be very successful (Figure 1).

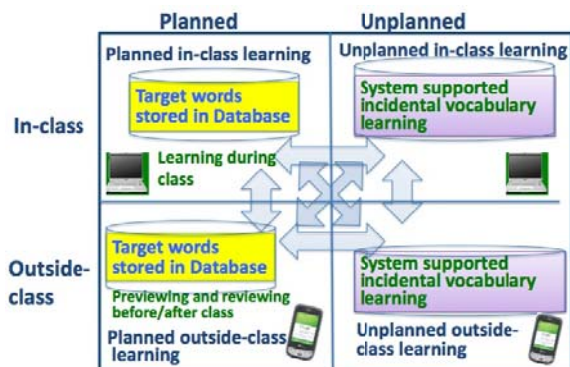


Figure 1. Incorporation of Four Types of Vocabulary Learning with the Help of Technology (adapted from So et al, 2008 [5])

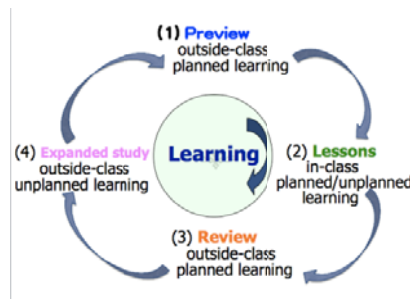


Figure 2. Cyclic Model of Learning (adapted from Takeuchi, 2007)

## 1.2 Cyclic Model of Learning

One premise of our seamless learning idea is that there are four processes of class learning: 1) previewing, 2) in-class lesson, 3) reviewing, and 4) expanded study. Good class should be conducted in the way that all these processes run smoothly and seamlessly. This concept is depicted by the term, ‘cyclic model of learning’, which was proposed by Takeuchi (2007) [8] (Figure 2), where ‘class’, in a broad sense, means not only learning in-class but also learning outside-class and it allows teachers to incorporate students’ self-learning into classroom activities [9]. Seamless learning and cyclic model of learning, these two concepts share the same idea that learning can occur wherever they are, and that every learning experience both in-class and outside-class interacts each other. This concept is critical for English education in Japan since it has been pointed out that learning time of English at school is not sufficient [8]. If in-class learning time is limited, there is no other way but to learn out-side class.

## 2. System Design

Based upon the above ideas, we design the following Seamless Mobile-Assisted Language Learning Support System (hereafter we call it SMALL System) (Figure 3). In our system, (1), (3), in Figure 2 are mobile-based outside-class planned learning, (2) is a PC-based in-class planned/unplanned learning and (4) is a mobile-based outside-class unplanned learning.

**Word Data** in Figure 3 consists of target words chosen by the teacher from the textbook. Data is imported to the system from an electric or OCR scanned textbook. **Quiz Logs** consist of all the quiz results the students, which are analyzed and evaluated. This newly gained data reflect review quizzes and difficulty level adjustment and facilitate their learning processes. **Learner Info** contains the students’ English levels and their fields of interests for the distribution of the customized contents. **Related Contents** are obtained through RSS feed and delivered to the students’ mobile devices according to their English levels and their interests for the expanded study. **Learning Log System** supports the students to register their newly acquired words and the system give them quizzes from new words.

The scenarios based on Figure 2 are as follows. Students will be beforehand given vocabulary tests and questionnaires to grasp their English levels and the fields of their interests. They are assigned to write about their current interests on the designated website



on a regular basis so that the system can grasp them which reflect the contents to be delivered for extended study.

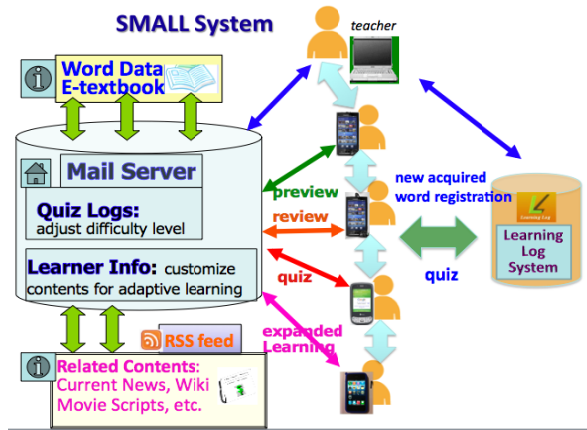


Figure 3. SMALL System

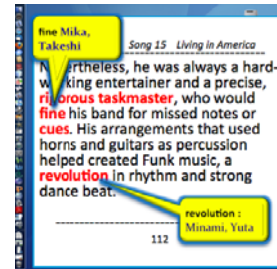


Figure 4. Textbook with Hyperlinks

(1) **Preview (mobile-based outside-class planned learning)**: Students receive messages which show the URLs to read the text for previewing and take target word quizzes. Students can choose either web-based texts and quizzes or mail-based texts and quizzes. They answer multiple-choice quizzes until they make correct answers. They can read texts and answer quizzes at any time and at any location using mobile devices, whether it is a smart phones or a conventional type. (2) **Lessons (PC-based in-class planned/unplanned learning)**: In the electronic/scanned textbook, target words are hyperlinked and when the teacher clicks them, new windows will be opened and they show names of the students who made wrong answers so he can pay attention to them during class (Figure 4). They are given web-based quizzes to make sure if they learn the target words during the lesson. (3) **Review (mobile-based outside-class planned learning)**: Students receive messages which show the URLs to read the text for reviewing and take target word quizzes. The system reports the test results with most frequently mistaken word ranking lists and the teacher will review these words in the next class. So the learning occurs continuously. (4) **Expanded Study (mobile-based outside-class unplanned learning)**: SMALL System recommends the contents of each student's interests which include target words learned in class. The target words are highlighted in the expanded study texts. The students register new words they learn through the expanded study and if the registered words are among target words to be learned or already learned in the textbook, then the system let them know it. That way their expanded outside-class unplanned learning will be linked to in-class planned learning. The system give them quizzes from the newly acquired words through outside-class unplanned learning to support gaining new vocabulary. The System shows each student his degree of advancement by counting his correct answers out of total number of target words. They are provided with quizzes of the words they already have answered correctly after a certain interval to make sure if they are retaining their newly acquired vocabulary. That way it is expected that their short-term memory will be transferred into long-term memory. During expanded study, if some students have read the same contents or register the same word, the system will let them know. It will possibly trigger peer-to-peer (P2P) discussion and let them interact each other in the knowledge-aware virtual learning community, which will lead P2P collaboration. In addition, each student is supposed to present in-class in turn what he/she has learned through his/her expanded study so that the teacher can incorporate

students' unplanned self-learning into classroom activities. Students are encouraged to collaborate other students who have the same interests during presentation task.

### 3. Methods

#### 3.1 Experiment 1

A hundred university students will be divided into two groups. Each group of students engage with the two conditions with and without SMALL System in turn (Phase 1 and 2) over six weeks. Pre- and post-tests will be conducted, and their test results and all the students' learning logs will be analyzed to see if there is any significant difference between the two conditions. The questionnaires will be used to assess advantages and disadvantage of SMALL System.

#### 3.2 Experiment 2

The purpose of this experiment is to verify the validity of adaptive Expanded Study of SMALL System. 100 university students will be divided into two groups (Group A with adaptive Expanded Study & B with Expanded Study without adaptation) to see if there will be any significant difference in vocabulary learning. Questionnaires and learning logs will be analyzed to assess its availability.

### 4. Early Insight

Possible advantages of SMALL System are: 1) Learners are provided with anytime-anywhere-based learning environment 2) Its implementation is easy. 3) In-class and outside-class learning are closely related so that learners can learn under the guidance of their teachers. 4) It compensates the lack of learning time in class. 5) Automatic message/contents delivery helps reduce teachers' heavy workload. 6) Customized contents help students enhance their motivation to learn more.

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# A pilot study of the effect of creating animated stories in visual programming environments for elementary students

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**Abstract:** Computer programming involves a high degree of problem-solving activity and is perceived as an essential skill for today's digital world. Recent studies have mostly focused on how to make programming accessible and engaging for children through computer game. The general goal of our research is to develop an understanding of how children learn to create projects in technologically rich situations and to develop ways to support children in visual programming situations. It builds on the knowledge that elementary school students can learn to program, through work with Scratch. They can use basic programming skills to design their own projects. We present evidence that describes the relationship between animated stories along with a series of factors that can potentially affect success with type of goal specificity and individual differences during Self-regulated learning environment.

**Keywords:** visual programming, goal specificity, individual difference, Self-regulated learning.

## Introduction

Since the 1970s, attempts to build programming environments for children started with Logo and Smalltalk; these a substantial amount of research on children's and students' use and learning of programming languages has been conducted [1]. Computer programming involves a high degree of problem-solving activity and is perceived as an essential skill for today's digital world. More recent game programming toolkits tend to have a stronger visual aspect than Logo, either in the sense that they enable designers to easily create graphical games or because they have a visual programming language, or both. This shifts the emphasis away from low level programming, enabling learners to focus on the other roles as designers or writers [4]. Making games is a rich task, in that it offers opportunities for children exercise a wide spectrum of skills (such as devising game rules, creating characters and dialogue, visual design, and computer programming) to create a complex artifact [5]. Therefore, game making has the potential to be a powerful learning environment. Scratch is designed to facilitate this process by providing a way to avoid debugging processes and syntax errors. The computer can be a tool for personal expression through the design and execution of creative coding projects. Students can design simple games or animated stories in groups or individually.

Programming is a method to solve the problem using the program syntax complex process. Effects of goal specificity on problem solving have been found in a number of recent studies [2, 6]. Solving problems without a specifically defined goal leads to higher learning

outcomes (schema acquisition) than solving problems with a specifically defined goal, usually stated as a specific problem state that has to be reached [7].

In order to understand the effect of students' performance, self-regulation and flow experience of created projects during self-regulated learning, The subjects, in this study, were sixth-grade learners participate in a 12-week Scratch programming courses to design animated stories through self-regulated learning cycle, and they were provided with different goals according to an experimental design with goal specificity (nonspecific goals versus specific goals) and individual differences (prior programming knowledge, self-efficacy, and computer game experiences) as factors.

## 1. Research Design and Implementation

This study was intended to examine the effects of type of goal specificity and individual differences factors on learners' programming performance, self-regulation and flow experience for created projects. The dependent variables included programming performance, self-regulation and flow experience. The independent variables were types of goal specificity (nonspecific goals versus specific goals; NSG versus SG) and individual differences (prior programming knowledge, self-efficacy and computer game experiences). The students who are self-regulated learners believe that opportunities to take on challenging tasks, practice their learning, develop a deep understanding of subject matter, and exert effort will give rise to academic success [3]. A self-regulated learning process was implemented to enables learners to act more effectively when the design tasks of created animated stories in computer programming (fig.1). Therefore, the research question to be answered was whether the type of goal specificity approach in crated animated stories projects helped to enhance programming performance, self-regulation and flow experience by students, and learners' individual differences factors whether affect programming performance, self-regulation and flow experience for created animated stories with scratch.

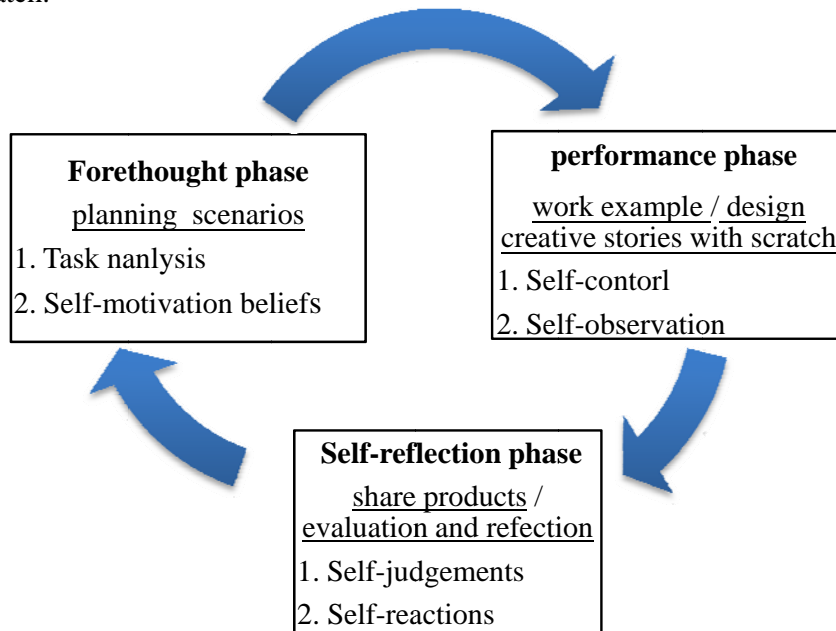


Fig.1 A cyclical model of self-regulated learning (modify from [8])

## 2. Data Analysis and Results

The effects of goal specificity and individual differences on programming performance, self-regulation and flow experience were examined by means of a  $2 \times 2$  Multivariate Analysis of Variance (MANOVA). The significance level was set to 0.05 for the study. The analysis is described below.

### 2.1 Analysis of goal specificity and individual differences on programming performance for creating animated stories

All of the two-way interactions were not significant for main effect of understanding of programming concepts was not significant on all dependent measures. Moreover, the main effect of type of goal specificity was significant on the performance of program application ( $F_{(1,50)} = .38$ ,  $p = .246$ ,  $\eta^2 = .027$ ) and was not significant on the other dependent measures. As the programming performance mean scores show in Table 1, the specific goal group outperformed the group on the performance of program application for mean scores. The result indicating that the learner receiving the specific goal strategy was better than the nonspecific goal strategy and specific goal strategy can arousing participants' the performance of program application.

### 2.2 Analysis of goal specificity and individual differences on self regulation for creating animated stories

Box's test of equality of covariance matrices revealed that the observed covariance matrices of the dependent variables were equal across groups (Box's  $M = 7.23$ ,  $F = 0.74$ ,  $p = .670$ ). All of the two-way interactions were not significant. Moreover, the main effect of scratch self-efficacy was significant on self regulation ( $F_{(1,50)} = 5.55$ ,  $p = .02$ ,  $\eta^2 = .100$ ) and was not significant on the others dependent measures. In other words, learners' self-efficacy can affect their self-regulated ability significantly; the high scratch self-efficacy group outperformed the low scratch self efficacy on self regulation. The result indicating that high scratch self-efficacy group during the process of a cyclical model of self-regulated learning was better than low scratch self efficacy group for promoted participants' self regulation.

### 2.3 Analysis of goal specificity and individual differences on flow experience for creating animated stories

Box's test of equality of covariance matrices revealed that the observed covariance matrices of the dependent variables were equal across groups (Box's  $M = 2.21$ ,  $F = 0.28$ ,  $p = .991$ ). All of the two-way interactions were not significant. The main effect of type of goal specificity was significant on animation flow antecedent ( $F_{(1,50)} = 6.82$ ,  $p = .01$ ,  $\eta^2 = .116$ ) and animation flow experience ( $F_{(1,50)} = 5.22$ ,  $p = .026$ ,  $\eta^2 = .091$ ). Moreover, the main effect of prior programming knowledge was significant on animation flow antecedent ( $F_{(1,50)} = 12.76$ ,  $p < .01$ ,  $\eta^2 = .197$ ). According the animation flow experience mean scores, nonspecific goals group outperformed specific goals group on animation flow antecedent and animation flow experience. The result indicating that nonspecific goals strategy promoted to participants' animation flow experience.

### 3. Discuss and Conclusion

The study described in this paper has investigated the effects of type the goal specificity and individual differences on learners' programming performance, self regulation and flow experience to creating animation. Firstly, for programming performance, it is concluded that: (1) The specific goal strategy enhances learners' the performance of program application; and (2) All of the factors of individual differences did not affect learners' programming performance during self-regulated learning. That is to say, the performances of the specific goals group not only better than nospecific group also exceeds its original performance. Secondly, for self regulation, the results showed that: (1) high self-efficacy for Scratch enhanced learners' self regulation; and (2) the type of goal specificity did not enhance their self regulation. That is to say, as learners have the more confident learning Scratch, the higher their self-efficacy. Therefore, their self regulation is better during the process of self-regulated learning. Finally, for flow experiences, the results showed that: (1) nonspecific goals strategy enhanced learners' animation flow antecedent and animation flow experience; and (2) prior programming knowledge that contribute to animation flow antecedent.

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# Learning Motivation, Performance and Metacognition within a Problem-based Gaming: Relations among Learners' Self-regulated Learning, Cognition Processing and Achievement

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**Abstract:** This present study is to investigate the relations among learners' self-regulation, cognition processing and achievement in problem-based gaming. Problem-based gaming is used as a mind tool to foster learners' motivation and cognition. And self-regulated learning regarded as a support and scaffolding motivationally, metacognitively, and behaviorally helps learners engage in their own learning cognitive process. Thus, the goal of this study is to test the conceptual model of the relations among learners' self-regulation, cognition processing and achievement.

**Keywords:** computer programming, problem-based gaming, self-regulated learning, motivation, cognitive processing, performance

## Introduction

Computer programming is significant but abstract and complex domain knowledge for learners to apply logic, algorithm, or even problem solving in their daily life. For the knowledge and skills of it have little link to learners' prior knowledge and learning experience, it is not easy to thrill learners' motivation and interest and anchor the knowledge between what they had learned and what they are going to learn [1, 13, 14]. On the other hand, problem solving in computer programming has been regarded as an essential and critical skill for learners. That is the reason why well-designed educational games can be used to meet these needs [4]. Problem-based gaming seems to be a solution for learners to enhance their knowledge construction and cognitive understanding [3, 4] and engage in problem solving while entertaining [4].

In problem-based gaming, motivation and cognition as two main factors are frequently investigated in many studies [5, 7, 12] because self-regulated learning primarily focuses on these two elements of learning showing how goal orientation and learning expectancies affect learners' use of cognitive processes [8, 10, 11].

Accordingly, the goal of this study is to explore the relations among learners' self-regulation, cognition processing and achievement. Problem-based gaming is used as a mind tool to foster learners' motivation and cognition. And self-regulated learning regarded as a support and scaffolding motivationally, metacognitively, and behaviorally helps

learners engage in their own learning cognitive process to fulfill their learning achievement. Thus, the conceptual model will be provide and tested to investigate the relations among these factors.

## **1. Conceptual Model Design**

### *1.1 Learning Computer Programming in Problem-based Gaming*

Computer science in school education mainly focuses on the learning of conceptual, strategic and even problem-solving knowledge and skills [14]. Computer programming instruction has been shown to enhance a variety of specific problem-solving skills [6] and is abstract and complex for learners to hardly organize their own knowledge construction and learning experience with the lack of motivation and interest [2, 14]. Games are generally viewed equally as having fun, but the fun factor is not the magic bullet in educational game design [3]. The essence of educational games is to engage and motivate learners through direct experiences within the game world [3, 4]. Thus, problem-based gaming is treated as a mind tool for learners to foster learners' both motivational and cognitive factors for integrating educational games and problem solving these two significant elements into learning computer programming.

### *1.2 Factors among Self-regulated Learning, Cognition Processing and Achievement*

Self-regulated learning mainly investigate two elements – motivation and cognition of learning, to explore how these two elements affect learners' use of cognitive processing [8, 10, 11]. And in self-regulated learning, learners are generally regarded as metacognitively, motivationally, and behaviorally active participants in their own learning process [16, 17] to enhance their motivation and their immediate environment, as well as their cognitive processing [15]. Moreover, they also judge and direct their performances and achievement, enlist self-reactive influences to guide and motivate one's efforts, and employ appropriate strategies to achieve success [18].

And to qualify specifically as self-regulated learning, learners' learning must involve the use of specified cognitive and metacognitive strategies to achieve academic goals on the basis of self-efficacy perceptions [17].

Thus, the conceptual model of the relations among learners' self-regulated learning shown as Figure 1 investigates the relation between motivation and cognitive aspect. The former is consisted of three parts: value components (intrinsic and extrinsic goal orientation and task value), expectancy components (control of learning beliefs, self-efficacy, and expectancy for success), and affective components (learning anxiety) [9]. And the later is consisted of two parts: cognitive strategies and metacognitive strategies [9].

And Conceptual model of the relations among learners' self-regulated learning, cognition processing and achievement is shown as Figure 2. The goal of the present study is to investigate the factors among self-regulated learning, cognition processing and learning achievement.



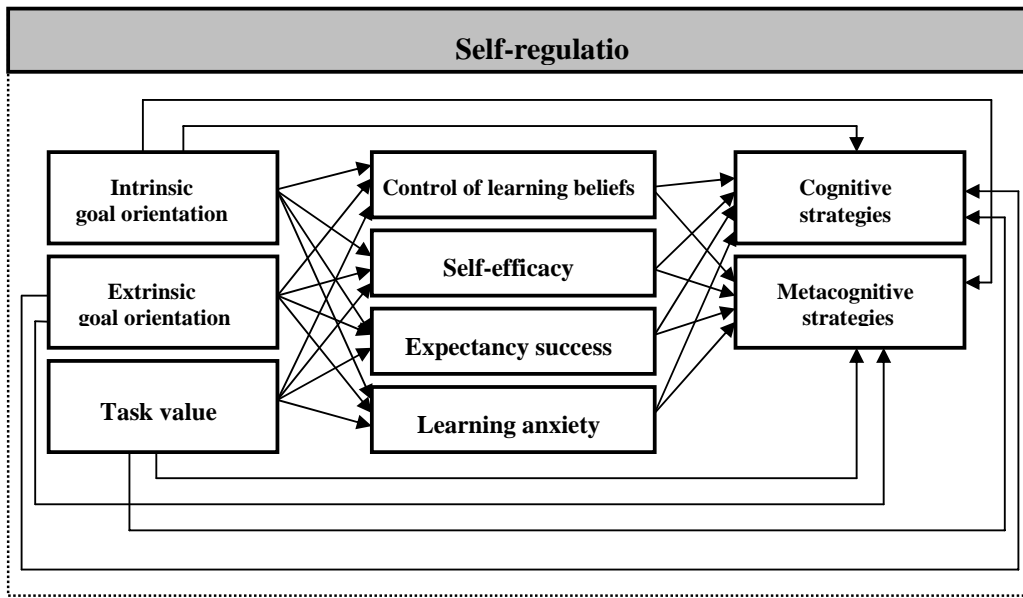


Figure 1. Conceptual model of the relations among learners' self-regulated learning

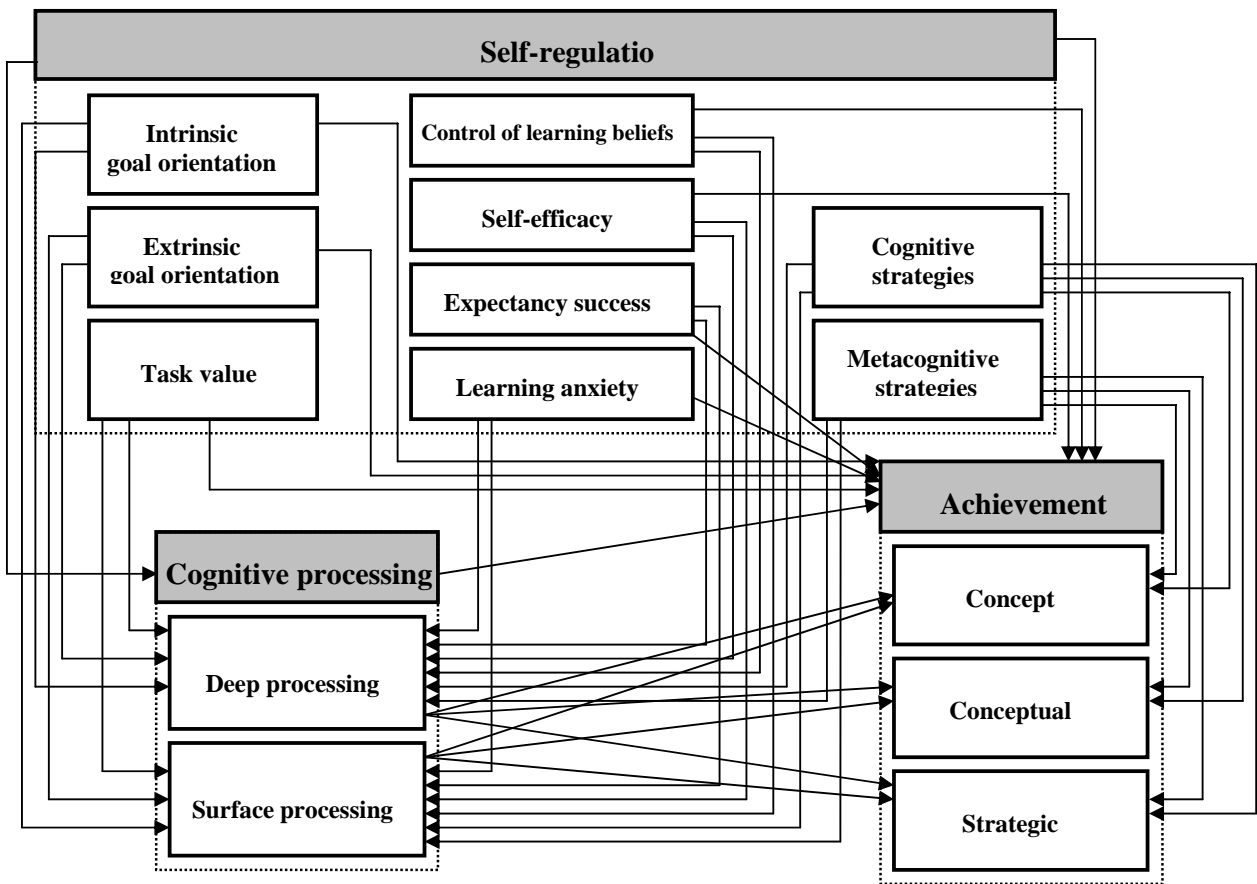


Figure 2. Conceptual model of the relations among learners' self-regulated learning, cognition processing and achievement

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# Effective Pedagogy for the Optimal Use of Free E-resources for Supporting Chinese Learners to Learn Primary English Grammar

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**Abstract:** This research aims to explore a pedagogical strategy for the optimal use of free e-resources for supporting Chinese learners in Hong Kong to learn primary English grammar. Through a combination of qualitative and quantitative methods, this research will progressively design, evaluate and then establish an effective pedagogical strategy that optimizes the use of free e-resources for learning primary English grammar. A twofold documentary analysis will be conducted for the design of a potential pedagogical strategy. To evaluate the effectiveness of the designed pedagogical strategy in the real classroom environment, two classes of local Primary 4 students will be subsequently invited to a one-month trial teaching. Students in the experimental group will learn primary English grammar under the designed pedagogical strategy; whereas their counterparts in the control group will receive no treatment during the trial teaching period. These two groups of students will sit for a pair of identical pre-test and post-test before and after the trial teaching, respectively, to investigate the impact of the designed pedagogical strategy on the learning achievement of students. Students in the experimental group will be asked to complete a questionnaire survey after the trial teaching to indicate their perceptions of the designed pedagogical strategy. One-fifth of the students in the experimental group will be further invited to attend individual interviews to share more in-depth opinions on the designed pedagogical strategy. This research will finally advise a model of the pedagogical use of free e-resources that optimizes the learning of primary English grammar among Chinese learners in Hong Kong.

**Keywords:** English, free e-resources, grammar, pedagogy, primary school, Chinese learners

## Research Motivation

The trend toward the use of e-resources in language education has spread over the world for decades. Through a preliminary review of the recognized academic journals in the relevant fields, such as *British Journal of Educational Technology*, *Computers and Education*, and *Educational Technology and Society*, it is noticed that in recent years more and more researchers continuously devote their effort to research studies regarding the use of different types of e-resources for supporting learners to develop language competence in the modalities of reading [1, 2, 3, 4, 5, 6], writing [7], listening and speaking [8]. The findings of these previous studies generally support the positive impact of the use of e-resources on enhancing the quality of language education. Based on the preliminary review of relevant literature, five directions are identified to be promising for future research in the related fields.

First, future research should address the shift from the traditional paradigm of learning from e-resources to the emergent paradigm of learning through e-resources in language learning with the use of e-resources [9, 10]. Second, future research should design experimental treatments that aim to increase germane cognitive load, moderate intrinsic cognitive load, and decrease extraneous cognitive load in language learning with the use of e-resources [2, 5]. Third, future research should focus more on investigating the approaches for meaningful integration of practical pedagogies with the use of e-resources in language classrooms [9, 10]. Fourth, future research should focus more on investigating the impact of the use of e-resources on supporting learners to develop high-level linguistic knowledge about syntactic rules [3, 9]. Finally, future research should put more effort into the investigations into the impact of the use of e-resources in language classrooms in the primary school sector, because language learning in primary school is critical for young learners to build foundation for the long-term development of linguistic intelligence [7, 9].

The research delineated in this paper is motivated by these five promising research directions. It sets to identify a pedagogical orientation that fosters Chinese learners in primary schools in Hong Kong to engage in the true learning of English grammar through the use of e-resources that maintain germane cognitive load in the learning process.

## **1. Research Plan**

This research aims to explore a pedagogical strategy for the optimal use of free e-resources for supporting Chinese learners in Hong Kong to learn primary English grammar. Three research questions are made for this research:

- (i) Which free e-resources are particularly constructive for the learning of English grammar in primary schools in Hong Kong?
- (ii) Which pedagogical approaches are particularly suitable for the teaching of English grammar in primary schools in Hong Kong?
- (iii) Which model for pedagogical use of free e-resources is particularly effective for the learning and teaching of English grammar in primary schools in Hong Kong?

This research will last for two years. A combination of quantitative and qualitative methods will be adopted in this research to explore a pedagogical strategy that optimizes the use of free e-resources for supporting Chinese learners in Hong Kong to learn grammatical knowledge in primary English classrooms.

The first stage of this research will focus on designing a potential pedagogical strategy that is particularly effective for supporting Chinese learners in Hong Kong to learn grammatical knowledge in primary English classrooms. At this stage, a twofold documentary analysis will be conducted to inform the formulation of the target pedagogical strategy. The first documentary analysis sets to gain insights into a list of free e-resources that is considered constructive for learning primary English grammar. Official documents about local primary English Language curriculum and academic work on learning primary English grammar will be thoroughly reviewed. The second documentary analysis sets to gain insights into a range of pedagogical approaches that is considered suitable for teaching primary English grammar. Academic work on pedagogical use of e-resources, in the contexts of both general for primary school education and specific for English Language subject, will be thoroughly reviewed. Based on the results of the documentary analysis, a pedagogical strategy potential for the optimal use of free e-resources for learning and teaching English grammar in primary schools in Hong Kong will be designed for further evaluation.

The second stage of this research will focus on evaluating the designed pedagogical strategy in the real classroom environment. At this stage, a local primary school that has rich experience in IT in education will be purposefully sampled as the partner school for this research. A trial teaching in the form of one-month summer supplementary course, which amounts around 20 one-and-a-half-hour lessons, will be arranged in the partner school. Two classes of Primary 4 students, of each consists of around 30 students with similar learning ability, will be randomly selected and then assigned to the experimental and control groups. Students of the experimental group will learn English grammar under the designed pedagogical strategy. A set of tailor-made learning materials such as activity worksheets will also be provided for students. The author of this paper will take charge of the material design and classroom instruction for the one-month trial teaching. Students of the control group will receive no treatment during the trial teaching period.

Three methods will be adopted in the evaluation work to investigate the effect of the designed pedagogical strategy. First, students of both the experimental and control groups will sit for a pair of identical pre-test and post-test [11] before and after the trial teaching, respectively. The test papers will include a series of questions that assesses knowledge of the students about key grammatical knowledge of English Language, such as tense and agreement. Second, a questionnaire survey [11] will be conducted at the end of the trial teaching. All students in the experimental group will be asked to complete a self-administered questionnaire to indicate their perceptions of the implementation of the designed pedagogical strategy for lessons about English grammar. Third, one-fifth of the students in the experimental group will be randomly selected for the semi-structured, individual interviews [11] to further investigate their perceptions of the implementation of the designed pedagogical strategy. The selected students will be asked to describe the changes in their process, motivation and achievement in the learning of English grammar through the lessons that implement the designed pedagogical strategy. The evaluation results obtained at this stage will contribute to the establishment of a model of the pedagogical use of free e-resources that optimizes the learning of primary English grammar among Chinese learners in Hong Kong.

## **2. Research Contribution**

The traditional classroom instruction in the topic of English grammar in primary schools exhibit two limitations, namely the overemphasis on the provision of mechanical learning practices; and the inadequacy in the provision of authentic learning contexts [12]. The pedagogical use of suitable e-resources is considered helpful in addressing these limitations for two reasons. First, the capability of multimedia data representations makes e-resources potential to offer a high flexibility in implementing diverse types of classroom activities for active learning [13]. Second, the tremendous e-resources related to everyday issues, in particular those available on the Internet for free access, are potential to provide plentiful sources of authentic learning contexts [12].

This research is of significance in inspiring teaching professionals to cope with the hotly debated challenges for the meaningful integration of free e-resources into subject-specific curriculum delivery in school education in the twenty-first century. English teachers in Hong Kong nowadays prefer using free e-resources, ranging from static PowerPoint slides to interactive subject-related websites, available on the Internet and provided by educational publishers to induce authentic learning for the development of integrated ability in language use. With the global acceleration of e-learning in school education in these years, there is a pressing need for English teachers to effectively make pedagogical designs that optimally use free e-resources for subject learning and teaching.

The effective learning of grammatical knowledge is essential for primary school learners to advance linguistic intelligence. In view of the inherent differences in the language systems between Chinese and English Languages, grammatical topics such as tense and agreement are considered to be the very important but most difficult component in the primary English curriculum in Hong Kong. For learners who succeed in mastering grammar use in English Language, a solid foundation will be laid for future development of integrated ability in the use of English Language. For learners who fail in developing a genuine understanding of the target topic, a lag in the growth of integrated language ability will occur. This will in turn have an adverse effect on the confidence of learners in learning English in general. This research, therefore, contributes to the preparation of Chinese learners in local primary schools for a sustainable development of linguistic intelligence.

The outcomes of this research will lead to a twofold benefit. First, this research will provide teaching professionals with insights into the most inspiring strategies for pedagogical design for the integration of e-resources into the classroom teaching of English grammar. Second, this research will prompt young learners to gain opportunities for the most effective process in the classroom learning of English grammar.

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# Effectiveness of a Strategic Training Module of ICT Integration in Classroom Teaching and Learning Process to Improve Teachers' Professional Development in Principles of Accounting Education

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**Abstract:** This research aims to study the effectiveness of a strategic training module utilizing ICT integration in classroom teaching and learning process to improve teachers' professional development in Principles of Accounting education at Malaysian secondary school level using accounting educational simulation courseware, ASSETBase. Series of research and training activities conducted from August 2005 to June 2007 showed that accounting teachers were enthusiastic and ready to embrace the idea of incorporating ICT integration into their classroom teaching and learning. The findings also suggest that ICT integration has become a key factor in improving teachers' professional development. However, it needs to be orchestrated together with other concerted efforts. But for various reasons, it could not be implemented. Variables factor used in this study are the cognitive aspects, competency on ICT skills, psychosocial changes in attitude, and the desire to be proficient and persistent. The contributions of the study are discussed together with the proposed research questions and approaches in this paper. Preliminary results demonstrated a significantly higher level of teachers' readiness in implementing the new pedagogical approach.

**Keywords:** Classroom integration of ICT, Technical Pedagogical Knowledge and Skill (TPCKS) framework, teachers' professional developments, CIPP approach program evaluation, Principles of Accounting

## Introduction

Principles of Accounting is a basic subject in accounting which deals with book-keeping and fundamental accounting concepts [1]. The subject aims to equip students with the knowledge and basic skills of accounting. It is also aimed at enabling them to practice and to interact accounting confidently as to generate interest and understanding towards business and industry. Presently, students at Sijil Pelajaran Malaysia (equivalent to "O") level are taught to acquire knowledge and skills through repeating practice of creating, keeping and maintaining full sets of ledger and journal entries, which is a long and routine process. With the introduction of computerized accounting courseware in classroom teaching, it is hope the processes can be shorten significantly.

The Ministry of Education, Malaysia (MoE) has taken initiatives to train teachers teaching Principles of Accounting subject to use accounting educational simulation courseware, ASSETBase in their classroom teaching and learning. Throughout 2005 and 2006, two thousand seven hundred and thirty (2,730) teachers underwent trainings as part of the initiative formulated by MoE to enhance their skills and knowledge at using the courseware as a teaching and learning tools, and in preparing a computerized full-cycle accounts. The evaluation from the above training sessions reflected teachers' positive perceptions towards using ICT in classroom teaching and learning, and in using the ASSETBase simulation courseware in general [2]. In supporting the initiatives, one

thousand three hundred and sixty five (1,365) national academic and technical schools were equipped with the ASSETBase courseware. MoE initiatives also highlighted the needs of redesigning the curriculum and instructional materials, revising students' achievement tests and improving the teacher training system. The height of the initiatives shows two memorandums of understandings were signed on 25<sup>th</sup> June 2007 between MoE and relevant professional accounting bodies: the London Chamber of Commerce and Industry International Qualifications (LCCI) and the Association of Chartered Certified Accountants (ACCA). As for the needs to redesign (upgrade) the curriculum and instructional materials, modular lesson plan was developed with intention to improve the quality of accounting teachers' professional development and to counter issues reported by teachers through the Accounting Teachers' Online Monitoring Systems. The lesson plan was later endorsed by representatives of accounting education stakeholders in the country. Various levels of lesson plan were introduced and analyzed as to identify the suitability of the module presented to suit a minimum availability of ICT infrastructure at individual school. In this study, the lesson plan will then further enhancement as to transform it into a strategic training module on ICT integration.

## **1. Literature Review**

Generally, three objectives are distinguished for ICT in education: ICT as the object of study, ICT as an aspect of a discipline or profession; and ICT as a medium for teaching and learning. In education, ICT as the object refers to learning about information and communication technology, which enables students to use ICT in their daily life. ICT as an aspect of the discipline refers to the development of ICT skills for professional or vocational purposes. ICT as a teaching and learning medium focuses on the use of ICT for the enhancement of the learning process of students [3]. In accounting education, ICT can be used for the purpose of functioning as an aspect of the accounting discipline, as well as, a medium for teaching and learning. Studies have shown that teachers begin to develop ways of improving their knowledge and skills in teaching and learning by creatively exploit readily available ICT courseware into their subject teaching [4].

### *1.1 Classroom Integration of ICT*

The integration of ICT in a classroom enhanced the teaching and learning process. A formal classroom-based training of IT using case studies, simulations, interactions with experienced professionals and other similar techniques helps the presentation of subject matter easier. In the accounting discipline, ICT plays a major role in developing the skills sets and professionalism necessary for teaching [5, 6]. ICT acts as a catalyst for speedier understanding of subject matters for teachers and students (ability to handle full sets of account) as well as acts as tools for teaching and learning (ability to embed ICT into the classroom lesson plan). Thus, through the use of ICT students can relate computer-based business systems within a financial accounting course and perform accounting tasks competently in the IT environment.

### *1.2 Pedagogical Framework (PF)*

Technological Pedagogical Content Knowledge (TPCK) framework by Mishra and Koehler [7] was similar to the PF research study model currently undertaken except with the absence of the skills component. As implied by Willis, Thompson, and Sadera [8] we subscribed the



skills component into TPCK, the PF study facilitates for smooth integration of ICT into accounting teaching and learning. The TPCKS (now known as Technological Pedagogical Content Knowledge and Skills) framework then became the model to develop strategies to improve teachers' readiness to integrate the ICT simulation courseware and help to promote professional skills required in accounting discipline. The TPCKS framework explains that the interaction between the knowledge set and skills (skills in maintaining full sets of accounts under computerized platform) allows for an emergent of teachers' creativity.

### *1.3 Teachers' Professional Developments*

Teachers' professional development involves working collaboratively, addressing contextualised authentic problems and negotiating meaning through practices [9]. Teachers' quality are increasingly linked to ongoing learning and enhanced by being practitioner researchers as a key group in the reforming of classroom practice for more effective student learning.

### *1.4 The Program Evaluation – Context, Input, Process, and Product (CIPP) Approach*

CIPP program evaluation model [10] made up of four phases of activities: context, input, process and product, by which the evaluation assists a decision-maker to answer four basic questions: (i) What should we do? (ii) How should we do it? (iii) Are we doing it as planned? (iv) Did the program work? By comparing the actual outcomes to the anticipated outcomes, better decision can be established.

## **2. Research Questions**

- (i) What are the demographic factors that can influence accounting teachers to use ICT in the classroom teaching Principles of Accounting?
- (ii) What are the additional skills sets required of accounting teachers' to implement new innovations using the computerized strategic instructional module in classroom?
- (iii) What are the perceptions of accounting teachers' on the usage of accounting educational simulation courseware, ASSETBase in classroom teaching and learning?
- (iv) What is the level of teachers' ICT usage as a pedagogical tool in accounting education as highlighted by the accounting education standard?
- (v) What is the effect of the training of strategic training module of ICT integration in classroom teaching and learning process to be under taken on the teachers' professional development?

## **3. Contribution**

The findings of this study can assist MoE to chart future plans that can propel the accounting teachers' professional development. It significantly contributes to the MoE national agenda to monitor the performance of ICT implementation in education system. By maximizing the usage of ICT in teaching and learning of Principles of Accounting, both teachers and students will experience the high standards of accounting procedures setup by the

international accounting professional bodies such as LCCI, ACCA and CIMA. Simultaneously, the needs of business and industry will be addressed.

#### **4. Methodology**

CIPP evaluation model approach is used to evaluate the educational training program conducted for the accounting teachers. Basically, the CIPP model requires that a series of questions be asked about the four different elements of the model: context, input, process and product. The effect of the undergone training on teachers' professional development will exhibit the effectiveness of the strategic training module of ICT integration in classroom teaching and learning process. Descriptive research will undertake to establish the empirical relationships of variables between the dependent variables: teachers' professional development (teachers' cognitive level, skills competency, attitude to change and desire) and the independent variables: success factor (teachers' demographic factors, teachers' additional skills set, teachers' perception on ICT and accounting educational courseware usage, technological situation/environment) within the conceptual framework.

#### **5. Preliminary Results**

A pilot study was conducted in 150 technical and national secondary schools nationwide in Malaysia. The preliminary result shows teacher-respondents have positive perceptions towards the integration of ICT using ASSETBase simulation courseware, given the mean score of teachers' readiness level is high. Further, most of the teacher-respondents understand the purpose of integrating ICT and the use of the courseware in teaching and learning and are serious in implementing new approach.

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