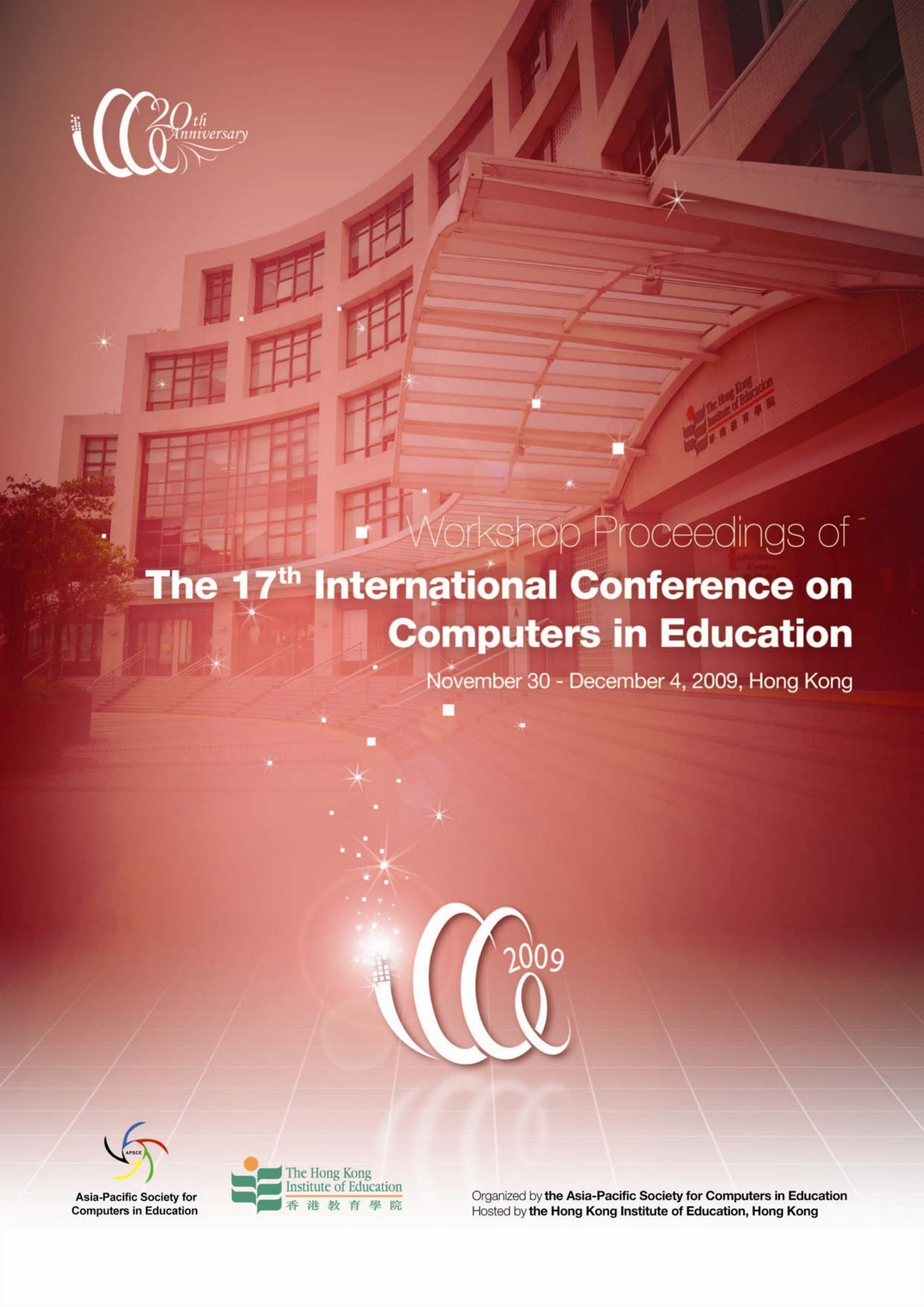

Workshop Proceedings of

The 17th International Conference on Computers in Education

November 30 - December 4, 2009, Hong Kong

ICCE 2009

Asia-Pacific Society for Computers in Education

The Hong Kong Institute of Education
香港教育學院

Organized by **the Asia-Pacific Society for Computers in Education**
Hosted by **the Hong Kong Institute of Education, Hong Kong**

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Preface

Although ICCE 2009 consists of six themes, there are still some areas within each theme that might attract interests from different groups. The organization of workshops alongside with the ICCE provides an extra platform to allow a variety of research focuses to be accommodated in a finer way. The aim of organizing these workshops is to bring together researchers of various interests in computers in education to present, discuss and explore the state of art of applying information technology in various aspects of learning.

We received eight workshop proposals this year. All papers consisted in this volume were gone through a rigorous peer reviewing process under the responsibilities of respective program committees, which were in turn, managed by respective workshop organizers. At the end of the reviewing process, we decided to have four workshops running in conjunction with the ICCE 2009. These papers were organized in the following four workshops:

- Modeling, Management and Generation of Problems/Questions in Technology-Enhanced Learning;
- e-Learning Tools, Techniques and Applications for Cultural Heritage;
- Design and Experiments of Classroom, Mobile and Ubiquitous Technologies Enhanced Learning; and
- Strategies for Practical integration of Emerging and Contemporary technologies In Assessment and Learning.

We are grateful to the authors for submitting the papers, to reviewers for their efforts in providing detailed reviews, and to programme committees for establishing the respective workshop programmes. We look forward to having your active participation in workshops in ICCE 2009.

Lam for KWOK
ICCE 2009 Workshop Co-ordination Chair

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- Workshop 1 -

International Workshop of Modeling, Management and Generation of Problems/Questions in Technology-Enhanced Learning

Kwok, L.F., Kong, S.C., Charoenporn, T., Hirashima, T., Kojiri, T., Mitrovic, A., Ogata, H., Sornlertlamvanich, V., Supnithi, T., Takenaka, M., Tarumi, H., Thaiupathump, C., Wang, F.L., Yu, F.Y., Yu, Y.T. (eds.) (2009). *Workshop Proceedings of the 17th International Conference on Computers in Education [CDROM]*. Hong Kong: Asia-Pacific Society for Computers in Education.

Call for Workshop Papers

The 3rd International Workshop of Modeling, Management and Generation of Problems/Questions in Technology-Enhanced Learning

Academic assessment, either in the form formative evaluation so as to improve teaching/learning or summative evaluation so as to evaluate the end result of schooling, often takes the form of questions and problems to be solved by students. As such, solving problems/questions is one of the most indispensable and important elements in the teaching and learning process. To allow students to reach a satisfactory mastery level, a sufficient amount of questions/problems are needed to enable students to apply learned knowledge to various situations. To deal with the demands, metadata of problems/questions, authoring or automatic generation of problems/questions, and adaptive exercise are pertinent issues.

Besides, a number of observations have been made about how student-generated questions can be of value and be a valuable strategy if realized on web-based learning environments. How various interventions of problems/questions and its claimed effects can be better understood and appreciated in light of different theories (such as test theory and metacognition) are in urgent need of further investigation and elaboration.

In ICCE2006 and 2007, we held successful workshops where we paid special attention to “questions/problems” in technology-enhanced learning. This is the 3rd workshop focusing on the same topic. This continuous workshop will provide a good and timely opportunity to present and share the results and issues of investigations about "problems/questions" in ICCE community. We cordially invite presenters and participants who are interested in further exploring the many facets and potential uses of "problems/questions" in education/learning from a theoretical, technological, pedagogical, sociological or administrational point of views.

Topics of interest include, but not limited to:

- Problem/question generation/authoring/posing
- Learning by problem/question-posing
- Problem/question variation/changing
- Problem analysis and evaluation
- Structurization of domain knowledge
- Problem/question selection
- Metadata or Ontology of problems
- Metacognition in problem-solving or problem-posing
- Test theory
- Instructional intervention for problem/question-authoring in classrooms

Kwok, L.F., Kong, S.C., Charoenporn, T., Hirashima, T., Kojiri, T., Mitrovic, A., Ogata, H., Sornlertlamvanich, V., Supnithi, T., Takenaka, M., Tarumi, H., Thaiupathump, C., Wang, F.L., Yu, F.Y., Yu, Y.T. (eds.) (2009). *Workshop Proceedings of the 17th International Conference on Computers in Education [CDROM]*. Hong Kong: Asia-Pacific Society for Computers in Education.

Problem-generation/selection by system

Kwok, L.F., Kong, S.C., Charoenporn, T., Hirashima, T., Kojiri, T., Mitrovic, A., Ogata, H., Sornlertlamvanich, V., Supnithi, T., Takenaka, M., Tarumi, H., Thaiupathump, C., Wang, F.L., Yu, F.Y., Yu, Y.T. (eds.) (2009). *Workshop Proceedings of the 17th International Conference on Computers in Education [CDROM]*. Hong Kong: Asia-Pacific Society for Computers in Education.

Automatic Text-Coherence Question Generation based on Coreference Resolution

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[b]*Institute of Information Science, Academia Sinica, Taiwan*
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Abstract: In this paper, we propose a multiple-choice question generation program based on coreference resolution for measuring learners' comprehension of the article. The coreference of the entire article is accomplished by the connection of noun phrases referring to the same entity in the real world. In order to improve question difficulty and discrimination, we employ clusters' relation of the coreference to generate the answer and distractor.

Keywords: coreference resolution, distractor, target words, agreement features

Introduction

Achieving at least a working knowledge of English is a necessity for many non-native speakers of English to pass basic requirements in fields such as medicine and computing, while for others, it remains a marker of competence in a globally competitive company or market. Taiwanese teachers teaching in Taiwan typically test students constantly in English classes on subject matter ranging from primarily grammar-oriented questions in basic levels to primarily reading comprehension-oriented questions in more advanced levels. However, the English educational mode may be so uninteresting and pressured to learners that its performance will be reduced. In this paper, we present one way in which we can make these teachers' lives easier, namely a program called Autoquiz based on Coreference Resolution of Filter Similarity (ACFS) that generates multiple-choice questions automatically from given texts. For learners, they can ubiquitously select any article that fits their interests as learning materials and use this system to measure their proficiency. This program is able to generate questions testing reading comprehension through a tactic similar to the way people process a reading while reading—resolution of coreference relations of noun phrases (see Figure 1). Different from the previous automatic multiple-choice question generation, this system measures not only learners' ability of memorizing vocabulary, phrases, or grammars but also learners' ability of the articles' comprehension and coherence.

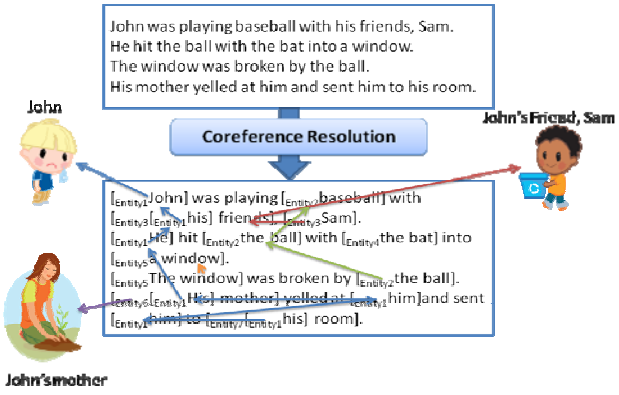

Figure 1. Coreference Resolution.

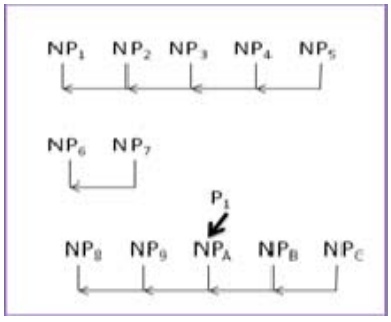

Figure 2. Sketch of our coreference chain.

1. The Proposed Methodology

For the purposes of this paper, we propose two sets of features to resolve two types of noun phrases (Pronoun and Non-Pronoun, hereinafter referred to as NP) respectively. For the purposes of this paper, we adopt the "chain division" representation (see Figure 2) which is that NPs are linked to their closest antecedent NP in a chain. We focus on monologue, a kind of writing in which the first personal pronoun and the second personal pronoun represent the writer and reader of the reading respectively. Here we just deal with the third personal pronoun. For the above idea, we will propose a method called "ACFS" (see Figure 3). Before introducing filters, we first define some symbols and operations explanation:

Symbol explanation:	**Operation explanation:**
(a) P: Pronoun	(a) drop(P): don't resolve P
(b) NP: Non-Pronoun Noun Phrase	(b) exclude(NP_a, NP_b): exclude the antecedent candidate NP_b ∈ $C(NP_a)$
(c) NP_a: active NP, the oncoming NP	(c) link(NP_a , NP_b): NP_b is the antecedent of NP_a
(d) NP_b: passive NP, one of candidates of NP_a	
(e) $C(NP_a)$: Candidates of NP_a	

The pronoun filter procedure is based on the filter rules in the right column:

Pronoun Filter Procedure:	**Pronoun Filter Rules:**
Input : [P ,C(P)], C(P) =(NP_1,NP_2…,NP_n)	Rule1: Is P the first personal pronoun?
IF Rule1 **then** *drop(P)*	Rule2: Is P the second personal pronoun?
ELSEIF Rule2 **then** *drop(P)*	Rule3: Is P Pleonastic Pronoun?
ELSEIF Rule3 **then** *drop(P)* and mark as pleonastic pronoun	Rule4: **Doesn't** P agree in number with NP_b?
ELSEIF Rule4 **then** *exclude(P, NP_b)*	Rule5: **Doesn't** P agree in gender with NP_b?
ELSEIF Rule5 **then** *exclude(P, NP_b)*	Rule6: **Doesn't** P agree in person with NP_b?
ELSEIF Rule6 **then** *exclude(P, NP_b)*	Rule7: Are P and NP_b in one of the conditions Syntactic Filter holds?
ELSEIF Rule7 **then** *exclude(P, NP_b)*	Rule8: Are P and NP_b in one of the conditions Lexical Anaphor Filter holds?
ELSEIF Rule8 **then** *link(P, NP_b)*	
Output : [P , C(P)'], C(P)' ∋ C(P) =(NP_1,NP_2…,NP_n)	

The non-pronoun filter procedure is based on the filter rules that be in the right column follow a different set of rules than the pronoun filters:

Non-Pronoun Filter Procedure:	**Non-Pronoun Filter Rules:**
Input : [NP_n , C(NP_n)], C(NP_n) =(NP_1,NP_2...,NP_{n-1})	Rule1: Are NP_n and NP_b in the appositive relationship?
IF Rule1 **then** *link*(NP_n , NP_b)	Rule2: Do the equal pattern of NP_n and NP_b exist in the same sentence? (ex: NP_a be NP_b)
ELSEIF Rule2 **then** *link*(NP_n , NP_b)	Rule3: **Doesn't** NP_n agree in number with NP_b?
ELSEIF Rule3 **then** *exclude*(NP_n , NP_b)	Rule4: **Doesn't** NP_n agree in animacy with NP_b?
ELSEIF Rule4 **then** *exclude*(NP_n , NP_b)	Rule5: **Doesn't** NP_n agree in gender with NP_b?
ELSEIF Rule5 **then** *exclude*(NP_n , NP_b)	Rule6: **Doesn't** NP_n agree in semantic class with NP_b?
ELSEIF Rule6 **then** *exclude*(NP_n , NP_b)	Rule7: Do the Google search count of the equal pattern of NP_n and NP_b smaller than threshold?
ELSEIF Rule7 **then** *exclude*(NP_n , NP_b)	Rule8: Are NP_n and NP_b Exact String Match?
ELSEIF Rule8 **then** *link*(NP_n , NP_b)	Rule9: Are NP_n and NP_b First Token Match?
ELSEIF Rule9 **then** *link*(NP_n , NP_b)	Rule10: Are NP_n and NP_b Prepositional Phrases Match?
ELSEIF Rule10 **then** *link*(NP_n , NP_b)	
Output : [NP_n, C(NP_n)'], C(NP_n)' ∋ C(NP_n) C(NP_n)=(NP_1,NP_2...,NP_{n-1})	

In this section, we will offer a short description of the features to which we have referred:
Appositive. An entity is considered to an appositive if it is enclosed by "," and ",", ";" or ".", is a proper name or contains an article, and is immediately preceded by another noun phrase in the text.

Exact String Match (for proper noun). Occurrences of identical entities corefer.

Prepositional phrases (for organization or person). Organization names that are inverted around a preposition "of", e.g. University of Sheffield are considered proper nouns.

Number Agreement feature. Head nouns, determiners, and verbs are used to determine the number of NP.

Equal pattern filter. We use contextual information to identify these equal patterns of the "NP_a be NP_b" form in the text and background knowledge to determine whether "NP_a be NP_b" is an equal pattern using a search result count from Google. The accuracy of result counts was improved using of the Google page for the US.

Semantic class feature. WordNet is used to obtain semantic information for head nouns.

Pleonastic Pronoun Detection. RAP (Lappin and Leass, 1994) proposed a set of patterns to detect pleonastic pronouns. Here we use these patterns to detect this kind of pronouns.

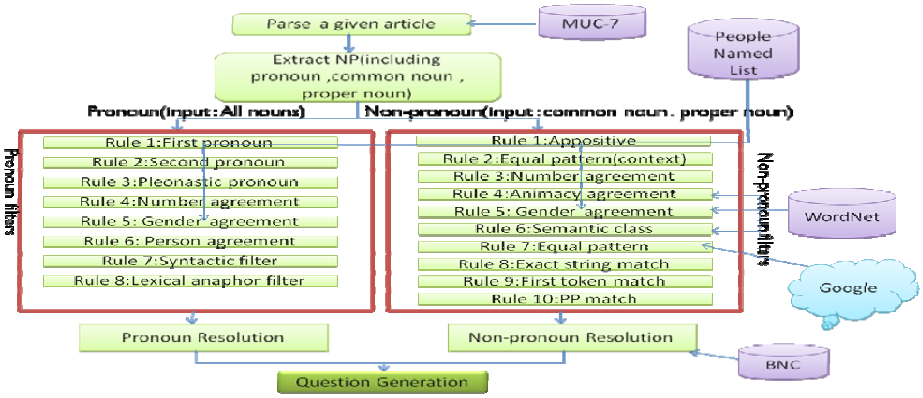

Figure 3. Process of Autoquiz based on Coreference Resolution of Filter Similarity (ACFS)

Animacy and Person Agreement feature. Objects are classified using WordNet. NPs classified in this database as human, plant or animal are marked "anim", and all other NPs are marked "inanim". NPs classified as human are marked "person", and all others are marked "nonperson".

Gender Agreement feature. A named list (http://www.natcorp.ox.ac.uk/), short lists made for such words as brother, mother, etc. and WordNet are used to distinguish between male and female first names.

First token match (for organization or person). First tokens in proper name NPs are matched with first tokens of other proper name NP with a rule stipulating that for "person" NPs, shorter proper name NPs have only one token.

Syntactic Filter on Pronoun-NP Coreference. A third person pronoun P is NOT coreferential with a NP if they are detected through matching a set of syntactic filter conditions RAP proposed.

Lexical Anaphor Filter. Lexical Anaphors includes reflexives (itself, ourselves, etc.) and reciprocals (each other, one another,…). A lexical anaphor A is coreferential with a NP if they are detected through matching a set of lexical filter conditions RAP proposed.

For non-pronoun resolution, we propose the following function like the idea Lesk proposed to measure the similarity score using the context knowledge of w_1 and w_2. For improving the accuracy, we extend the contexts of the concepts. We adopt two text resources: text and BNC (http://www.natcorp.ox.ac.uk/). We use the following function for computing the similarity between two entities NP_a and NP_b :

$$\text{Similarity}(w_1, w_2) = \frac{\text{Overlap}[(Ew_1 + Bw_1), (Ew_2 + Bw_2)]}{\text{Max}[\text{Length}(Ew_1 + Bw_1), \text{Length}(Ew_2 + Bw_2)]}$$

Where Bw_i is the sentence set where the ith word occurs in BNC; Ew_i is the sentence set where the ith word occurs in the article; Length(Ew_i+Bw_i) is total word number of sentence sets of Ew_i and Bw_i; Max is the larger one between sentence sets of two words. Overlap is overlap score between sentence sets of two words. After processing the above filter procedures, we use our proposed similarity function to compute similarity of the remaining candidates of each NP and select the candidate which has the highest similarity score as its antecedent.

For pronoun resolution, we adopt the weight algorithm Lappin and Leass(1994) [2] proposed. The algorithm uses the following factors and initial weights (see Table 1).

Table 1. Salience Factors and their initial weights

Factors	Initial Weight
Sentence Recency	100
Subject Emphasis	80
Existential Emphasis	70
Accusative Emphasis	50
Indirect Object and Oblique Complement Emphasis	40
Non-adverbial Emphasis	50
Head Noun Emphasis	80

See the following steps of the weight algorithm:

(a) An additional salience value is assigned to NPs in the current sentence.

(b) The salience values of antecedent candidates in preceding sentences are progressively degraded relative to the salience values of NPs in the current sentence.

(c) Proximity is used to resolve ties among antecedent candidates with equal salience values.

For question generation method, the targeted question form, multiple-choice, consists of one question per target word, and tests examinees via one correct answer choice and several incorrect choices (distractors) per question in the following way:

(a) Determine the blank target key. Here there are three target types: pronoun, pleonastic pronoun, and NP.

(b) Determine the answer. The answer for a pronoun question type is the antecedent NP of the pronoun in question. For pleonastic pronouns, the answer is “none of the above”. The answer for NP question types is the NP itself or the closest antecedent NP in the coreference chain.

(c) Determine the distracters. For all question types, the distractors are NPs obtained from all coreference chains except for the chain in which the target word appears. In order to improve question difficulty, the agreement feature (including number, gender, and semantic class) of the distractors is as similar as possible to the agreement feature of the target word.

(d) Generate the Multiple-Choice Cloze Question (see Figure 4).

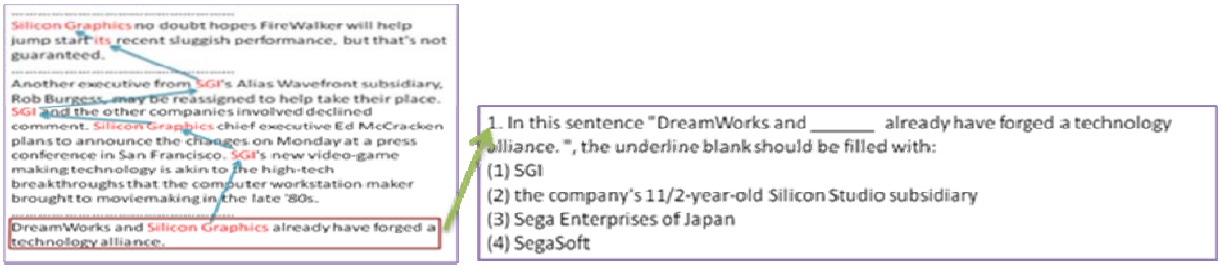

Figure 4. Abstract of the article and a question of its reading comprehension based on ACFS

2. Evaluation

In this section, we evaluate the performance of our proposed coreference resolution and automatic quiz based on it. We choose ten articles in MUC7 as experiment material parsed by Link Grammar Parser. It generates 738 questions. We analyze the generated coreference result which is evaluated by precision, recall, and F1 score of B-CUBED evaluation method and also evaluate the generated questions by accuracy and Usability, which are defined as follows.

$$\text{Precision}_{E_i} = \frac{|\text{Right}(\text{Response}(E_i))|}{|\text{Response}(E_i)|}, \quad \text{Precision} = \sum_{i=1}^{N} W_i \times \text{Precision}_{E_i}$$

$$\text{Recall}_{E_i} = \frac{|\text{Right}(\text{Response}(E_i))|}{|\text{Key}(E_i)|}, \quad \text{Recall} = \sum_{i=1}^{N} W_i \times \text{Recall}_{E_i} \qquad F1 = \frac{2 \times \text{Precision} \times \text{Recall}}{\text{Precision} + \text{Recall}}$$

$$\text{Accuracy}_{\text{answer}} = \frac{\text{number of correct answer choices}}{\text{number of questions generated}}, \quad \text{Accuracy}_{\text{question}} = \frac{\text{number of valid questions}}{\text{number of questions generated}}$$

$$\text{Usability}_{\text{distractor}} = \frac{\text{number of usable distractors}}{\text{number of all distrators}}, \quad \text{Usability}_{\text{question}} = \frac{\text{numberof questionswhichall distractors are usable}}{\text{numberof questionsgenerated}}$$

A cloze item is considered accurate of the answer when the answer of the generated question and the target word of the original sentence in the text refer to the same entity. A cloze item is

considered accurate of the question when the question is valid. A cloze item is considered usable when the distractor results in an inappropriate sentence. Table 2 shows the experiment results of coreference resolution of our proposed approach, ACFS, and two baselines containing ALL ONE CLASS which includes all noun phrases into one class and EACH ONE CLASS which includes each noun phrase into one class.

Table 2. Experiment result of the generated coreference resolution and the generated questions

Method	B-CUBED	Threshold					
		0	0.1	0.2	0.3	0.4	0.5
ACFS	Precision	0.610	0.667	0.687	0.714	0.859	0.948
	Recall	0.809	0.799	0.798	0.789	0.785	0.773
	F1	0.687	0.726	0.737	0.748	0.818	0.849
All One Class	Precision	0.041					
	Recall	1.0					
	F1	0.079					
Each One Class	Precision	1.0					
	Recall	0.685					
	F1	0.811					
$Accuracy_{answer}$		0.6668001	0.7227987	0.73617727	0.7529692	0.87695324	0.9502388
$Usability_{distractor}$		0.9659349	0.9646487	0.9613409	0.9585665	0.95408535	0.9542581
$Usability_{question}$		0.9070345	0.903176	0.89325255	0.88492936	0.88381463	0.8720042
$Accuracy_{question}$		0.60165715	0.65412635	0.65662163	0.6678301	0.7854123	0.8432764

We use different thresholds to analyze the relation of accuracy and threshold and find out the best accuracy of coreference result in which threshold of ACFS. The higher value the threshold is set on, the higher value the precision and F1of ACFS have. On the contrary, ACFS has the lowest the recall value when the threshold is set on the highest value. When using B-CUBED evaluation method, there is a special situation that ALL ONE CLASS and EACH ONE CLASS make the precision and the recall equal to 1.0 respectively. With the threshold set on 0.5, F1 of ACFS the equals 0.85 that is higher than the two baselines. Here we propose four ways to analyze the questions. As the above coreference, we use the thresholds from 0 to 0.5 to analyze the relation with accuracy and usability. The higher value the threshold is set on, the higher value $Accuracy_{answer}$ and $Accuracy_{question}$ of the generated questions have. On the contrary, $Usability_{distractor}$ and $Usability_{question}$ have the lowest value when the threshold is set on the highest value. $Accuracy_{answer}$ of the generated questions equals 0.95. For the experiment results of coreference resolution and the generated questions, the precision of coreference result of ACFS affects $Accuracy_{answer}$.. The recall of coreference result of ACFS affects usability of distractors. F1 affects $Accuracy_{question}$.

3. Conclusion and Future Work

In this paper, we propose an automatic multiple-choice generation method based on coreference resolution to measure learners' comprehension of the article and understand their learning situation. We employ groups' relation of the coreference to generate the answer and distractor for improving question difficulty. For discrimination, the answer and distractor of the question are in the similar agreement features. In this paper, we use the simple question type to generate questions. For enriching the question, we can add 5W question types, including what, who, which, when and where, to our system in the future.

Acknowledgements

This work was supported by the National Science Council of Taiwan, R.O.C., under contract numbers NSC-97-2631-S-008-004.

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Problem Generation as Structure Simplification Following Problem-Solving Process

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Abstract: In this paper, three types of increasing problem simplification, (1) formulation partialized problem, (2) solution partialized problem and (3) specialized problem are introduced. They are defined as problems that can be solved as sub-process of the original problem. In this paper, a model of problem solving process is proposed. Based on the model, then, the three types of increasing problem simplification are described. Several ways to help students with the simplified problems are also explained.

Keywords: Increasing Simplification, Problem Generation, Problem Simplification, Scaffolding, Problem Structure Transformation

Introduction

Problem solving practice plays a crucial role in enhancing the students' problem-solving capabilities. Developing an advanced and elaborate form of problem practice is, therefore, one of the most important issues in the research of the computer-based learning environments. In problem solving exercises, a student often fails to solve a problem. In that case, teaching the correct solution is not always an effective way to help the student because he/she may passively accept the solution without trying to check it or regenerate it [1]. Therefore, how to help a student solving a problem him/herself is an important issue. Polya suggested that using problems which are generated by simplifying the original difficult problem is one of the most promising methods to realize such help [2]. This method is actually popular in one-on-one human tutoring. The purpose of this research is to realize this method in computer-based learning environments.

The simplest way to realize this support is to prepare various simplified problems to each original problem used in the problem exercise beforehand. However, it is not an easy task to prepare enough number of problems. Moreover, when the student fails to solve even the simplified problems, simpler problems are required. Based on these considerations, it is hard to prepare every necessary simplified problem beforehand.

Automatic problem generation from the original problem is a promising approach to realize effective use of the simplified problems. In this research, first, a model of problem-solving process that describes the process as a series to change problem structure is proposed. Simplified problems are defined as a problem which can be solved by (i) partialized process and (ii) specialized process of the original problem only.

Section 1 describes a framework for characterizing problems based on sub-processes in and intermediate structures created during the problem-solving process. By using the description, three types of increasingly simplified problems are defined. In Section 2, description of problem structures to realize the simplification is explained. Currently, only

mechanics problems in high school are used as examples. To confirm the applicability of this research to other domains is a future work.

1. Definition of Increasingly Simplified Problems

This section describes a framework to characterize a problem with the following three components: (1) surface structure, (2) solution structure, and (3) constraint structure [3,4]. Next, three types of simplified problems are described; (I) formulation partialized problem, (II) solution partialized problem and (III) solution specialize problem.

1.1 A Model of Problem-Solving

Several investigations have indicated that the formulation of a problem is often the most difficult task for students in problem-solving. This suggests that the formulation process is important to manage the difficulties of problems. Several models of problem-solving represent the formulation process as refining surface feature s of the problem [5,6]. In this research, the surface features are described with a semantic network structure of objects, their attributes and relations between the objects. This network is called "surface structure". Mover, refinements are regarded as changes in the surface structure to which numerical relations can be applied. For example, in mechanics, when a problem includes statements such as "smooth incline", there is an object "incline" in the surface structure with attribute "smooth". To apply numerical relations to the surface, the "smooth" should be changed to "frictional coefficient zero". The structure to which numerical relations can be applied is called "formulated structure" and the process to make the formulated structure "formulation process". Numerical relations are applied on the formulated structure and the required value is derived. This process is called "calculation process" and a structure including the required value is called "goal structure".

Based on this view, the problem-solving process can be divided into three phases; (1) statement-understanding process, (2) formulation process, and (3) calculation process, as shown in Figure 1. Because the task of the formulation process is to reduce and remove differences between the surface structure and the formulated structure, the surface structure is useful to characterize the formulation process. The task of the calculation process is to derive the required value by applying a series of numerical relations. The series of numerical relations is called "solution structure" and use it to characterize the calculation process in this paper.

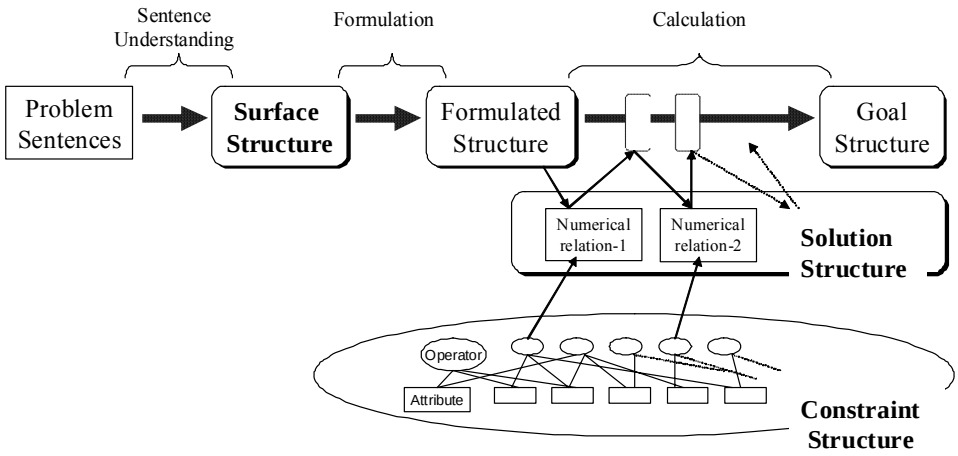

Figure 1. A Model of Problem-Solving Process.

Numerical relations which don't contribute to solve a problem but which exist in the situation set up by the problem are also important to characterize the problem. For example, numerical relations according to kinetic energy aren't necessary to solve Problem-1 shown in Figure 2, but the numerical relations are necessary to solve Problem-2 posed in the same situation. Therefore, numerical relations included in the situation are also important to characterize problems. The situation is characterized by a network composed of numerical relations among attributes included in the situation. The network is called "constraint structure" in this research.

[Problem-1] A block of mass *M* is put on a smooth incline quietly. The angle of the incline is *q* and the gravity acceleration value is *G*. Find the force of the block in parallel direction to the incline.
[Problem-2] A block of mass *M* is put on a smooth incline quietly. The angle of the incline is *q* and the gravity acceleration value is *G*. Find the kinetic energy of the block after *T* seconds.
[Problem-3] A person, who is going up in an elevator moving with velocity *V0*, releases a ball. Find the velocity of the ball after *T* seconds. The gravity acceleration value is *G*.
[Problem-4] The ball is thrown with initial velocity *V0* to the upper vertical direction. Find the velocity of the ball after *T* seconds. The gravity acceleration value is *G*.
[Problem-5] A block of mass *M* is put on a smooth incline quietly. The angle of the incline is *q* and the gravity acceleration value is *G*.
(5a) Find the force of the block in parallel direction to the incline.
(5b) Find the velocity of the block when it moved for a distance of S on the incline.
[Problem-6] A block of mass *M* is put on a coarse incline. The angle of the incline is *q* and the gravity acceleration value is *G*. The coefficient of friction between the block and the incline is m. Find the acceleration of the block in parallel direction to the incline when its initial velocity is *zero*.

Figure 2. Examples of Mechanical Problems

1.2 Categorization of Simplified Problems

In this paper, a problem is characterized by a surface structure, solution structure and constraint structure. Then, simplification of an original problem is carried out by reducing the problem-solving process or by specializing in the numerical relations used in the process. The reduction of problem-solving process is carried out by formulating the surface structure or partitioning of the solution structure. Formalizing of the surface structure means reducing of the formulation process. A problem that can be generated by formalizing the surface structure of the original problem is called "formulation partialized problem". Partitioning of the solution structure means reducing of the calculation process. A problem that can be generated by partitioning the solution structure of the original problem is called "solution partialized problem". Specializing of the problem-solving process is carried out by specializing in the constraint structure. A problem that can be generated by specializing in the constraint structure of the original problem is called "solution specialized problem".

Problem-4 is a formulation partialized problem for Problem-3, that are shown in Figure 2. The surface structure of Problem-3 is Structure-A shown in Figure 3. To solve Problem-3, Structure-A should be changed to Structure-B where "elevator" is omitted and "velocity of the elevator" is transformed to "initial velocity of the ball". Structure-B corresponds to the surface structure of Problem-4. Because Problem-4 has the more refined surface structure than Problem-3, Problem-4 is easier than Problem-3 in the formulation process.

Problem-5a is a solution partialized problem of Problem-5b. Figure 4 shows the solution structure of Problem-5b. Derived denotes the attribute value is derived in the calculation process but isn't an answer of the problem. By changing several derived attributes to given attributes or required attribute, a part of the solution structure of the original one can be generated. The problem with such a partialized solution structure is simpler than the original problem in the calculation process. In the solution structure of Problem-5b, by changing "acceleration of the block in parallel direction" to the required attribute, a partialized solution structure is generated. Therefore, Problem-5a characterized by the partialized solution structure is a solution partialized problem of Problem-5b.

Problem-5a is a solution specialized problem of Problem-6. Figure 5 shows a part of the constraint structure of Problem-6. Simplification of the constraint structure is achieved by specifying an attribute value that can be omit it in the constraint structure. For example, when the value of the frictional coefficient becomes "zero", the frictional coefficient can be omitted in the constraint structure. Consequently, several numerical relations can be also simplified or omitted in the constraint structure. In Figure 5, when the value of the frictional coefficient becomes "zero" in the constraint structure, shown in Figure 5, the equation of motion is simplified from "$ma = mg \sin\phi - \mu mg \cos\phi$" to "$ma = mg \sin\phi$". Such specialized numerical relations can be used only in the specialized situation where the frictional coefficient is zero. Then, the original numerical relations can also be used in the specialized situation. Therefore, Problem-5a characterized by the specialized constraint structure is a solution specialized problem of Problem-6.

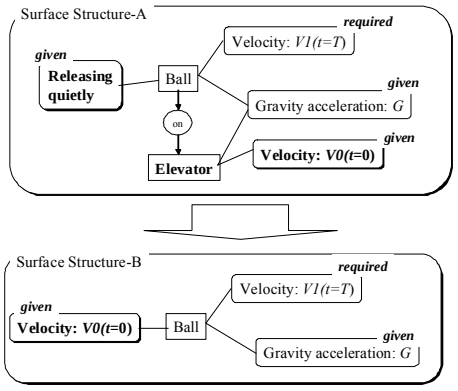

Figure 3. Simplification of Surface Structure.

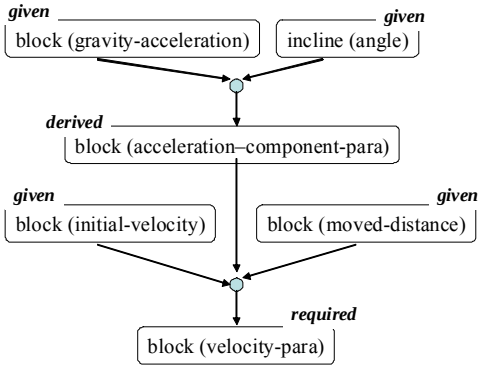

Figure 4. Solution Structure of Problem-5b

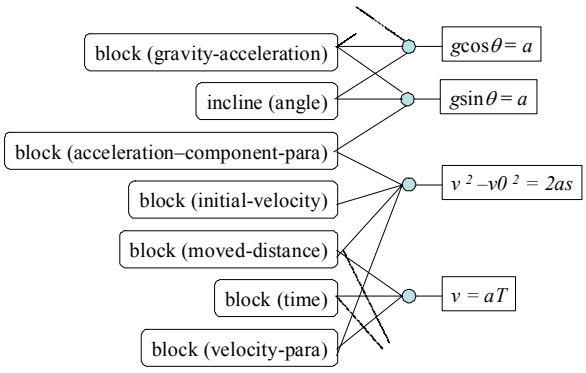

Figure 5. A part of a Constraint Structure.

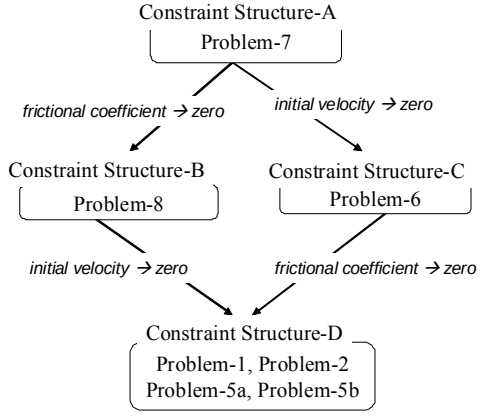

Figure 6. A Network of Constraint Structure.

2. Description of Problem Structure

To realize the problem generation based on the definition of the problem simplification, it is necessary to prepare characteristic description for each problem. Although the quantity of description for each problem increases, because the description can be written independently of the context of problem practice, it is expected to reduce the load to prepare problems and their relations by hand.

In order to realize this problem generation, it is necessary to prepare (1) surface structure, (2) solution structure, (3) constraint structure, but also (4) problem sentences for the surface structure, (5) formulated structure, (6) formulation operators which are used to explain the change from the surface structure to the formulated structure, and (7) problem sentences for the formulated structure. Currently, because modeling of formulation process is not enough, the description of the process of formulation process should be prepared.

Although the way to write constraint structure is clear, the number of numerical relations is often too many to write for each problem. However, one constraint structure includes many problems and there are not so many possible constraint structures in the domain of high school mechanics. So a network of the constraint structures can be prepared. Figure 6 show a part of the network of the constraint structures. In the situation of Constraint Structure-A, the block has the initial velocity and the frictional coefficient. Then, a specialized constraint structure by changing the initial velocity to zero is Constraint Structure-B. By using this network, the constraint structures do not have to be written for each problem. The research to generate the network itself with a method of automatic modeling is currently investigating.

3. Concluding Remarks

In this paper, three types of increasing problem simplification, (1) formulation partialized problem, (2) solution partialized problem and (3) solution specialized problem are defined. Because the simplified problems can be solved as sub-process of the original problem, it is possible to judge them as simplified ones without context of their learning. This research has been mainly investigated from the viewpoint of support facility of problem solving exercises. The discussion from the viewpoint of question generation is the most important remaining future work as well as the practical implementation and evaluation [7].

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Question Repository Model on Open Source LMS: A Case Study of LEARNSQUARE

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Abstract: Web-based learning becomes an important tool in education. The use of web-based testing together with web-based learning helps improving quality of teaching and learning. Addition of the question repository model into the web-based testing enhances the system efficiency. This paper represents the model of question repository in our open source LMS; LearnSquare. A standard metadata in LOM is used to define a question. In addition, the development of new features for recommending a question helps user to select a suitable question for their tests.

Keywords: Question Repository, Web-based testing, Open source LMS, Recommended System

Introduction

Online learning via web-based system becomes widely use in education, however, online learning hardly comes with web based testing. Testing is an important component of learner evaluation in the entire process of learning [1]. Improving online learning, web-based testing is one of the key technologies [2].

In online system, it will be beneficial to have variety of questions in the same topic for users to choose for make their tests. All of questions are stored in a question repository. The questions are generated by users that use the same system. The question repository encourages user to generate a question and finally create questions with higher quality.

We have developed an open source Learning Management System (LMS) called LearnSquare in the past few years. The system is broadly used in many schools and organizations in Thailand. Although LearnSquare could generate questions and tests, it could not keep or share them with other systems. Question repository function is always required by users because this function can help them to generate, collect and reuse a question. Moreover, sharing of question is occurred.

When a question repository is ready to collect questions, a concern issue is how to manage questions in a repository. The problems are how to make it easy for searching and how to make a decision to choose a question. Metadata is a main factor to classify a question. Defining a metadata to each question can improve a quality of exploring data. In addition, developing a recommended function helps users to decide to select an appropriate question.

This paper presents a question repository in LearnSquare and proposes a recommended model to enhance testing system.

1. System Overview

Our project is developed based on LearnSquare. The question repository function is one of a function in the system. Moreover, we design a new sub system for recording using question history.

1.1 LearnSquare

LearnSquare is a Thai open source Learning Management System (LMS) which is supported by National Electronics and Computer Technology Center (NECTEC), Thailand. LearnSquare provides educational opportunities in Thailand, especially, schools in rural areas. Most of these schools have poor teaching quality, and local teachers are not well-educated due to the lack of good infrastructure to reach knowledge resources. Therefore LearnSquare is aimed to help improving the quality of education in rural areas to reach the similar standard level as that in urban areas [3]. The user interface of LearnSquare is shown in figure 1.

LearnSquare functions are divided into three main groups; content management, system management and user management. Content management is related to courseware manipulation, study media creation and reusable content. System management is an overall system control such as module control, user interface control and site control. User management is for tracking and controlling three user groups: student, instructor and administrator [4].

One of good characteristics of LearnSquare is that it can support the content package following SCORM version 1.2 [5]. Users can create content from authoring tools supporting SCORM standard and import it to the system. Alternatively, users can generate content from LearnSquare and export it to be used with other SCORM standard LMS. Work that is associated with LearnSquare will be developed according to SCORM, especially the metadata which SCORM is based on.

LearnSquare can create a question in two ways. The first method is to generate a question within LearnSquae internal system where the latest version is developed to have three types of question. The second method is to create a question by using the external system, Hot Potatoes [6]. This system has a variety of question formats, such as Quiz, Cloze, Crossword, Mix, Matching, or the combination of those. These externally generated question formats are compatible with LearnSquare where students' scores can be systemically collected and used in evaluation process created by teachers. In this paper, we focus on the questions that are created from a function in LearnSquare.

Figure 1. LearnSquare User Interface.

1.2 System Design

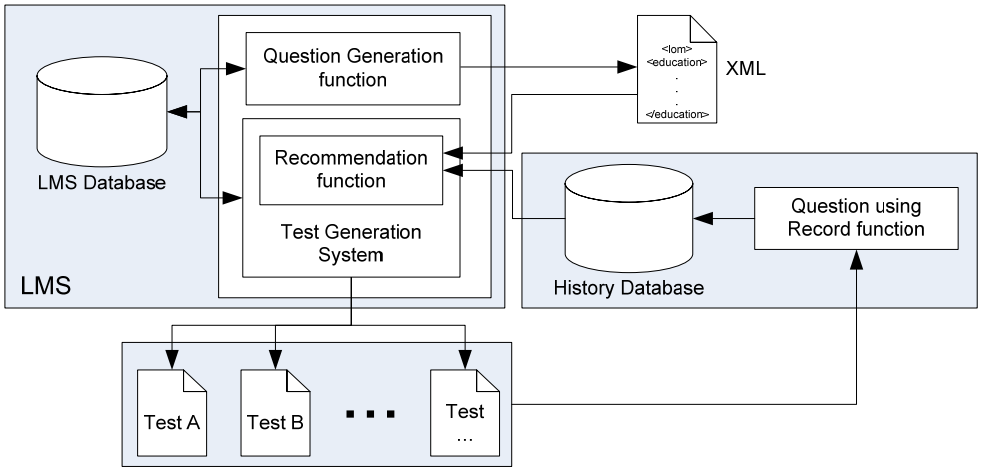

Figure 2. System Components.

Figure 2 shows all of components in the system. The system is separated into 2 main parts. The first part is the question generation system which is improved from the previous version of LearnSquare and enhanced by including metadata. The metadata of each question is recorded in XML structure. The question recommendation function is added within the test generation system for assisting an instructor. The second part is further developed separating from the LMS and called the question using record system. The question using record function receives using history of each question and then keeps it in the history database.
The data in XML file and the data in the history database are represented via the question recommendation function.

2. Question Repository Model

We improve the LMS in two main areas; the Question Generation and Test Generation.

2.1 Question Generation

The question generation system is developed as a function within LMS which can create 3 types of question; i) multiple choice ii) word addition in the sentence and iii) questions from the reading passage. All type of question is created as multiple choice questions. Moreover, information relating to each question is generated according to acceptable metadata standard.

2.1.1 Learning Objects Metadata (LOM)

Learning Objects Metadata (LOM) [7] is well suited for describing modular content. LOM uses the following categories to describe resources. We applied 4 categories with our project; educational, right, relation and classification as shown in Table 1 [5]. Each category has an element that contains child elements. We choose some of child elements to describe each question.

Table 1 Metadata Category.

Category	Child Element Name	Properties
Educational	interactivityType	the dominant mode of learning supported
	difficulty	how hard it is to work with or through the SCORM Content Model Component
	description	used to comment on how the SCORM Content Model Component is to be used
Right	cost	whether the SCORM Content Model Component requires some sort of payment
Relation	resource	Describe the target SCORM Content Model Component that this relationship references.
Classification	purpose	Define the purpose for classifying the SCORM Content Model Component.
	keyword	contains keywords and phrases descriptive of the SCORM Content Model Component relative to the stated Purpose (<purpose>) of this specific classification, such as discipline, idea, skill level, educational objective, etc

2.2 Test Generation

The Test Generation system operates by searching for the related questions in the question repository following user requirement. Figure 3 shows the interface of Test Generation system. After users define parameters of the test, all correlated questions is shown in a panel below the searching form, and then users can choose the questions they want. Users can filter the question by using parameters that is related to question metadata.

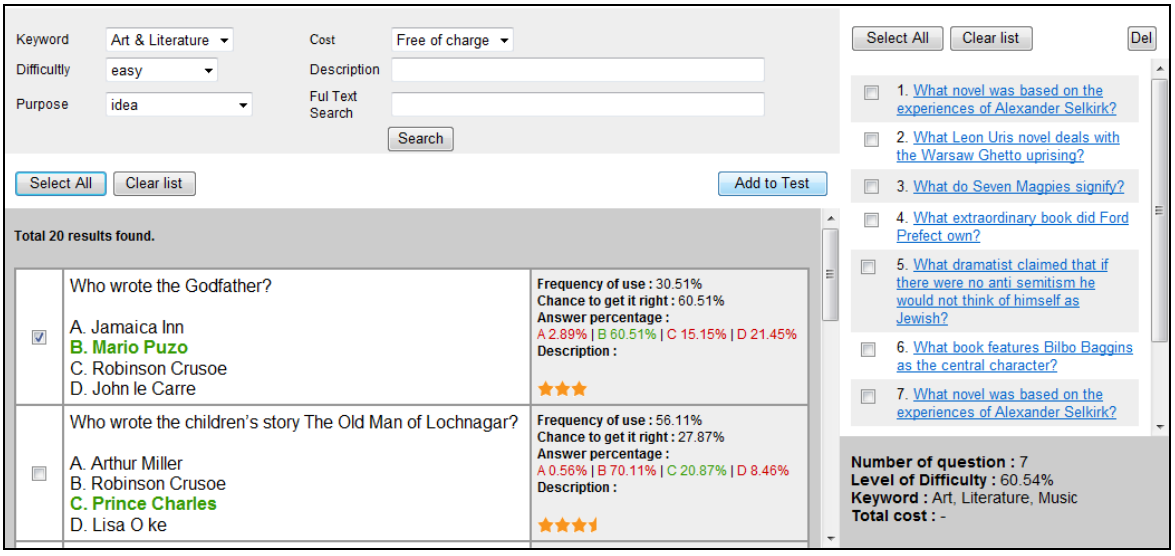

Figure 3. Test Generation user interface.

2.2.1 Recommendation function

The recommendation function is used for showing question information to the user. As shown in figure 3 an information dialog is shown in gray area next to a question and users can use this information to consider the use of the question.
Moreover, summary of the test is shown in gray box below a test frame. A level of difficulty is shown in the test summary which is used as a factor to define a level of the test.

3. Question using record system

The question using record system is developed to collect the using history of each question including the frequency of use, answer percentage for each choice, and calculate

a chance for student to get the question right. All these information will assist users to design the test.

4. Conclusion and Future work

Question repository improves web-based testing to be more efficient. This paper, we developed new features to support a question repository in our open source LMS (LearnSquare) resulting in enhancement of the question and test generation. In a question generation part, we used a metadata that SCORM is based on to classify a question. The question recommendation function is included in test generation system to help users to select a suitable question for their tests. This model will make a community in generating a question.

In the future work, we try to apply the specification of Question and Test Interoperability (QTI) to our system. A comparison between two specifications will be performed and we will choose the best one for our product.

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Student generation of problems

Kwok, L.F., Kong, S.C., Charoenporn, T., Hirashima, T., Kojiri, T., Mitrovic, A., Ogata, H., Sornlertlamvanich, V., Supnithi, T., Takenaka, M., Tarumi, H., Thaiupathump, C., Wang, F.L., Yu, F.Y., Yu, Y.T. (eds.) (2009). *Workshop Proceedings of the 17th International Conference on Computers in Education [CDROM]*. Hong Kong: Asia-Pacific Society for Computers in Education.

Any Effects of Different Levels of Identity Revelation for Online Student-Generated Questions Activities?

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Abstract: The focus of this study is to examine whether there are any differential effects of different identity revelation modes (real-name, nickname, anonymity) for student-generated questions activities. One hundred and one 7th graders from three classes participated for six weeks. An online learning system that allows students to contribute to and benefit from the process of question generation and peers' feedback was adopted. A pretest-posttest experimental research design was used. Data analysis did not confirm original contemplation that different levels of identity revelation lead participants to view their interacting partners or the process differently.

Keywords: Anonymity, interaction process, nickname, student-generated questions

1. Introduction

In light of information processing theory, student-generated questions may direct students to reflect back on received information, and elaborate and transform information into connected forms. Additionally, in view of constructivism and metacognition, engaging in student-generated questions learning tasks may induce students into a habitual state of constructing personally meaningful knowledge and the employment of various metacognitive strategies [1]. On the empirical side, the cognitive, affective and social potential of student-generated questions learning activities has been asserted by numerous researchers [2-7]. While theoretical and empirical bases are in support of a student-generated questions instructional approach, the facts that a majority of students have not experienced it during their formal course of study [8-9], and that students being introduced to the activities expressed concerns over their ability to construct good questions [7] warrant attention.

To permit its adoption and diffusion in classrooms, for the past few years the researcher led her research team working on creating an online scaffolded student-generated questions learning space by embedding different types and levels of supports [10]. One of such supports is different identity revelation modes - anonymity and created identity (via nicknames) in addition to real name.

1.1 Why different identity revelation modes

According to social psychology literature, evaluation anxiety and self-validation based on social comparison may become less of a concern to participating parties in situations where participants are not identified [11-15]. By lessening inner restraints, anonymity has

been suggested to permit group members to meet needs that they cannot otherwise satisfy, and promoted intimacy, affection, and playfulness [16-17].

Although, like anonymity, nicknames could protect the real identity and privacy of participants, the flexibility and fun of changing identity to suit individual's frame of mind at users' discretion holds further motivational value for participants [18]. In view of its prevalence in newsgroup, online chat-rooms and forums, any effects it may have on learning, as compared to real-identity and anonymity, should warrant its adoption in educational contexts.

1.2 Purpose of the study

While most research found statistically significant effects of anonymity as compared to identified situations on perceptual impression, communication and behavior [11-15, 19-20], and found students exhibited varied preference toward different identity revelation modes in online student-generated questions space [18], whether different identity revelation modes in learning contexts induce different effects was not substantiated. Considering that identity concealment and recreation is one of the prominent features affordable by networked technologies, the comparative effects of real-name, nickname, and anonymity on learners' perceptions toward their interacting parties (assessors) and the communication process is the focus of the study.

2. Methods

2.1 Participants and study context

One hundred and one 7th graders from three classes participated in the study for six weeks. The study took place in a "Science and Life Technology" course taught by one instructor. For the duration of the study, each week students head to a computer laboratory to participate in the online student-generated questions activity after attending to three instructional sessions on biology. A learning system titled Question Authoring and Reasoning Knowledge System (QuARKS) that allows students to contribute to and benefit from the process of question generation and peer feedback was adopted.

2.2 Experimental design and conditions

A pretest-posttest experimental research design was adopted. Three treatment conditions were devised for the study, differing in their level of identity revelation - the real-name group, the nickname group, and the anonymity group.

In the real-name condition, student's full-name is retrieved automatically from database and shown on screen when questions and feedback are viewed by assessors, and authors, respectively. In the nickname group, student's self-created identity is shown at the top of the generated questions and rendered comments. In the anonymity group, information on the question-author or assessor is not shown, and only "anonymous" is marked.

2.3 Experimental procedures

Three intact classes were randomly assigned to different treatment conditions. Each week students were directed first by the instructor to individually compose at least one question for each of the three question types (true/false, fill-in-the-blank and multiple-choice) in accordance with covered instructional contents. They then moved on to individually assess at least one question from a pool of peer-generated questions for each question type.

To ensure that participants possessed the fundamental skills of question generation associated with each of the chosen question types and the follow-up peer assessment, a training session with hands-on activity was arranged at the commencement of the study in addition to the operational procedures of QuARKS. To establish baseline on students' perceptions with regards to different aspects of the involved activity, real-identity mode was set for all treatment conditions for the first two sessions. A questionnaire on examined variables was disseminated for individual completion before different treatment conditions was implemented in different groups at the third week. After exposure to the activity for six weeks, students completed the same questionnaire.

2.4 Measurements

The effects of different treatment conditions on students' perceptions of their interacting parties (23 items) and interaction process (23 items) were assessed by the same pre- and post-questionnaire consisting of three 5-point Likert scales (from strongly agree, 5, to strongly disagree, 1). Existing instruments on related areas were referred to, and items were adapted to fit the targeted experimental context. A group of 242 7th graders from four different schools were recruited for instrument validity and reliability. Only items passing item analysis, factor analysis and internal consistency were included in the actual study.

3. Results & Discussion

The means, standard deviations of pre- and post-assessment and adjusted means are listed in Table 1. ANCOVA found that students in the real name, nickname and anonymity modes did not perform statistically differently in attitudes toward assessors ($F=2.55$, $p > .05$), or perceptions toward interaction process with assessors ($F=0.88$, $p > .05$).

Table 1. Descriptive statistics of observed variables of three identity revelation modes

Observed variables \ Treatment groups		Real-Name (N=35)	Nickname (N=34)	Anonymity (N=32)
Attitudes toward assessors	Pre M (SD)	85.4 (8.98)	75.55 (14.17)	79.43 (14.19)
	Post M (SD)	87.64 (11.54)	78.61 (11.40)	78.86 (13.17)
	Adjusted M	84.52	81.58	79.43
Perception toward interaction process with assessors	Pre M (SD)	89.61 (9.16)	81.42 (8.70)	85.71(11.99)
	Post M (SD)	90.22 (12.09)	85.68 (11.11)	85.57 (13.21)
	Adjusted M	87.45	88.84	85.62

A prior study by the researcher found that most participants preferred anonymity or nickname as their chosen identity revelation mode, when authoring or assessing questions (Yu & Liu, 2008). The follow-up experimental study did not find statistically significant differences in the observed variables. Whether such differences will affect the quality of student-generated questions and learning in the studied subject will warrant further examination.

4. Acknowledgements

The work reported n this paper is funded by a 3-year research grant from the National Science Council, Taiwan, ROC (NSC 96-2520-S-006-002-MY3). The author would like to thank the instructor, Shannon Huang, and research assistants, Meiju Chen, Knem Chen and Yu-Zen Liao for their assistance during the process.

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Analysis of the Learners' Assessment Activity in a Collaborative Learning Support System Based on Question-posing

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Abstract: A collaborative learning support system based on question-posing by learners named Concerto III has been developed. It has been applied to a distributed asynchronous environment since 2006. In previous study, learning effectiveness based on number of question-posing and quality of posed question has been analyzed. As the analytical results, it was revealed that posing many questions or posing high-quality question had a positive effect on learners' learning effectiveness. In this study, assessment activity in the learning support system is analyzed. As for analysis of learners' assessment activity, learners' action log data stored in Concerto III was visualized. As the result of visualization and more analysis, it was revealed that a learner who made assessment of the question immediately after answering it marked higher score in post-test than those who did not. Thus, making assessment of the question immediately had a positive effect on learners' learning effectiveness.

Keywords: Learning on question-posing, Learning support system.

Introduction

With the rapid advancement of information society, many Web-based learning support systems have been developed (Yu, 2005). This study is focused on a system for learning based on question-posing. Some literature have reported that question-posing is a highly intelligent activity, and that it contributes to improve students' problem-solving skills (Yokoyama, 2005). Some literature have also studied that learning based on question-posing is beneficial to students' cognitive development in the light of cognitive psychology because such learning activities involve the cognitive processes such as rehearsal, organization and elaboration (Yu, 2005).

A collaborative learning support system based on question-posing called Concerto has been developed (Hirai, 2008). The system provides the following major functions: question-posing, answering questions, assessment of questions, and communication support with a threaded Bulletin Board System (BBS).The system has been applied to a distributed asynchronous environment (Hirai, 2008). Concerto III which have enhanced communication support in Concerto have been also developed.

In previous study, learning effectiveness based on number of question-posing and quality of posed question has been analyzed (Hirai, 2009). The analytical results indicated that (1)

the learners who posed questions actively marked a higher score in post-test than the learners

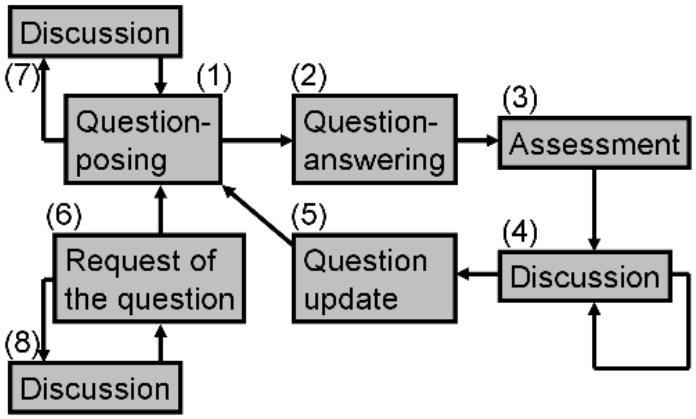

Figure 1: Usage process of Concerto III.

Table 1: Learners' action log in Concerto III

log	Explanation
Create	A learner created a question
Answer	A learner answered a question
Assess	A learner assessed answered question
Update	A learner updated his/her posed question
Submit	A learner submitted a comment in BBS
Browse	A learner browsed comments in BBS

who posed inactively, (2) the learners who posed high-quality questions increased more in score from pre- to post-test than the learners who posed low-quality.

In this study, assessment activity in a learning support system based on question-posing is analyzed.

In this paper, as for analysis of learners' assessment activity, learners' action log data stored in Concerto III is visualized. As the result of visualization, it was revealed that a learner who made assessment of the question immediately after answering it marked higher score in post-test than those who did not. The originality of this study is that it was revealed that making assessment of the question might have a positive effect on learners' learning effectiveness.

1. Usage Process of Concerto III

Figure 1 shows the usage process of Concerto III. In this system, a learner called question-poser poses a question at first (Figure 1 (1)). The other learners answer (Figure 1 (2)) and assess (Figure 1 (3)) the posed question. Then, the question-poser and the other learners communicate with each other with respect to the posed question (Figure 1 (4), (7), (8)). The question-poser updates the posed question if necessary (Figure 1 (5)). Concerto III also provides a function of "request of question-posing" (Hirai, 2008) (Figure 1 (6)).

2. Visualization of log data

In this section, learners' action log data stored in Concerto III is visualized. Table 1 shows a part of learners' action log. It is difficult that the whole log data of the whole learners are

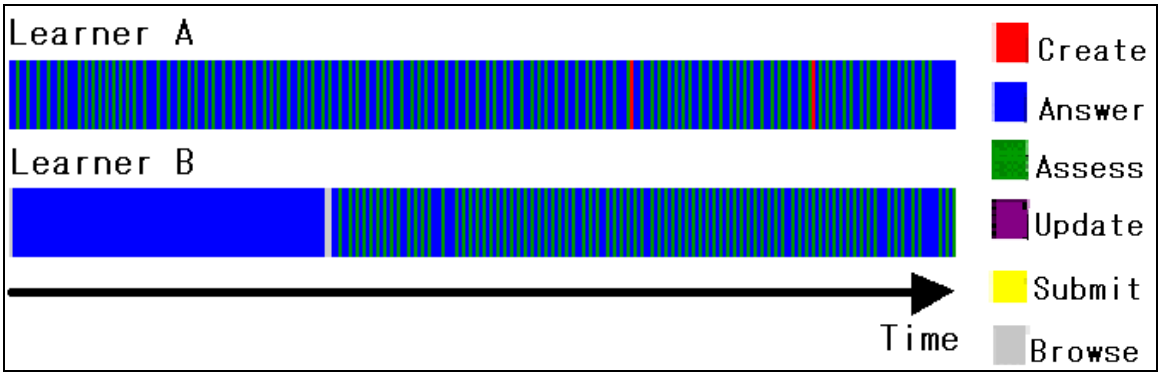

Figure 2: Visualization of learners' action log data

Table 2: The categorized group

	The percentage of assessment
Group 1	75% or more
Group 2	50%-75%
Group 3	less than 50%

described or looked in text base. The log data was visualized with the visualization method in (Seshimo, 2008). Seshimo et al. have visualized learners' log data in color base.
Figure 2 shows two examples of the visualized log data. Each log is visualized in particular color and it is placed from the left side along the time. Then, a learner's log data is visualized in a bar graph. In short, this graph shows the time series of action log for each learner. This visualization method may help to look learners' action easily.
A feature was identified in the visualized graph. That is assessment immediately after answering the question. In the first part of each log, while Learner A assesses immediately after answering the question frequently, Learner B does not. Thus, the learners who assess immediately after answering the question frequently and those who do not are compared in the light of learning effectiveness.

3. Analysis

3.1 Methods

As for assessment immediately after answering, 62 learners who answered more than 10 or more questions were divided in three groups based on the percentage of assessment. Table 2 shows the groups. The percentage of assessment is calculated as follow:

$$\frac{No.\ \ assessment\ \ immediately\ \ after\ \ answering}{No.\ \ answering} \times 100\%$$

For each group, the pre-test score carried out before using Concerto III and the post-test score carried out after using Concerto III are compared. The pre- and post-test scores used in this study were from Tokyo Gakugei University course "Introduction to computer systems" in the 2008 academic year (please see [3]). Normally, comparison should be carried out with same sample sets. However, 35 learners took the pre-test, which is different from number of students taken the post-test, because this pre-test is optional for learners. But, statistical analysis in next section was carried out after consideration of this problem. For example,

Table 3: The results of pre-test for each group

	No. Students	Average	Standard Deviation
Group 1	20	54.0	23.7
Group 2	11	59.1	21.2
Group 3	4	67.5	29.9

Table 4: The results of post-test for each group

	No. Students	Average	Standard Deviation
Group 1	30	62.7	11.9
Group 2	19	58.6	17.9
Group 3	13	50.5	17.6

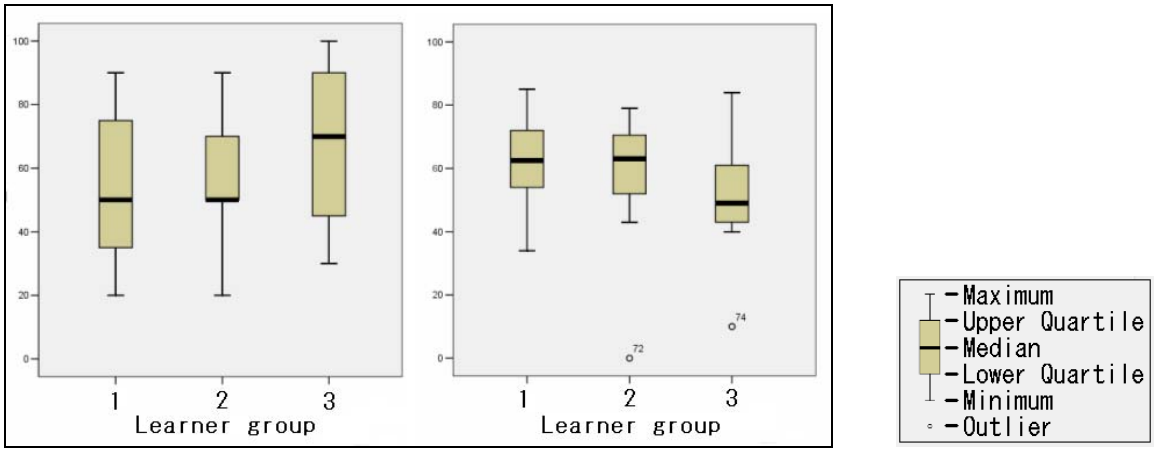

Figure 3: The distribution of pre-test (the left side) and post-test (the right side)

Table 5: The result of multiple comparison in pre-test score

	Group 1	Group 2	Group 3
Group 1	-	-	-
Group 2	-	-	-
Group 3	-	-	-

Table 6: The result of multiple comparison in post-test score

	Group 1	Group 2	Group 3
Group 1	-	-	*
Group 2	-	-	-
Group 3	*	-	-

- No significant difference between two groups (significant level = 5%)
- * Significant difference between two groups (significant level = 5%)

multiple comparison with SPSS for Windows 13.0J was carried out after consideration between two or more different sample sizes. Table 3 and Table 4 show the results of pre- and post-test for each group. Figure 3 shows the distribution of pre- and post-test.

3.2 Results and Discussion

Table 4 and Table 5 show the result of multiple comparison in pre- and post-test score. As the result of multiple comparison (significant level = 5%) in three groups pre-test score, it indicated no significant difference between three groups' average. As the result of multiple comparison (significant level = 5%) in three groups post-test score, it indicated significant difference between average of group 1 and group 3.
In the post-test, average score of group 1 is 62.7 and average score of group 3 is 50.5. According to this, a learner who made assessment of the question immediately after answering it marked higher score in post-test than those who did not.
A learner needs to understand learning materials for assessment. Yu et al. (2005) have reported that peer-assessing learning activities encourage participants to gauge objectively and critically the adequacy and correctness of posted questions. They have also reported that learners presumably add details to their existing cognition, explore and correct their misconceptions, and/or re-organize their current knowledge structures by online interaction and open communication with peers pertaining to the question and the correct answer. Thus, making assessment of the question frequently had a positive effect on learners' learning effectiveness.

4. Conclusion

In this study, assessment activity in a learning support system based on question-posing has been analyzed. In this paper, as for analysis of learners' assessment activity, learners' action log data stored in Concerto III was visualized. As the result of visualization, it was revealed that a learner who made assessment of the question immediately after answering it marked higher score in post-test than those who did not.
In future work, we will identify new feature in the visualized graph. We will use association rules mining (Hamano, 2007) and identify new feature.

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Changing Students' Perceived Value and Use of Learning Approaches for Online Student-Generated Questions via an Integrative Model

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Abstract: This study investigated whether integrating online question generation tasks as part of the instructional process affected learners' perceived value toward the introduced strategy, and their adoption of learning approaches. Fifty students registered for an "Instructional Principles" course participated in the integrated condition while 161 students were put in the non-integrative condition. Data analyses via *t*-tests found statistical significant differences in task value (p <0.001) and surface approach (p <0.001). Students in the integrative study perceived higher value toward the online question-generation tasks and adopted surface approach significantly less frequently than those in the non-integrative approach. Implications for technology diffusion, instructional strategy instruction, and future studies are provided.

Keywords: technology integration, learning approaches, online student-generated questions, task value

Introduction

In light of information processing theory, constructivism and metacognition, student-generated questions learning activities should have cognitive, affective and social potential for students [1]. Empirical evidence on its facilitative effects, such as enhancing learners' comprehension, cognitive strategies, metacognitive strategies, creative thinking, interest, confidence, and communicative process within groups, etc. has been asserted by numerous researchers [2-7].

Despite the preponderance support for the student-generated questions approach, the issue related to "will students perceive its task value after a limited instructional exposure and adopt its use to support their learning?" should be of importance for the introduced technology.

According to technology acceptance models, perceived usefulness and task value of the innovation play a prominent role in the diffusion and adoption of new technology for a broad range of innovations (be it soft or hard technology) [8-10]. In particular, perceived usefulness is one of the two highlighted measures in the well-known Technology Acceptance Model (TAM), which explains how and when users form attitudes towards an incorporated innovation, which in turn leads to acceptance and level of adoption [11].

To yield insight to the implementation and technology diffusion process, this study explored if integrating online question generation tasks as part of the instructional process affected students' perceived value and reported learning approaches. Two research questions are thus proposed. They are: (1) if integration versus no-integration differ in

learners' perceived value of the question generation tasks? (2) if integration versus no-integration differ in learners' reported learning approaches?

1. Literature Review

The online student-generated question technology introduced in this study has brought much potential to enhance teaching and virtual interaction among learners. Moreover, it transforms the way in which pedagogy and learning is conducted. Learners are engaged in constructing and modifying their internal knowledge representations and structures through process of composing questions. Factors leading to success of technology integration such as technology infrastructure, technical support and teachers' technology beliefs, have been intensively studied in past decades and driven the improvement of technology design [12-15]. However, pedagogical factors, contributing to learners' cognitive gains during the implementation process, remain little known.

Additionally, activity theory argues that technology integration occurs in the interaction between teachers and learners [16]. Learners are usually viewed as outcome producers; however, their perceived value and process of interacting with this technology, which might affect the occurrence of the outcomes, was neglected. Learners' perceived task value influences their engagement in a learning task [17-18]. Moreover, learners tend to adopt such an innovative technology of which they see the relative advantages [12]. As such, how the pedagogical implementation of the online question generation technique correlates to students' perceived value and orientation to learning approach during the process would bear relevancy for instructors interested in cultivating technology-enhanced classrooms.

2. Method

2.1 Participants and Online Learning System

A total of 201 participants matriculated in secondary teacher education programs at five national universities in Taiwan participated. Fifty students of the 201 students registered for an "Instructional Principles" course were assigned to the integrated condition, in which online question generation technologies were integrated.

A learning environment that allows students to contribute and benefit from the process of constructing questions and exchanging thoughts with their peers about the composed questions in a cyclic way was used in the study. The adopted system permits various types of student-generated questions learning activities and support multimedia uploads.

2.2 Experimental Conditions and Procedures

For students in the non-integrative conditions they were given limited in-class instructional explanations of the core concepts and associated effects of the student-generated questions approach. On the other hand, for the integrative condition as a routine for a whole semester, students were given opportunities to generate two questions on the covered chapter in a 20-minute class time after exposure to a training session on the basic concepts on question generation. A teaching assistant routinely gave feedback by purposely selecting three to five pieces of students' work to accentuate important

question-generation practices and used it as a conclusion of each online question generation learning activity.

3.3 Variables and Measures

Two scales were used for the study. Adopting Pintrich's conceptualizations (1989) on task value [19], task value in this study was defined as learners' perception that the introduced online student-generated questions learning task is useful to them in terms of their learning and future job. It was measured by a 9-item 6-point Likert "Task Value of Online Student-Generated Questions Scale" (1, "not at all true of me" to 6, "very true of me."). The exploratory factor analysis results indicated that each item had high factor loading (between 0.67 and 0.84) on one single factor. The total variance explained by the factor was 58% and the reported Cronbach's α was 0.91.

Learning Approach grounded on the Student approaches to learning (SAL) theory consists of deep and surface approaches. A surface approach refers to strategies interacting with motives, in which learners tend to rote learning content and subsequently reproduce it in order to avoid academic failure while in a deep approach students seek meaning in order to understand [20]. Each Approach has ten corresponding items on a five-point scale (0, "never or only rarely true of me" to 4, "always or almost true of me"). The variable was measured by the "Study Process Questionnaire," which was developed by Biggs, Kember and Leung (2001) with established validity and reliability [21].

3. Results

Table 1 presents the descriptive statistics of the examined variables of the two conditions. For the integrative group, the mean scores of perceived task value in the questionnaire rested in the upper half of the possible score ranges while for the non-integrative group it rested in the middle. Explicitly, students in the integrative environment generally expressed positive attitudes towards the value of online student-generated question task with a mean score of 43.12; however, those in the non-integrative environment was more conservative and not affirmative of its value for their present learning or future work.

Students, with the extended experience of question generation in class, indicated their inclination towards a deep learning approach happened "*almost half of the times*" (a mean score of 21.78). Additionally, their inclination toward a surface approach happened only "*sometimes*" (with a mean score of 11.12). As for the non-integrative condition, their inclination toward a deep learning approach happened "*almost half of the times*" (with a mean score of 21.57), similarly to the integrative condition, but their inclination toward a surface approach happened also "*almost half of the times*" (with a mean score of 18.48).

Table 1 Descriptive Statistics of the Variables

Environment	No.	Variables	Mean	SD	Possible Score Range
Non-integrative model	161	Task Value	35.99	7.39	6-54
		Surface Approach	18.48	7.21	0-40
		Deep Approach	21.57	6.37	0-40
Integrative model	50	Task Value	43.12	5.41	6-54
		Surface Approach	11.12	6.44	0-40
		Deep Approach	21.78	6.93	0-40

Note: a. Integrative denotes learners in the environments with online question generation technology full integrated.

Data analyses via *t*-tests were performed to examine the effects of different integration arrangements (with and without online question generation task integrated) on perceived task value and learning approaches orientations (Table 2). Statistical significant differences were found in the scores of task value (p <0.001). The students in the integrated group perceived higher value toward the online question-generation tasks.

Statistical significant differences between the integrative and non-integrative models were found in the surface approach. Students in the integrated group tended to adopt significantly less frequently the surface approach (t = 6.46, p <.05). The differences in frequency of using deep approach between two different conditions, however, did not reach significant level (t = -0.2, p >.05).

Table 2. *t*-tests Results of Tasks Value and Learning Approaches

	Task Value		Surface Approach		Deep Approach	
	Mean (SD)	*t*-value (*p*-Value)	Mean (SD)	*t*-value (*p*-Value)	Mean (SD)	*t*-value (*p*-Value)
Non-integrative	35.99 (7.39)	-7.42 (<0.001*)	18.48 (7.21)	6.46 (<0.001**)	21.57 (6.37)	-0.2 (0.839)
Integrative	43.12 (5.41)		11.12 (6.44)		21.78 (6.30)	

4. Conclusion

This study investigated if an integrative approach of online student-generated questions influenced students' task value and learning approaches. Two major findings are obtained and discussed as follows. First, the integrative model lead students in the integrative group to the significantly more positive attitudes towards the value of the introduced task than the non-integrative model. The similarity between the exercised learning technique and the certification exam might increase students' perceived value of the introduced strategy for their career motives, preparation and plans, and thus enhanced their perceived value of the strategy. The results that students in the integrative environment generally expressed higher positive attitudes towards the value of online student-generated question task confirmed the importance of pedagogical implementation of the introduced technology. The more systematic learning process the learners are engaged in, the more relative advantages of the introduced technique they will observe, thus leading to their higher value of the introduced technology.

Learners generally adopt different learning approaches for accomplishing their learning tasks according to their awareness and interpretation of the contextual factors, such as course requirements, learning process, etc. The findings of this study further confirmed that extended engagement in the online student-generated questions strategy effectively diverted students to adopt a surface learning approach, which tends to view learning as rote memorization and thus is not beneficial for their own learning in the long run.

Based on findings from the present study and literature on existing technology integration, it is suggested that for students to adopt an efficacious approach to the student-generated questions strategy an integration model where students not only are introduced to the fundamentals associated with the strategy, but being able to experience the strategy more extensively during the learning process should increase students' perceived value and positive learning approaches inclination.

Acknowledgements

This paper was funded by a 3-year research grant from the National Science Council, Taiwan, ROC (NSC 96-2520-S-006-002-MY3). The author would like to thank research assistants, Shannon Huang, Meiju Chen, Knem Chen and Yu-Zen Liao for their assistance during the process.

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Kwok, L.F., Kong, S.C., Charoenporn, T., Hirashima, T., Kojiri, T., Mitrovic, A., Ogata, H., Sornlertlamvanich, V., Supnithi, T., Takenaka, M., Tarumi, H., Thaiupathump, C., Wang, F.L., Yu, F.Y., Yu, Y.T. (eds.) (2009). *Workshop Proceedings of the 17th International Conference on Computers in Education [CDROM]*. Hong Kong: Asia-Pacific Society for Computers in Education.

The Effect of the Game-based Problem-posing System for mathematical learning

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Abstract: "Problem-posing" is an experience-converting instructional strategy for effectively enhancing students' thinking abilities and is broadly discussed in many domains. This study aims to probe into the possibility of technology assistance for problem-posing strategy. Based on the design principles of problem-posing and game theories, we designed a game-based problem-posing and solving system. Moreover, the influences of game-based problem-posing Math learning activities for students' problem-posing, problem- solving abilities, and flow are discussed. Four classes of fifth graders were participated in the research. Two classes were provided with game-based problem-posing system, while the other two used paper-based problem-posing method. The result shows that game-based problem-posing system positively enhances students' overall flow and problem-posing abilities.

Keywords: Problem posing, collaborative learning, flow experience, game-based system.

Introduction

A number of researchers have attempted to understand the relationship between problem-posing and problem-solving. Silver and Cai (1996) investigated the relationship between problem-posing and problem-solving through 509 middle school students. The result found a highly positive correlation between problem-posing and problem-solving abilities. In addition, English (1997) discovered the problem-posing does not only train students to identify the key elements in a question, but also prompt their problem-solving ability. However, difficulties were encountered in traditional problem-posing activity. For instance, students reflected that problem-posing activity was more difficult in contrast with assessing peer-posed questions and drill-and-practice exercises of problem-posing (F.-Y. Yu et al., 2005). As a result, students felt dreary towards the activity, which made it difficult to promote problem-posing in instruction (English, 1998; Mestre, 2002). Due to the above-noted downfalls of problem-posing, we think the problem-posing activity, which is comparatively more difficult should be integrated with other activities to sustain students' intrinsic motivation. For example, games and evaluation could be added to the original problem-posing and problem-solving activities. Students can pose questions to test and compete with one another to increase their problem-solving abilities and interest

in problem-posing. Many research findings have shown that game-based learning environment could provide participants opportunities to develop cognitive ability. Ellington, Adinall, and Percival (1982) supposed that games are entertaining, which can help learners sustain a longer attention span during learning and develop higher cognitive abilities in a more relaxing process. When the task matches students' abilities, immediate feedback and clear goals are provided, those conditions would help them focus on the task at hand and gradually enter the state of flow (Csikszentmihalyi, 1988). In sum, the game-based approach provides a fine environment to develop spontaneous learning and inquiry skills (Raybourn & Bos, 2005). From reviewing previous research, little was found on integrating problem-posing and problem-solving with game-based learning. Thus, the present study used a computer game as the experimental environment and designed a game-based problem-posing system based on the flow effect created by the game-based scenario. By examining the process of problem-posing and problem-solving, the present study investigated the effect of the game-based problem-posing system on students' abilities of problem-posing and problem-solving, and flow experiences.

1. Problem-Posing System Design

The current research developed a procedure of a game-based problem-posing activity based on Polya's (1945) four phases of problem-solving (understand, plan, carry out, look back) and Leung's (1993) four phases of problem-posing (pose, plan, carry out, look back) adapted from Polya's model. Please see Table 1. Therefore, the phases from problem-posing and problem-solving are connected to form a continuous cycle. The procedures of problem-posing and problem-solving closely tie to each other and foster students' abilities of synthesis and induction (Dillion, 1982).

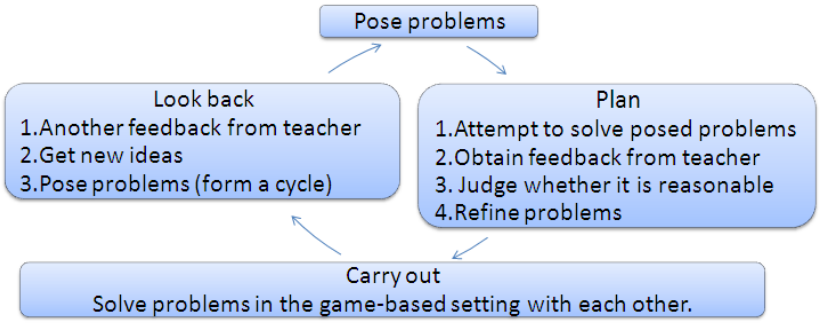

Fig. 1. The Procedure of the Game-Based Problem-Posing Activity.

The problem-posing system is Internet-based. As they log into the system and enter the interface of the problem-posing activity, it is further divided into three steps: setting the test range, generating problems, and verifying the posed problems. The problem-solving function of the system is designed to be game-based to increase the response motivation. The system contains six games as shown in Figure 2. A posed problem and its response options are shown on the left of the interface. The game field is displayed on the right of the interface with response options embedded in it. With a clear goal and immediate feedback, the game can help students focus on the task at hand and enter the state of flow to optimize their learning. After the whole test is completed, students will return to the problem-posing function and start generating problems again.

Fig. 2. The web pages for solving the posed problems in the game-based environment.

2. Method

The current research involved four Grade 5 classes from Hsi-Men Elementary School in Taipei. There were 92 participants consisting of 48 males and 44 females with an average age of 11 yr. Class was the unit to assign groups, which the two experimental classes were given the game-based problem-posing system whereas the two control classes received the traditional paper-based instruction for problem-posing activity. The experimental and control groups contained 45 and 47 students respectively. The content material was the addition and subtraction of fractions with different denominators in the format of word problems. It is to probe the changes in the four dimensions of problem-posing (i.e., accuracy, flexibility, elaboration, and originality) (Silver & Cai (2005)), problem-solving abilities before and after treatments.

The experiment was conducted once a week for 2 weeks. Both the experimental and control groups paired up students for collaborative learning. Each time, the activity was divided into two sessions of 40 min. Yet, before the actual experiment, students from the experimental classes were given 40 min to try out the system on their own. As the actual experiment started, the experimental classes first used the system to pose problems for 20 min. Then the teacher gave feedback and guided students to use the system to solve posed problems for 20 min. Next, students were given 10 min to refine posed problems followed by problem-solving via the system for 20 min. Finally, the teacher spent 10 min providing feedback. In total, the two sessions took 80 min. Control classes took the same procedure with paper-pencil and blackboard instruction. On the very last lesson of the experiment, the Flow Experience (Scale Novak et al., 1997) was administered. After the two-week experiment was finished, every participant was given a posttest.

3. Results

To collect data on participants' problem-solving ability, a pretest and a posttest developed by researchers of the present study were employed. Prior to the analysis of one-way ANCOVA, the test of homogeneity of within-class regression was conducted for equation-listing ability, calculation ability, and overall problem-posing ability. The F values are 10.04 ($p = .00 < .05$), 9.88($p = .00 < .05$), and 5.59 ($p = .02 < .05$), respectively. Significant differences were resulted, which indicated the two within-class regression slopes were nonparallel and the presumption of homogeneity of within-class regression coefficient was not met. Instead, Johnson-Neyman method was implemented to examine the interaction effect of the instruction methods. For the overall problem-solving ability, the equation listing ability and the calculation ability from the posttest, when the pretest score was lower than 19.39(24 is the full mark), 10.56 (12 is the full mark) and 8.72 (12 is the full mark), respectively, the game-based method was found to be more effective than the traditional method. In other words, the result indicated that students whose pretest scores were lower could benefit from the game-based problem-posing system. On the other hand, after excluding the effect of the pretest (covariance) on the posttest, there was a significant difference between groups in overall problem-posing ability, $F = 17.69$, $p = .00 < .05$. Results indicated that the experimental group scored significantly higher than the control group in terms of the overall problem-posing ability. And it also has a significant difference was yielded between groups in accuracy ($F = 24.49$, $p = .00 < .05$), flexibility ($F = 22.36$, $p = .00 < .05$), elaboration ($F = 10.42$, $p = .00 < .05$) and originality ($F = 11.39$, $p = .00 < .05$). As flow experience analysis, the flow experience scale was conducted with participants and analyzed. T-test was preformed to detect any

significant difference between both groups in terms of the flow experience. The result indicated a significant difference between groups, $t = 5.39$, $df = 78$, and $p = .00 < .0$. As such, the flow experience of the experimental group was significantly higher than the control group.

4. Discussion

In general, for the problem-solving posttest with a total of 24, there was an interaction effect between both groups except for students whose pretest was between 19.39 and 24. For students who obtained below 19.39 in the pretest, the game-based problem-posing system was effective to promote the problem-solving ability and to adapt individual difference. A number of scholars have agreed that problem-posing instruction could enhance the problem-solving ability (Tsubota, 1987; Skinner, 1991; English, 1997). Interestingly, the results of the present study did not conform to the account. It might be due to the ceiling effect (Berger, 1992) by high-performance students in both groups. The posttest scores of high performers from both groups were close to the full mark, which resulted in insignificant difference in the posttest. On the other hand, there was a significant difference in the posttest scores for the low performers from both groups, where the motivation of the experimental group could be enhanced by the gamed-based system to promote the problem-solving ability. It can correspond with the point that the game-based activities could induce motivation in learning and maintain interest in learning (Norman, 1981; Krulik & Rudnick, 1983).

For the four dimensions of the problem-posing ability and their scores in total, the current study found that the experimental group performed significantly better than the control group. It can promote one's problem posing ability through a cycle forming by problem posing and solving (Polya, 1945; Dillon, 1982). For example, student A from the experimental group posed the following problem in the pretest: John has 2/3 of the pack of cookies. After giving Mark 1/6 of the pack of cookies, how much is left for John? For the posttest, student A posed, "Sue has 1/4 of the box of chocolates which is less than Kuo by 3/8 of the box. How many boxes of chocolates do they have altogether?" From the examples, it is shown that student A progressed from using one problem type to integrating two problem types in terms of flexibility. From the aspect of elaboration, it evolved from one-step to two-step. And he also put the keyword "less" and "altogether" to promote problem solving. When we investigate student A's problem-solving process, we found student A solved questions posed by student B: Chiao ate 4/9 piece of the cake. Shen had 2/5 more pieces than Chiao. How many pieces did they have altogether? It is evident that during the process of problem-solving, students did reflect and adjust….and all those were shown in their performance on problem-posing.

In contrast with peer-assessing, item-viewing and drill-and-practice learning activities, students perceive problem-posing is more difficult (F.-Y. Yu et al., 2005). Even though problem-posing instruction could enhance one's meta-cognition, the approach of the instruction is still constrained by the format of test. The game approach can increase learners' internal motivation. Thus, during the state of flow, they would spend more time to participate on the activity to accomplish satisfying learning outcomes (Ellen et al., 1982). Some scholars believe that the game approach can increase the flow experience (Csikszentmihalyi, 1988; Raybourn & Bos, 2005; Lancy, 1985). Based on the result, the experimental group experienced a better flow than the control group. It shows that students felt more challenged when participating in the game-based problem-posing system.

5. Conclusion

Being capable of correctly posing mathematical problems is important to develop students' mathematical conceptions. Performing one's creativity through organizing one's thought and posing new problems has positive effect to learners. The game-based problem-posing system in the current research was effective in promoting the overall problem-posing ability for students with a pretest score below, but not for those between 19.39 and 24. It was effective in the four dimensions of the problem-posing ability (i.e., accuracy, flexibility, elaboration, and originality). As such, the experimental group performed better than the control group in the overall problem-posing ability. It is concluded that the game-based problem posing system could be applied in the problem-posing instruction. The system was intended to let learners become more interested in mathematics and learn mathematical problem-posing. Then, based on those experimental results, it discussed whether it could improve fifth graders' problem-posing ability, problem-solving ability in application questions of addition and subtraction of fractions with different denominators application, and the flow experience. The system in the present study could effectively induce a higher level of the flow experience and increase motivation in learning.

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Problem solving practice

Kwok, L.F., Kong, S.C., Charoenporn, T., Hirashima, T., Kojiri, T., Mitrovic, A., Ogata, H., Sornlertlamvanich, V., Supnithi, T., Takenaka, M., Tarumi, H., Thaiupathump, C., Wang, F.L., Yu, F.Y., Yu, Y.T. (eds.) (2009). *Workshop Proceedings of the 17th International Conference on Computers in Education [CDROM]*. Hong Kong: Asia-Pacific Society for Computers in Education.

Insertion Training with Computer Acupuncture Education System

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Abstract: As one of the series studies for the development of a computer training system for acupuncture, this paper deals with the construction of a system capable of quantitatively evaluating the training effect of the insertion technique. Precise insertions without pain require high technique obtained by repeated training and experience. However, the insertion technique has hardly been quantitatively analyzed in past times. In this study, the research for the development of a training system for a quantitative indexing of insertion operation in acupuncture has been done. The measurement and training system enabling the training of insert speed of needle were developed. Finally, the effect of developed system was confirmed by proof experiment.

Keywords: Acupuncture, Computer training system, Insertion, Quantification of technique

Introduction

There is recently an increasing research trend to combine the medicine with engineering [1]. In consideration of such an increasing trend, however, it is hardly satisfactory in the field of acupuncture training. Acupuncture is such to looking firstly for the acupoint along the meridian distributed in a 3D style on the human body, and to insert the needle using hands with precise force adjustment [2]. It is known to be very difficult in the conventional training method to understand the 3D position of an acupoint using a textbook showing only 2D pictures, and such techniques as the precise adjustment of speed and force for an insertion are usually obtained by watching the motion of an expertise doctor.

In order to achieve a better training effect for acupuncture, a computer training system has been proposed [3]. A human body model to teach the 3D position of acu-points with real-time true-false judgment[4], the teaching of insertion angle for acupuncture[5], and the construction of a training system using the force feedback system[3], have been studied and developed. The learning case using the developed training system is demonstrated in Fig. 1.

In the development of the training system, it has been pointed out that the quantified index to the training of acupuncture is important [6], and for this purpose that the system should be developed with real time true-false judgment [7]. As one of the series studies carried out by us, this paper tried to solve the problem in the “insertion” motion, which is to hold the needle and insert it into the skin having an acupoint with precise adjustment of

force, speed, and angle. Here we define the "insertion" action is to beat the needle handle 4-5 (*mm*) into the skin after looking out the right acu-position. Upon an insertion, the speed of the needle of an expert doctor was measured and the insertion was characterized. The characterized results were applied to make quantified indexes for the construction of a training device and system. The effect of the training system was confirmed by a valuation experiment.

Fig. 1 Training of acu-point position.

1. Indexing of insertion speed

Following the preliminary experiment result on the measurement of insertion speed [6], the model insertion speed from an experienced doctor was measured. The speed was normalized as a rectangular wave described with formula 1, here f(x) is the insertion speed (*m/s*) and x is the time (*s*), respectively. The normalized graph is shown in Fig. 2 as a heavy line.

$$f(x) = \begin{cases} 0.0 & (f(x) < -0.055) \\ -0.1 & (-0.055 < f(x) < -0.005) \\ 0.0 & (-0.005 < f(x)) \end{cases} \quad (1)$$

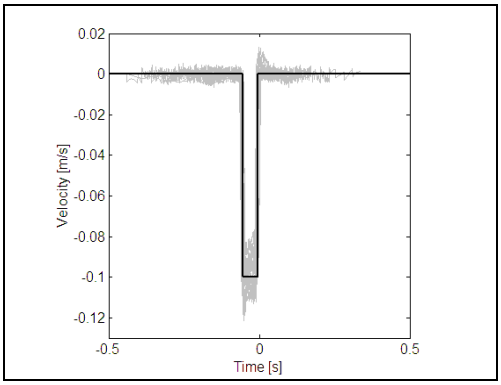

Fig. 2 Normalized of vertical needle speed

It is possible to use the normalized graph to index quantitatively the insertion speed for training. It is then decided to use the needle speed in the vertical direction to judge the true or false of a beginner. A value of 0.08m/s for insertion speed was set to be the success standard for the beginner [7].

2. Construction of insertion training system

2.1 Device of Training System

As described earlier, the speed from an experienced doctor can be expressed with formula 2.1. Taking the value as standard, a system with quantitative indexing for insertion training was constructed. The system is made by 3 parts, i.e., the operation device, the speed measurement unit, and display unit for indicate the training results. The schematic of the system is shown in Fig.3.

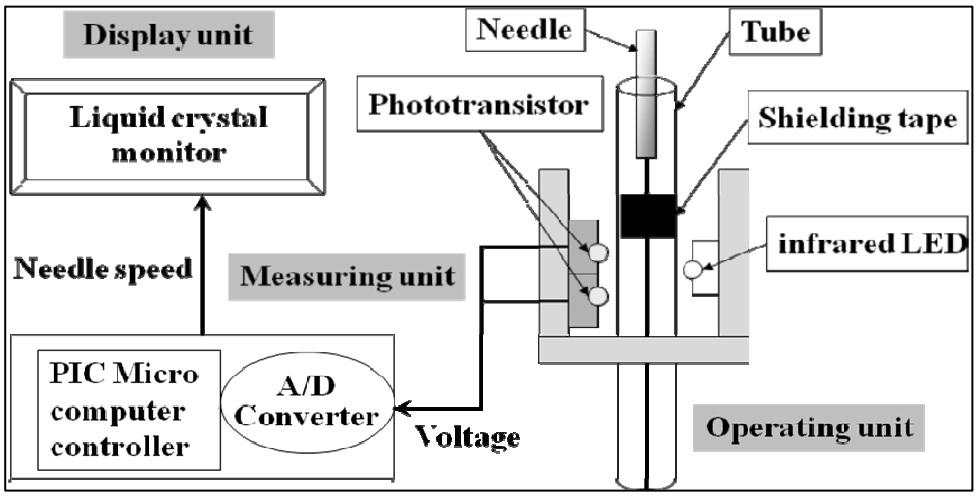

Fig.3 The schematic of the training system

During training with the system, the trainee does the insertion operation the same as in an acupuncture treatment, that is, to hold the lower part of the tube with one hand, and to put the needle into the skin to do an insertion. The speed of needle was calculated using PIC (Peripheral Interface Controller) from the data measured by an optical sensor. Calculated speed was provided to the LCD (Liquid Crystal Display) display to show the trainee. The above process is done real timely, leading to an improvement in insertion technique.

2.2 Sensor

The measured parameter was the vertical speed of the needle when put into the skin. The measurement distance is ranged as 4-5mm from the skin according to the practical case. The time for the needle passing through the distance

Compact sensors such as a high speed quantum Infrared Ray (IR) sensor, a small and Light Emitting Diode (LED) IR sensor were used for the non-contact and high sensitivity sensing. The Phototransistor (PTr) shown in Fig. 4 is one of the TPS622 made by TOSHIBA, and IRLED in Fig. 4(b) is a TLN117 made by TOSHIBA. One sensor weighs 0.1g only, and PTr has a fast response of 6μs, both are suitable for the insertion speed measurement. Acrylic is used to making part around the sensor to saving weight while with high durability.

(a) PTr (TPS622)

(b) IRLED (TLN117)

Fig. 4 Sensors

2.3 Measurement

An IR shading film is attached to the needle, and move vertically together with the needle. Two PTrs and related LEDs in the opposite side were positioned beyond the movement range of the IR shading film. The moving range of needle is 4-5mm, and the distance between PTr1 and PTr2 was set 2.5mm. When IR light was blocked in sequence by PTr1 and PTr2 during the measurement, the electricity flowing through them was changed, and the voltage output to PIC changed accordingly. The change of voltage was recorded together with time counts. Taking t(*s*) as the time difference between PTr1 and PTr2 when blocking IR light, l(*m*) the distance between PTr1 and PTr2, the speed of needle v(*m/s*) can be obtained from formula 2.

$$v = l / t \qquad (2)$$

2.4 Operation and display

Eggplant and apple were used as insertion object for their similarity with the body and skin, while practical needle and tube were used in the operation part, so an insertion most similar to medical treatment is considered possible. The finished training device is shown in Fig. 6. The speed of needle v(*m/s*) was real-timely displayed in Liquid Crystal Display (LCD) (Fig. 7).

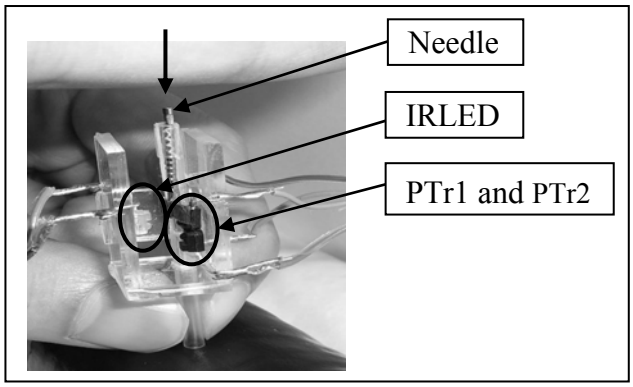

Fig. 6 Training device

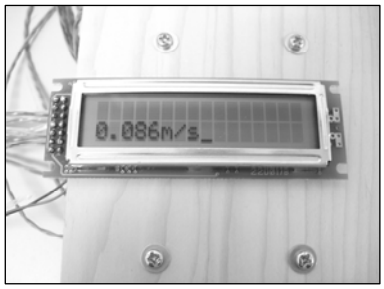

Fig. 7 Display of needle speed

A trainee is easy to know his technical level by comparing with the data from a doctor, and a continuous approach to the doctor's is possible by repeated practice. The system is useful in reach the goal more quickly.

3. Proof Experiment

To confirm the effect of this system, experiment on 6 persons (3 male, 3 female in the 20th) was carried out. They were divided into 2 groups, one doing insertion training 5 minutes a day with use of the training system and another the same time but without the

use of the system. Both groups use the training system only for the first and the last day for a comparison of learning effect. The group with use of the system shows higher level of training effect, though the difference is not so large due to the short period of training time for comparison.

A standard deviation of trainees (A-F) in insertion speed was summarized in Fig. 8 as the 7 days training results, represented by trainees A, B, C for the group using the system and trainees D, E, F for the group without. There is also a small difference in Fig. 8 showing the effect of using the system.

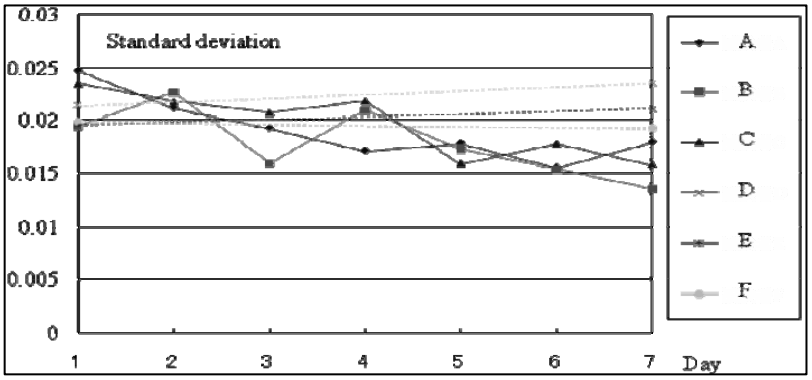

Fig. 8 Standard deviation of trainees in insertion speed training

4. Conclusions

The research for the development of a training system for a quantitative indexing of insertion operation in acupuncture has been done. The measurement and training system enabling the training of insert speed of needle was were developed. Needle and tube the same as those in medical treatment were used in the training device. The speed of needle during insertion was recorded and displayed to the trainee to allow a real time true-false judgment. The trainee knows instantly the training effect at once which is very much helpful to the improvement of the technique. The effect of the system was confirmed by proof experiment.

Acknowledgements

This study was done partly with the finical support from the JSPS Grant-in-Aid for Scientific Research(C).

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A Map-based Assessment System Supporting History Education

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Abstract: History education is hard for teachers to illustrate the history events accompany geography location, date and names. Besides, students learned History which people thought as common sense might not be true. Teachers have to cultivate students' historical thinking and realize the History development. If there is no appropriate geography tool for students, it would be hard for students to imagine the indefinable geography location and to organize the History events order. Students will lost their learning motivation and just cram some names or date into their mind that they even don't understand. In History education, teachers need to prepare history material and maps to describe the event front and back. Maps could enhance the history lessons to understand their local and global environment, and how human activities take place in these environments. The authors propose a map-based assessment system supporting History education which combines Bloom's taxonomy and History learning objects category in authoring items. Teachers can adjust the exam and items with the cognition and learning objects distribution easily. Students can realize the geography information with this system.

Keywords: History Education, Assessment, Google Map, Bloom, Authoring Tool

Introduction

Using geographical maps to teach and assess history is one of the best ways to support students to fully understand concepts related to major historical events. History events occurred with geographical location, time and people. A map will show the distance, the neighboring countries, the climate which is related the history development.

History education is different from normal subject education. Students heard and learned partial history concept when they are children. Some concept is wrong and not really exists. History concept might learn from TV, historical novel, the old talks, radio and etc. Teachers have to motivate students with active learning and think historically. The way to assess the history learning and teaching objectives has no standard, but learning objective guides teaching and assessment. With our assessment analysis, the teacher can adjust his/her teaching strategy, and redesign or reorganize learning materials if necessary. In addition, students can also learn the key point of learning materials. The analysis of assessment provides the learners with the most important element of each subject and each course, individually.

The organization of this paper is as follows. Section 2 introduces related educational issues and related researches. In Section 3, architecture and implementation of the architecture are described. Section 4 concludes the work and talks the future work.

1. Related Work

1.1 History Education

Hilary B. (1994) wrote "Making Progress in History: the objectives of Learning History", this chapter is collected the textbook "Teaching History". This book talks about the challenging aspects in history teaching, but it is not just about curriculum history. It aims to show the learning objectives, assessment index, past researches and how the teacher teaches to reach the National Curriculum Attainment Target. The National Curriculum Attainment Target has three targets. The first attainment target (AT1) is Knowledge and Understanding of History. AT2 is interpretations of History, and AT3 is Use of Historical Sources.

1.2 Assessment Systems

Map-based assessment system is helpful and interactive for learners. However, not too many map based assessment systems are developed for history education. In 2007, Yang H.C. et al. [7] propose an on-line Assessment Management System Based on QTI and Web 2.0 with AJAX which uses an asynchronous communication way and provides a better using experience to users. The on-line adaptive testing system provides the Question and Test Interoperability (QTI) standardized item and adaptive assessment mechanism. José Bouzo et al. (2007) [6] apply google maps to develop the IMS QTI compliment assessment system which described the assessment with web maps from Google Maps.

1.3 History Education Environment

More and more history education environments are created by researchers. Lo J. et al. (2009) [5] apply GIS information to develop a web-based spatial-person-temporal history educational system. This system used the acronym HES-SPATO (history educational system based on SPATO); SPATO means spatial, person, action/attribute, and temporal object. The participants in the experiments showed positive attitudes to this system. Chang W.C. et al. (2009) [3] integrate several ubiquitous technologies which include RFID, GPS location, and Google map in game-based learning. They try to construct a location-aware, digital game-based learning environment and adapt Taiwan's historical culture in the learning scenario. Akkerman, Sanne et al. (2009) [1] design a mobile and multimedia game for History education about Medieval Amsterdam. Users use UMTS/GPS phones for communication and exchange of information when they explore the history of Amsterdam by walking in the city. 216 students experienced this History game, in group of four or five students. There are three types of storification: receiving (spectator), constructing (director) and participating in (actor) the story designed in the game.

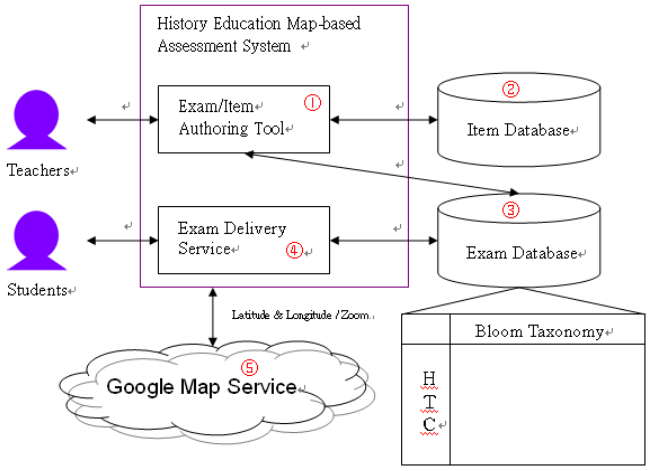

Figure 1. System Architecture

2. History Education Map-based Assessment System

2.1 System Architecture

This system has two kinds of users, one is teacher, and the other is student. Teachers can author/edit the test items (Figure 1 ①), select items from the item database (Figure 1 ②) and store/retrieve the exam sheet in the exam database (Figure 1 ③). This system will delivery the appropriate exam to students (Figure 1 ④). There are four item types, map-based multiple choice problem, essay question, sequence question and map-based question. Each item will have the related information like the difficulty and discrimination. This system displays the exam sheet distribution percentage of the cognition level in Bloom's taxonomy and History Teaching objects Category (H.T.C.). According to the item's latitude, longitude and zoom parameter, Google map service will transfer the appropriate geography picture (Figure 1 ⑤).

2.2 Bloom and History Assessment index

We applied Bloom's Taxonomy and History Assessment index to evaluate the history assessment and distribution. We introduce the two educational theories in the following.

In 1956, Bloom [2] invented Bloom's Taxonomy which is divided into six levels in the taxonomy from lowest order processes to the highest:

Knowledge presents the basic concepts and the previously-learned materials by recalling facts. Comprehension indicates understanding of facts and knowledge by comparing, organizing, and giving descriptions. Application means people solve problems to new situations by applying previously-learned knowledge, skill and technologies. Analysis exhibits analyze the elements, relationships and organizational principles to make inferences and discover evidence to support generalizations. Syntheses reveals collect information together and integrate elements to propose alternative solutions. Evaluation means learners make judgments according to internal evidence and external criteria.

In 1994, Hilary Bourdillon [4] proposed the objectives of Learning History. There are forty-five statements of attainment which intended to cover the eleven years of compulsory schooling and support the pupils at level 10. To synthesis and generalise the three ATs, the author provides seven elements to clearly definitions. (1)Chronology (AT1)： Students should understand the concepts and vocabulary of time. (2)Similarity and Difference (AT1)：Students need to know the difference and similarity between the same words. (3)Contemporary Attitudes (AT1)：Describe and think over the different ideas and attitudes of people in an historical situation. (4)Continuity and Change (AT1)：To find out reasons and suggest reasons why the ancient did some events and the actions. (5)Cause and Consequence (AT1)：The individual factors and the relationships among the factors, including the backgroud, the personal motivation, the historical event intention will affect history development. (6)Use of Sources (AT3, levels 1-10)：Encourage students to use the evidence to describe and explain the past. (7)Interpretations of History (AT2)： History is not only interpreted by the historians and novelists, but also through films, magazines and TV programs.

2.3 Exam authoring Tool

Figure 2 shows the multiple choice item authoring interface for teachers. We introduce the functionalities in the following.

A1 shows the marker and the related location name or information which can be edited in A2. A3 supports input latitude and longitude. Teachers can choose text item, multiple choice item and essay question in A4, select the marker on the map (A5), set the correct answer (A6) and define the Bloom cognition level (A7). This tool provides clear function (A8), preview edited item (A9), submit and save to database (A10).

A learning activity or exam includes more than one test item, we called "Learning Task" for learners to challenge the exam like playing in a game. Therefore, teachers can set the learning task name, the related course unit, task start time/end time, proportional scale and the other related information (B1 in Figure 3). After teachers choose the appropriate test items (B2), the tool will show the Bloom cognition distribution percentage (B3).

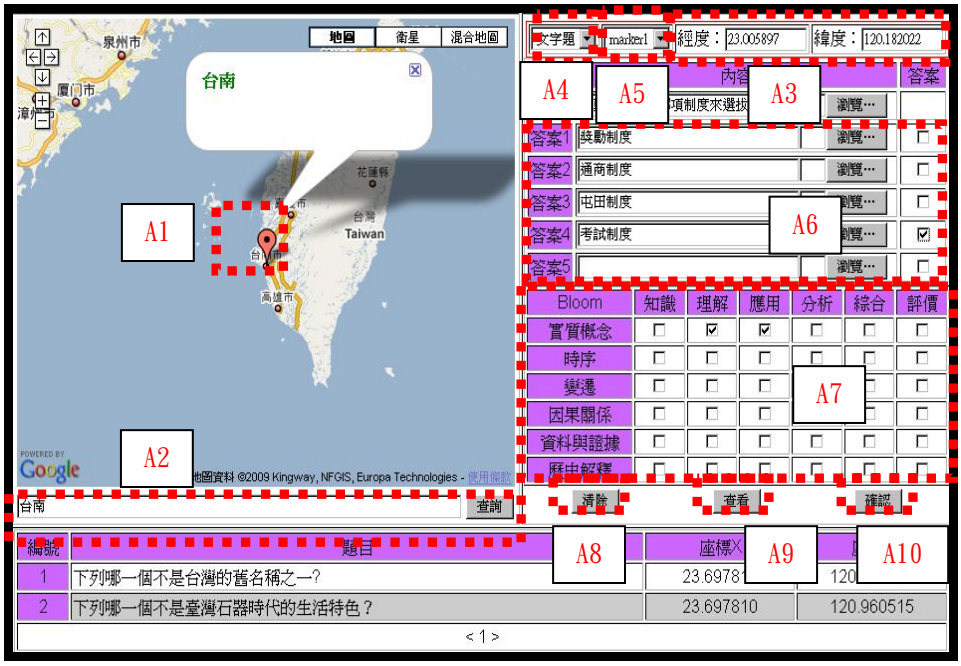

Figure 2. New test item authoring interface

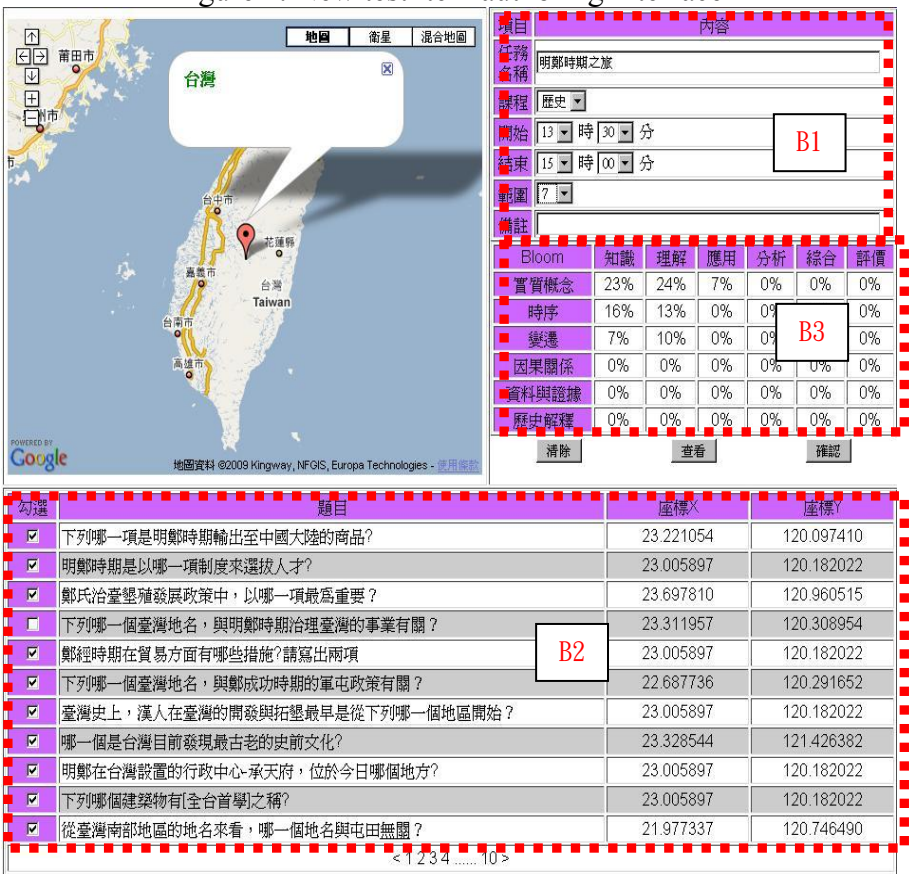

Figure 3. The learning task authoring interface

2.4 Exam Delivery Service

Figure 4 shows the multiple choice question. C1 reveals the geographical location. Learners can click the marker "balloon" to realize the related information, such as video and website. After students viewed the question body (C2), they can choose one of the items (C4) and click the submit button (C3).

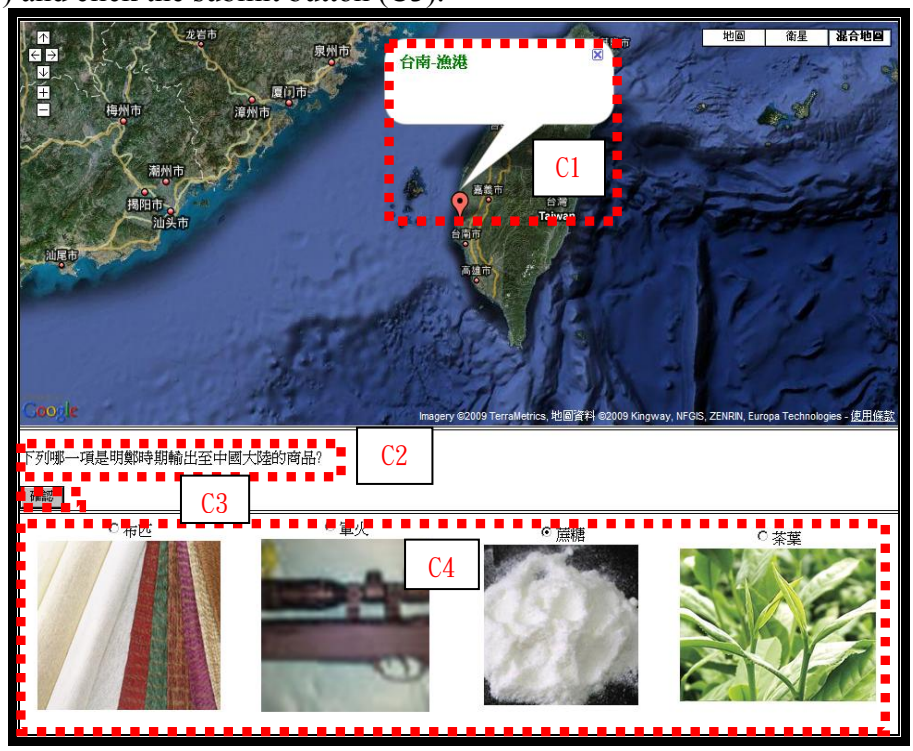

Figure 4 A map-based multiple choice problem for students

3. Conclusion and Future Work

Students are hard to learn History with complex information and easily lost their learning confidence learning History which includes geography information, decade information, person and event. In this paper, the authors provide a map-based exam authoring tool for teachers. Students can easily understand the geographical location and promote the learning motivation. The authors applied History education learning objects and Bloom's taxonomy to display the exam sheet for teachers. Teachers can adjust the exam and items in this system. This system is not yet test by History learning activity, a pilot experiment is designed in the near future.

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Development and Evaluation of a Computer-based Training of Questioning

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Abstract: Questioning as a learning strategy can improve learning outcomes because it helps to integrate new knowledge into prior knowledge. In this project we compare two forms of training (question stems vs. question prompts) in an experiment. We consider the prior knowledge of learners as well as the numbers and quality of their questions. We aim at empirically based statements about the effectiveness of a computer-based training of questioning.

Keywords: Computer-supported learning, questioning, text understanding, evaluation

1. Goals of the project

Effective questions that lead to a deeper understanding are rarely asked by students in lessons. One reason for this may be inconvenient attributions of students (e. g. Fuhrer, 1994). Another reason might be that learners have difficulties with asking good questions. Previous studies have shown that some training of questioning can result in higher level questions and better learning outcomes (e.g. Graesser & Person, 1994; King, 1990). However, these studies have some shortcomings: (a) they do not compare different forms of training in an experimental setting, (b) the cognitive level of questions (quality) has not yet been considered appropriately, (c) there are inconsistent results considering the influence of prior knowledge on the number and quality of questions. In order to address these shortcomings, we compare two different forms of a computer-based training in a field experiment: question prompts and question stems. A computer-based training helps to avoid inconvenient attribution processes of students and thus, facilitates asking questions. It also allows controlling the research conditions more effectively. Further, we consider the domain specific prior knowledge of learners.

2. Theoretical framework

Previous studies yielded inconsistent results concerning the influence of prior knowledge on the quantity of questions (e. g. Miyake & Norman, 1997; van der Meij, 1990). Students need to be aware of their knowledge gaps in order to ask questions to close these gaps. This requires a base of domain specific prior knowledge (Miyake & Norman, 1979). On the one hand, Miyake and Norman found an inverted U-shaped function of the relationship between prior knowledge and number of questions. On the other hand, van der Meij reports negative linear relations.

The quality of questions is judged by their cognitive level. According to the taxonomy of Bloom (1974) several classifications for questions have been developed (e. g. Andre, 1979). We judge the quality of questions according to the PREG model (Otero & Graesser, 2001).

The PREG model (Otero & Graesser, 2001) predicts the occurrence of questions during text understanding. It also explains the relation between the depth of understanding and the cognitive level of questions asked (their quality). According to this model, questions are asked when learners experience cognitive dissonance caused by inconsistencies in the learning materials (e. g. written texts). The PREG model predicts questions on three cognitive levels: text surface, text base and situation model.
(a) Text surface: learners understand the meaning of a particular word or concept (e. g. the meaning of "antibiotics")
(b) Text base: learners understand the meaning of coherent propositions in a text (e. g. the meaning that antibiotics have no effect on viruses)
(c) Situation model: learners construct relations between their prior knowledge and the meaning of the text because some propositions are left out from the text (e. g. learners found out the reason for the introduction of standard time zones because they activate their prior knowledge on the development of railways)
While working with learning materials learners may experience discrepancies on each of these three levels resulting in questions with different quality.

3. Research questions

Does a training of questioning improve the number and quality of learners' questions? We suppose the training to be effective regardless of its form (question prompts vs. question stems). This is in line with Rosenshine et al.'s (1996) assumption that students should ask more questions after the training than before. Furthermore we consider the quality of the questions. We expect students in the training-groups to ask more questions on a higher cognitive level than students in the no-training group (cp. PREG model).

Does a higher number of questions result in better learning outcomes? Asking questions should help to activate elements of a learning content. Therefore, these elements should be better integrated into the new knowledge structure resulting in deeper understanding. Furthermore, we want to find out how prior knowledge influences the number and quality of questions (cp. Miyake & Norman, 1979; van der Meij, 1990).

Do different forms of training (question stem vs. question prompt) yield differences in the learning outcomes? The effectiveness of both forms considering the prior knowledge of learners has not yet been examined. We expect the condition "question stems" to be more effective, resulting in better learning outcomes. Actively completing the questions should lead to a deeper understanding compared to the selection of fully formulated question prompts. Learners with low prior knowledge, however, should report a higher mental effort (Paas & van Merriënboer, 1993) when working with the question stems. This may lead to a lower post-test performance. Further, we suppose learners with low prior knowledge to benefit less from both forms of the training.

The table contains examples for question prompts and question stems on the three levels of understanding according to the PREG model. The examples are to be seen in the context of each text.

Level of understanding	Examples for question prompts	Examples for question stems:
Text surface	What is the meaning of social Catholicism?	What is the meaning of …?
Text base	How is the essay of Adam Smith related to Great Britain's economic success?	How is … related to …?
Situation model	What is the reason for the enormous production of iron?	What is the reason for …?

Fig. 1: Examples of questions prompts and question stems on three levels of understanding

4. Method

Between March and June 2009 a pilot study was conducted in order to test the learning materials and the instruments developed. The participants were 37 students (14 boys, 23 girls) of two high schools in Germany. Their mean age was 14.16 years (SD=.602). The students were randomly assigned to one of the experimental conditions.

4.1 Experimental conditions and dependent variables

The pilot study comprised two experimental groups that received different forms of a training of questioning (question stems vs. fully formulated question prompts) and a control group without training. Students in the condition "question stems" were asked to choose question stems and complete them on their own. Students in the condition "question prompts" were asked to choose questions they wanted to be answered. Further, students in the experimental groups and in the control group (no training) were asked to formulate their own questions. Students read the text and selected the prompts and stems in a computer-based system. That is, on the left side of the monitor they found the text and on the right side they found the stems and prompts as well as a field for their own questions.
To measure the effectiveness of the training we collected data on the following variables:
number of questions before and after the training (pre- and post-test questioning),
cognitive level of questions (cp. PREG model) before and after the training,
learning outcome and
transfer of questioning to another topic.

4.2 Materials

Texts about historical topics (Roman Empire, crusades) served as learning materials. We used texts taken from magazines that are relevant for history lessons. We analyzed their meanings with propositions (van Dijk & Kintsch, 1983). The propositions were used to manipulate the texts to provoke questions on three cognitive levels according to the PREG model (Otero & Graesser, 2001).

4.3 Instruments

The influence of the training on number and quality of questions was measured by a pre- (first session) and post-test (fifth session). Both tests consisted of texts about historical topics (Roman Empire, crusades). The students' task was to formulate their questions to the text while reading. The quality of questions asked was judged in accordance to the PREG model (Otero & Graesser, 2001) on three levels of understanding. In the 2nd, 3rd and 4th session (training sessions) students received the training with question stems and question prompts and completed criterion oriented learning tests (Klauer, 1987). These tests measured their domain specific knowledge and the learning outcome after working with the texts. The criterion oriented learning tests aimed at measuring retention, understanding and application (Bloom, 1974).
The transfer test of questioning consisted of a biology text. We counted the numbers of questions and judged their quality.

4.4 Control variables and instruments

To control other potential variables that may have influenced the performance of students during the training, we gathered the following data:
the verbal ability of the students (test of vocabulary from the KFT [Heller et al., 1985]),
their general knowledge in history (history grad of the last report),
their motivation while working with the learning materials (Questionnaire on Current Motivation [QCM] [Rheinberg et al., 2001]),
their prior knowledge of the topic in the learning materials (criterion oriented pre-test [Klauer, 1987]) and
their mental effort while working with the materials (mental effort scale [Paas & van Merriënboer, 1993]).

The data collected is analyzed by multivariate procedures, e. g. MANOVA.

4.5 Procedure

The training consisted of six sessions. In the first session students read a text about the Roman Empire. They were asked to formulate all their questions while reading (pre-test, questioning). Afterwards, students received an introduction into the topic "questioning". They were told about the benefits of asking questions as a learning strategy. Additionally, they were given examples of questions on the three levels of understanding according to the PREG model. Their verbal abilities and general knowledge in history was also gathered during the first session.
In the 2nd, 3rd, and 4th session students received the training with question stems or question prompts or formulated questions on their own (control group). In each session they read a text about the industrialization of 19th century Europe. While reading students completed the tasks described under point 4.1. Before and after working with the learning materials students completed criterion oriented learning tests. Their motivation (QCM) was measured before working with the texts. After working with the text students reported their mental effort on the subjective rating scale.

In the 5th session students read a text about the crusades in the Middle Ages. They were asked to formulate their questions on their own while reading (post-test, questioning).

In the 6th session students read a biology text about the risks of antibiotics. Their task was again to formulate their questions while reading (transfer test, questioning).

5. Results

The results have not yet been completely analyzed but will be presented on the conference.

6. Educational significance

With a computer-based training we can prevent inconvenient attribution processes of students. These processes seem to stop students from questioning in ordinary lessons (Fuhrer, 1994). A computer-based training should encourage students to ask questions that fill in their knowledge gaps. Furthermore, to learn and practice questioning should facilitate learning and promote transfer of this learning strategy to other subjects as well.

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- Workshop 2 -
International Workshop on e-Learning Tools, Techniques and Applications for Cultural Heritage

Kwok, L.F., Kong, S.C., Charoenporn, T., Hirashima, T., Kojiri, T., Mitrovic, A., Ogata, H., Sornlertlamvanich, V., Supnithi, T., Takenaka, M., Tarumi, H., Thaiupathump, C., Wang, F.L., Yu, F.Y., Yu, Y.T. (eds.) (2009). *Workshop Proceedings of the 17th International Conference on Computers in Education [CDROM]*. Hong Kong: Asia-Pacific Society for Computers in Education.

Call for Workshop Papers

Workshop on e-Learning Tools, Techniques and Applications for Cultural Heritage

A lot of educational and cultural institutes all over the world have attempted to digitize and organize their cultural treasures in order to make the diversity of cultural heritage accessible to all mankind. Advanced technologies, therefore, play an important role as a method to explore the culture both transferring and sharing. On the one hand, the scientific field explores the possibilities to provide appropriate technologies for digital and integrated access to cultural heritage collections. On the other hand, the cultural heritage institutions are more and more eager to collaborate among each other and to provide culture information.

This workshop is dedicated to explore the opportunities of people in this area share and maintain their own culture based on e-learning technology.

The theme of the workshop is "e-Learning Tools, Techniques and Applications for Cultural Heritage". This capture the role of the workshop as a forum to discuss current practices and future directions related to the tools, techniques as well as applications on e-learning for cultural heritage including history, art, language,and so on.

Topics of Interest

We invite scholars and practitioners who have been involved in the e-learning and cultural heritage research to submit paper on any topics related to the workshop theme. Papers may reflect on a wide spectrum of issues related to e-learning on cultural heritage.

Relevant topics for the papers include but are not limited to the following:

- User modelling
- Museums
- Digital archives
- Digital libraries
- Creative industries
- Municipality public services
- Tourist services
- Language/Dialect
- Mobile museum guides & personal museum assistants
- Context-aware information presentation
- Adaptive navigation and browsing
- Personalized museum guides
- Interactive user interfaces
- Semantic Web technologies
- Recommendation strategies
- Adaptation strategies for text and non-verbal content
- Success story on applying e-learning to cultural heritage
- Open standard for cultural heritage

Kwok, L.F., Kong, S.C., Charoenporn, T., Hirashima, T., Kojiri, T., Mitrovic, A., Ogata, H., Sornlertlamvanich, V., Supnithi, T., Takenaka, M., Tarumi, H., Thaiupathump, C., Wang, F.L., Yu, F.Y., Yu, Y.T. (eds.) (2009). *Workshop Proceedings of the 17th International Conference on Computers in Education [CDROM]*. Hong Kong: Asia-Pacific Society for Computers in Education.

Affective Classification of Movie Scenes Based on Two-pass Clustering Technique

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Abstract: Video-based learning not only provides rich content but also gives multimedia e-learning environment. In this paper, we present an affective movie classification tool, which automatically segments and labels emotion tags for the given video film. Our method integrates nine audio and visual features from each input video. Then the proposed two-pass clustering technique is used to group similar video scenes and gives labels. One good property of our method is that the need of manual annotated training data is un-required. We compared with the other famous algorithms such as ART2 and K-means. The experimental result shows that our video affect classification tool yields better accuracy (recall and precision) than the other clustering approaches. In short, it achieves ~80% in F-measure rate for 119 testing scenes.

Keywords: video content-based analysis, self-organizing feature map.

1. Introduction

With the development of multimedia technology, digital video collection is growing rapidly in recent years. In particular, language learning by video films receives a great attention in the e-learning research fields. How to organize and effectively utilize contents in videos involves in many technologies. Bolle et al. (1997) [1] showed that user preferred to search and retrieve videos that indexed previously rather than merely watching tens of thousand movies. Moreover, semantic content analysis and classification provides even better organization labels for video indexing. Developing such a system to support multimedia learning is indispensable.

Early studies about video content classification focused on genre-based [2] [4]. However, genre is insufficient for some movie scenes, e.g., the scenes in romance category may be included in joy or sorrow clips. It is too coarse to reflect the affective components of the film [12]. Maitland [8], the Emmy-Award-winning director and editor said, "*It is the filmmaker's job to create moods in such a realistic manner that the audience will experience those same emotions enacted on the screen, and thus feel part of the experience.*" There are full a variety of emotions in a movie so that these factors are essential to video content analysis.

The goal of this paper is to develop an automatic video emotion tag classification method to support multimedia learning. To enhance the emotion tag classification accuracy, we extract audio and visual features. Then the proposed two-pass clustering technique is used to group similar video-clips into set of clusters. We therefore use these clusters and map them to human defined labels. The main advantage of our method is not only training data free but also more accurate than traditional clustering approaches. By labeling emotion tags for each video clip, our system reduces the efforts of organizing

similar video scenes for human labeler. Furthermore, learners could easily select and retrieve videos according to the emotion tags.

2. System design and implementation

Our system consists of feature selection and movie scenes classification which are illustrated as figure 1. After the classification step, user can easily retrieve the video clips that similar to the movie scene which he/she selected through the classification database.

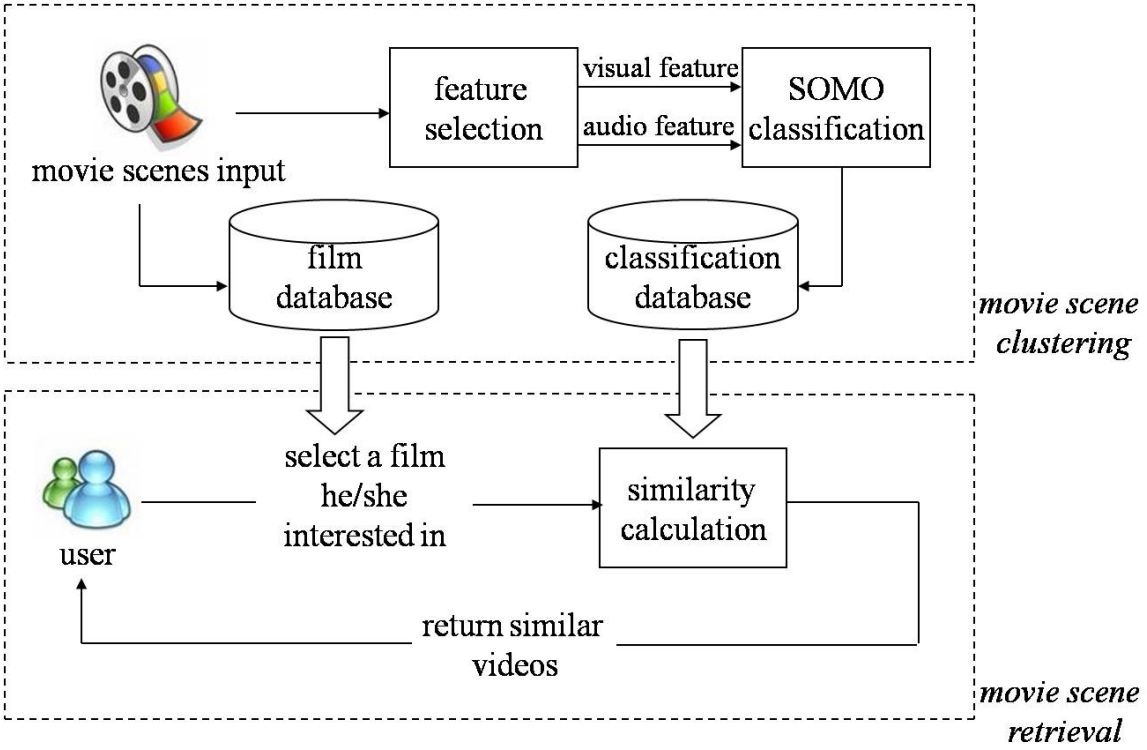

Figure 1. System overview

2.1 Feature selection

It is an important step to select proper audiovisual features from each movie scene to represent itself. A film is made up by lots of artistic elements, such as color distribution, sound and shot rate etc. These works are arranged by directors in order to convey emotions in the movie to audience. Therefore, we can emerge affective meaning of movie scenes from audiovisual cues.

The features we used in our system, list in Table 1, are representative in affective film classification [6] [7] [9] [10] [12] [13].

Table 1. Feature vector input

Type	Feature set	Extracted features	Num of Values
Visual	Shot	Average shot length	1
		Number of shot groups	1
	Action	Visual disturbance	1
	Color	MPH	12
		Average saturation	1
	Lightness	Medium of lightness	1

		Proportion of shadow area	1
Audio	Volume	VSTD	1
		VDR	1
	Zero crossing rate (ZCR)	Average ZCR	1
		Standard dispersion of ZCR	1
	Spectral centroid	Average spectral centroid	1
		Standard dispersion of spectral centroid	1
	Spectral roll-off	Average spectral roll-off	1
		Standard dispersion of spectral roll-off	1
	MFCCs	Average MFCCs	12
		Standard dispersion of MFCCs	12

2.2 Classification

After extracting audio and visual features from each scene, we use self-organizing feature map optimization (SOMO) [11], an unsupervised artificial neural network for classification. Previous studies usually adopted supervised data classification method, such as support vector machine (SVM) [13] and hidden Markov model (HMM) [5]. Although supervised approaches have been proved effective, they rely on a majority of training data and training time. As opposed to supervised approaches, SOMO provides good clustering through original data features.

Due to too many clusters yielded by SOMO algorithm, we find the number of movie scenes in each cluster is too few. It does not effectively apply for our retrieval system. Therefore, we further adopt hierarchical agglomerative algorithm (HAA) to merge pairs of similar clusters for reducing the number of groups. In our experiment, we find that average-linkage agglomerative algorithm could have a better result.

2.3 Implementation

Clustering results would be saved into the classification database. When users try to search a movie clip, this system will be able to retrieve the clips that have similar affective contents with what he/she selects from the database. In the top part of figure 2, the movie scene user interested in would play automatically and the related tags would list besides it. The bottom part returns the similar movie scenes so that user can easily view these clips with the same emotional content.

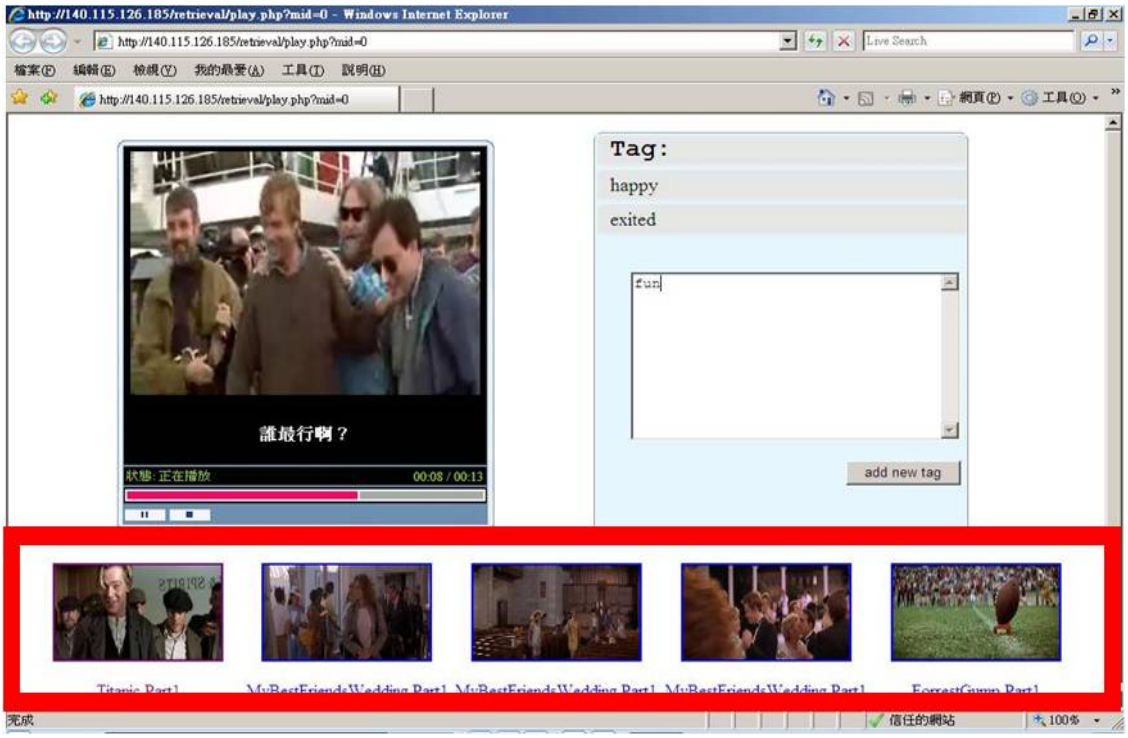

Figure 2. The video user selected and the similar video

3. Experiment results

We extracted 119 scenes from eleven movies, some of which are recent famous ones and some are from [12]. The movies we selected include four genes: action, romance, drama and horror. Every scene is about 45 seconds and contains at least one emotional event. Seventeen persons are employed independently to label each scene to be the ground truth.

The results of the SOMO algorithm and other well-known unsupervised classification algorithm, ART2 [3] and K-means for comparison can be seen in the following. We use the same 119 scenes for testing data, and the outputs merge into 39 groups for comparison. The results are shown as table 2.

Table 2. Average accuracy, recall, precision and F_1 of three algorithms

	Accuracy	Recall	Precision	F_1
SOMO+HAA	**66.65%**	**87.18%**	**70.79%**	**78.14%**
ART2	65.02%	80.35%	69.46%	74.51%
K-means	62.73%	76.05%	68.36%	72.00%

Four statistics our method carried out approximate to 70%, especially for the F-measure has a high rate approximated to 80%. It indicates SOMO with HAA turned out an suitable result. Only our method has the average precision over 70%. The average recall of our method is 11% which is higher than the result of K-means algorithm.

4. Conclusion

In this paper, we propose a novel emotion tag classification method for video scenes. We analyze the content of videos and extract audio and visual features from them. By means of tow-pass clustering technique, the unsupervised artificial neural network and hierarchical agglomerative algorithm, similar video films will be grouped into the same

clusters. This method is not only training data free but also better than other unsupervised algorithms, which is demonstrated in the experiment.

One direction for future work is to find out whether this classification and retrieval system are helpful to improve learners' attributes and motivation. A proper experiment for participants will be set to evaluate according to questionnaires or ARCS motivational model.

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Designing of Adaptive e-Learning System based on Content Link Hiding

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Abstract: Most of e-learning systems in Thailand are created as web-based learning, but they have limitation of learning effectiveness. This paper presents an approach to improve an e-learning system to be more intelligent where the system can adapt corresponding to student's behavior. Adaptive navigation technology on link hiding technique is used to display appropriate links based on student behavior while visiting page. The designed system will present different learning paths to students according to their knowledge levels.

Keywords: Adaptive E-learning, Adaptive Navigation, Link hiding technique

Introduction

E-Learning plays an important role in pedagogy activities to support education without barrier of location and time. In Thailand, most e-learning systems are designed to function as web-based learning, thus students can access on-line course via website. However, the systems lack adaptation feature that would correspond to student's behavior, consequently resulting in limitation of learning effectiveness [1]. The intelligent e-learning system becomes widely used in educational society, which aims to support students by including tracking modules, students' behavior module, etc.

There are many adaptation technologies such as adaptation presentation and adaptation navigation. Adaptation navigation can be divided into many techniques, namely, sorting links, hiding links, direct guidance, link annotation, etc. However, these methodologies are too difficult and complex to develop.

This paper presents an approach to adapt e-learning system using adaptation navigation technology on link hiding technique. The link hiding technique is a simple way to scope the direction of contents to students.

This paper is organized into four sections. Section 1 explains a background concept of adaptive learning system, while in section 2 we propose a link hiding technique with algorithm to navigate the system. Section 3 presents an implementation guideline to develop the system. Finally, section 4 shows conclusion and our future work.

1. Background

An intelligent e-learning system is composed of many components such as, adaptive engine, student tracking, content modeling. In terms of adaptation technique, we focus on link hiding technique.

1.1 Adaptation Technology

In a web-based hypermedia system, contents and links of pages can be adapted with two technologies, adaptive presentation and adaptation navigation technology [2]. The objective of the adaptive presentation technology is to represent content objects in several types or formats. The contents are divided into several pieces, which each piece is sent to individual student depends on a level of his/her knowledge [3]. The objective of the adaptation navigation technology is to dynamically change the page information based on the appearance of visible links. This paper focuses on Adaptive Navigation Technology based on Link Hiding Technique.

Link hiding technique [4] is a technique that reduces the navigation space and students cognitive overload by hiding links to pages. This technique can be used with all types of links, text, image, map, etc.

1.2 Student Model

Student model is one of the essential components in an intelligent tutoring system, which is used to keep track of a student. It can be divided into three types as shown in table 1.

Table 1 Student's characteristics [5]

Type	Meaning
Personal data	The student's personal characteristics (name, ID, e-mail ...).
Performance data	The student's cognitive and individual characteristics, as well as other general long-term characteristics.
Overlay data	The current level of mastery of designing patterns and attributes related to the corresponding elements in content.

We focus on overlay data which keeping track of visited pages and applying link hiding technique to navigate the flow of learning.

2. Link hiding technique

Link hiding technique can be used with non-contextual, index, and map links by hiding buttons or menu items. Moreover, link hiding is simple to implement and more stable than other navigation techniques such as sorting because sorting technique is only compatible with non-contextual links making the order of links unstable [4].

2.1 Node representation

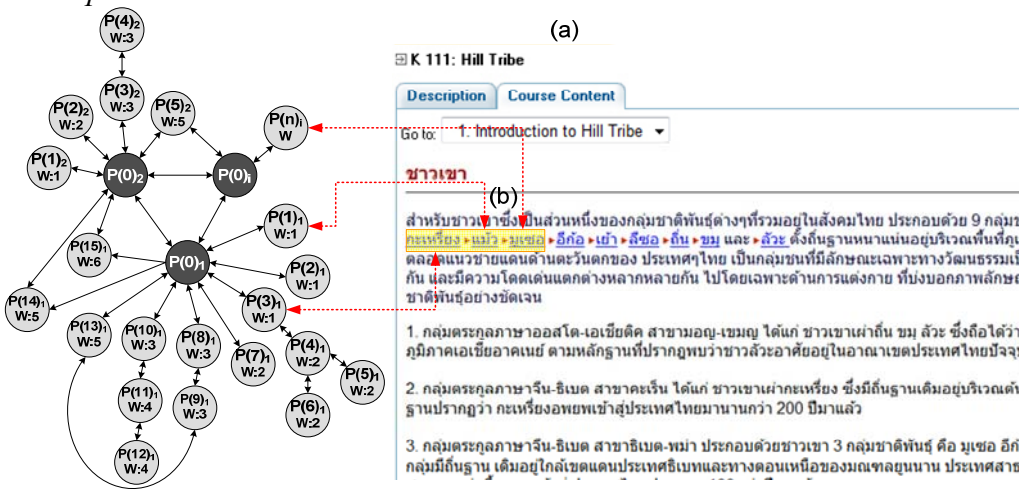

Figure 1. A collection of nodes.

Figure 1 shows a collection of nodes representing a course. P(0)i node shown in dark gray node stands for a first page of a lesson i. It is a center of other pages and compatible to a component (a) in HTML page. Page node, P(n)i , shown in light gray node stands for a content page n in a lesson i. It is compatible to components (b) in HTML page.

We give a weight for each node to classify the level of intellectual behavior that teacher designs in content. It is based on Bloom's taxonomy as shown in Table 2.

Table 2 Student's characteristics [6]

Weight	Topic	Meaning
1	Knowledge	Recall data or information.
2	Understanding	Understand the meaning, translation, interpolation, and interpretation of instructions and problems.
3	Application	Use a concept in a new situation or unprompted use of an abstraction.
4	Analysis	Separates material or concepts into component parts so that its organizational structure may be understood.
5	Synthesis	Builds a structure or pattern from diverse elements.
6	Evaluation	Make judgments about the value of ideas or materials.

2.2 Course Navigation Algorithm.

To hide or display link in content, we calculate the ratio of the number of nodes classified by a weight and the total number of nodes. The result is presented in term of percentage as shown in Figure 2.

$$\text{Percentage of visit node} \quad \frac{\sum_{i=1}^{n(P_n)} W_i + \sum_{j=1}^{n(P_m)} W_j}{\sum_{j=1}^{n(ln)} \sum_{i=1}^{P_{ln}} W_i + \sum_{i=1}^{m} W_j} \times 100 =$$

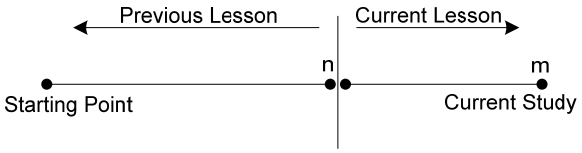

Figure 2. A diagram of visited node.

We represent the meaning of symbols as follows:
$n(P_{m)}$: An array of pages that a student visits in current lesson.
$n(P_{n)}$: An array of pages that a student visited in the previous lesson.
n(ln) : An array of all previous lesson.
P_{ln} : A number of page in lesson ln.
m : A number of current page.
W_i : A weight of page i.

Scale of a weight level: We define the ratio of the number of nodes classified by a weight and the number of all nodes, shown in Figure 3. There is one node with weight 6. The number of nodes in this lesson is 20. The range of level 6 is 0-5%.

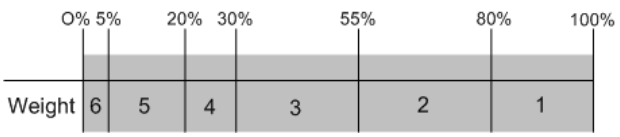

Figure 3. Compare a result with node's weight.

The overall diagram on scale of weight level is illustrated in Figure 3. All links that have a weight more than or equal to the result will be displayed in the page. On the other hand, all links will be hided if the weight of that page is less than the result. In the example shown above, student A visit 13 nodes from 20 nodes, from the formula in Figure 2, the result is 60.34%. Therefore, the pages will show level 2 (level 2 range from 55%-80%) and other pages that weight higher than 2 will be shown in links format.

3. Scope of Implementation

An interface design of this program is shown in Figure 5-7. The bold italic texts are linked to content pages. For example, student A and B visit the same page in Figure 5, and student A clicks all links in this page while student B clicks some links. The system shows the number of links for student A more than that for student B. Figure 6 and 7 show the content presented to student A and B, respectively.

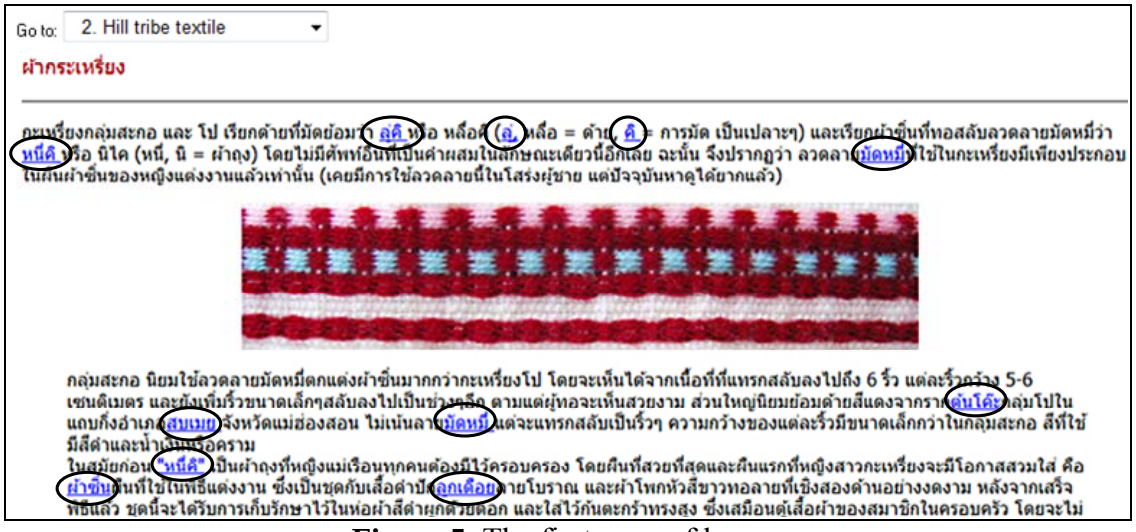

Figure 5. The first page of lesson

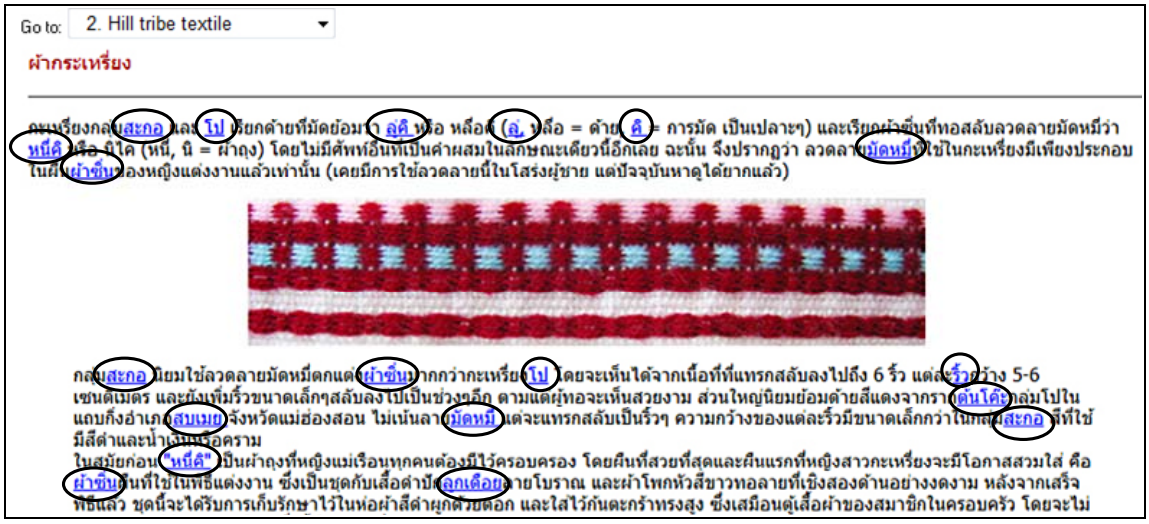

Figure 6. Interface shown to student A

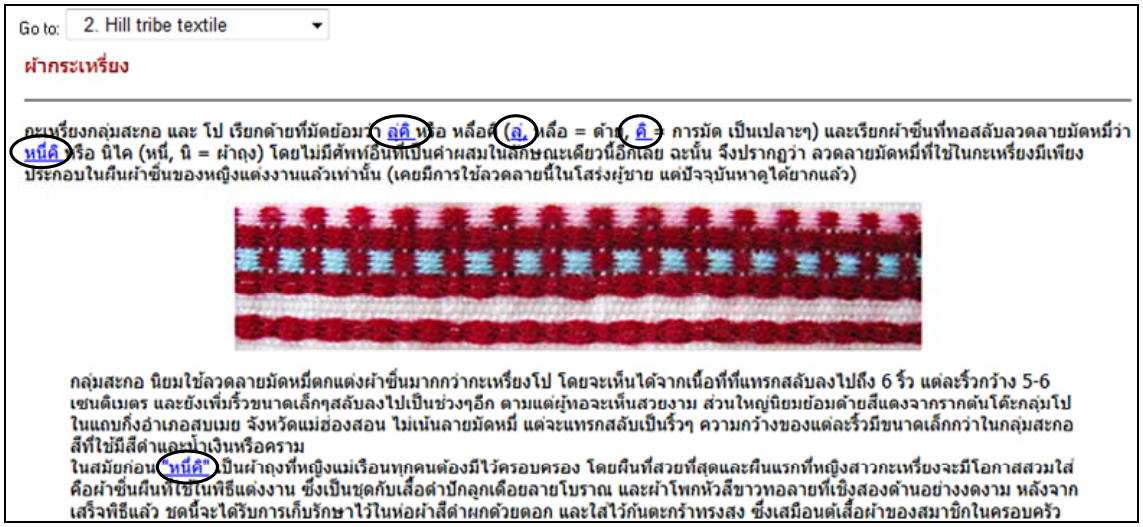

Figure 7. Interface shown to student B

4. Conclusion and Future work

We design and develop an e-learning system by applying hide linking technique based on student's behavior. This paper uses the link hiding technique and proposes the rules calculated from percentage of visiting a page, and compare a weight of the page. If a student visits a lot of links, it is assumed that the student cannot progress the work well. So the content of easy level will be displayed. Otherwise, the content in a more difficult level will be displayed.

In the future, we plan to implement and apply an ability of SCORM 2004 standard in a sequencing and navigation section to navigate content [7].

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Introduction of RFID Smart Museum Guide at Chao Sam Praya Museum

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Abstract: This paper will demonstrate how RFID technolgy can improve the quality of life and also serve as a tool to educate and encourage the interest in the culture heritage. An example presented in this paper is the introduction of implementing the Smart Museum Guide concept for the Chao Sam Praya museum, a museum depicting ancient artifacts unearthed from the old capital of Thailand. It will also present a concept for scaling development to museums all over Thailand and ultimately link all museums into one central database.

Keywords: RFID, museum, cultural heritage, e-learning

1. Introduction

Thailand is a country with a rich cultural heritage. It is home to two UNESCO world heritage sites, namely the historic town of Sukhothai and city of Ayutthaya, where millions of tourists from all over the world visit yearly. However, these historical sites, along with great many national museums and local exhibits, receive much less enthusiasm from Thai nationals when compared to foreign tourists. The museums and historical sites are side shows or pit stops for vacationing Thai citizens on their way to national parks and sunny beaches. This is not due to the disinterest of Thai culture from Thai people, as evident in various literature, cultural traditions and festivals that are still strongly practiced around the country. Instead, the mundane status of the museums stems from its mundane presentation. While fascinating museums elsewhere have deployed interactive gadgets to connect visitors with artifacts, most notably by using Radio Frequency Identification (RFID) Technology, Thai museums still present artifacts with regular fine print in front of the show pieces.

Recent attempts by students in local universities to incorporate RFID with Personal Digital Assistance (PDA) for a museum guide system have been noble but are still only senior projects in the university. Moreover, these senior projects aim to provide assistance or information to people who are familiar with technologies like the PDAs. The regular mass in Thailand whom has not had sufficient experience with a personal computer may find the technology difficult to use. Nevertheless this is considered as a good starting point for RFID Technology to bring the past in Thai museums back to life. If we can collaborate with the museums and gather the real system requirement, we could design the right tools that are suitable for the idea of a 'Smart Museum Guide', a museum that collects visitor information and guide them along the museum according to their interest. It will also be a great tool for collecting visitor pattern to improve the museum presentation techniques. However, an important thought to keep in mind is that the museums should be designed to accommodate as many types of visitors as possible, including people who are familiar with technology and those that are not familiar. Appropriately deploying RFID innovation

at the museum will significantly improve the quality of visits to these important cultural treasures.

This paper will demonstrate how RFID innovation can improve the quality of life and also serve as the introduction of implementing the Smart Museum Guide concept for the Chao Sam Praya museum, a museum depicting ancient artifacts unearthed from the old capital of Thailand, the city of Ayutthaya.

2. Related Work

Adoption of RFID technology has recently been accelerating due to the decrease in cost and development in complimentary technologies like smart phones, PDAs and wireless communication. For museums, there have been many research and applications in using RFID technology to increase value, mostly taking advantage of the technology as a sensor. The current work on RFID implementation can be categorized into two main types, as a guidance system and as a system for collecting visitor information. The ability to track visitor movement throughout their visits can provide useful information for museum management[1] and customer relationship management schemes[2]. As for concrete design, His *et. al* [3] proposed a brilliant idea of using RFID wristband as a tool to communicate between the visitor and the system to provide another dimension of science museum experience for visitor. This first type is mostly for data mining and analysis to improve museum service, as a back office application.

The other popular application is to implement RFID as part of a guidance system on PDAs to help improve user experience through mitigation of lost time [4]. This is done by providing visitors with electronic maps on their PDAs to view their location and path. Automation provided by the sensors help reduce human resource needs for museum services such as group guidance while keeping the same level of customer satisfaction. Security application like the work of Fiona Tennant and Doug Rogan[5], which focus on protecting small portable artifacts from theft, can also be found, but less common than the first two types. Nevertheless, existing application tends to be focused on increasing management efficiency, user accessibility and improve visitor experience for only one museum with little or no external cooperation with other museums.

The concept presented in this paper will be similar to other adoptions of RFID technology. However, the concept of this application is divided into three phases with the final scale extended beyond only one museum, expanding to link multiple museum data and visits into a central database. The ultimate goal is to achieve a national database of museums and its treasures for integrated use by all visitors, new and old.

3. Conceptual Framework

The controlling idea for implementing RFID innovation into Thai museum is to improve the visitor's experience and ultimately elevate museums into an accessible and popular method of preserving the national cultural heritage. The ability to provide fast, relevant and interesting information to visitor is crucial to achieving that goal. Coupled with web technologies, RFID tags in museums can help realize the goal and become an excellent e-learning method for children and adults alike.

The RFID implementation will be two folds. It will be used for building a Smart Museum Guide system and secondly to initiate the construction of a database containing artifact information while also linking user experience to the database. This will be done in three phases, starting with a proof of concept phase to test out the feasibility and design

through building a prototype system for the Chao Sam Praya museum. The museum contains various artifacts of the ancient city where many people visit year round. A computer aided guidance system will be built to help visitors navigate through the museum, using computer terminals as check points along the way. It will be a good sample to test out the system and get substantial user feedback.

The second phase is to scale the development to other museums in Thailand and establish information standards for future exchanges. Necessary modification of the computer program or website to accommodate additional museums will be made during this phase. Museum information and data on its collections will be inputted into the individual database of each museum server. Data specification and structure will be analyzed to establish an open standard for the data in all museums. The standard is to be used for information linkage in the final phase.

On the last phase, user data and museum information will be linked to an information center which will act as an interactive website for visitors before and after museum visits. This will be done by using XML message to communicate between the central server and museum servers. Visitors will then only need to visit one website to get information for museums all over Thailand. The ability to link information from many museums is also a good foundation for other useful applications, like packaged tours, interactive information for revisit values, or for government management of the museums.

The ultimate goal is to build an accessible network of museums that are enjoyable to visit because of the personalized interaction enabled by RFID implementation, thus promoting the cultural heritage of Thailand's museum and acting as a great e-learning center for students of all types.

4. Technology

4.1 RFID

RFID is an acronym for Radio Frequency Identification which is a technology for identifying information of an object or person through the use of radio waves. It was developed in the 1970s for the purpose of identifying objects in long range, with many types of 'tags' available. The tags contains a small chip and radio antenna to send and receive information and due to its small size, the tags can be inserted or attached to many different shapes like a card, coin, keychain, or a wrist band. Because the tags are hidden from view or protected by an outer coating, it is much more durable to whether, physical damage, and physical obstruction when compared to the conventional barcode system [6].

4.2 Web Service

Web service is a software system designed to support the exchange of information between two or more computers through an existing network. The language used for the exchange is XML with an interface that can be read by the computer, such as WSDL (Web Service Description Language).

Web service works by sending information through HTTP (Hypertext Transfer Protocol) protocol like normal web pages. The difference is the use of SOAP (Simple Object Access Protocol) protocol for specifying information sent to applications between two web services.

5. Prototype

The prototype will be a windows application that will run on a windows platform on a terminal computer. The first interface will be for user registration at the counter for first visits. The page will contain fields to enter user data which will then be identified by an assigned identification number. The RFID tag, a wrist band, will contain and use the identification number to reference the visitor as s/he browse through the museum. Example interface for visitor data input is shown in Figure 1.

Figure 1. Depicting the interface for entering visitor information and preferences

As for the Smart Museum Guide, the system will calculate the appropriate route from the visitor's interests provided in the beginning and the amount of time the visitor has for the session. The system will then direct the visitor to the first destination where the first object of interest will be (see Figure 2).

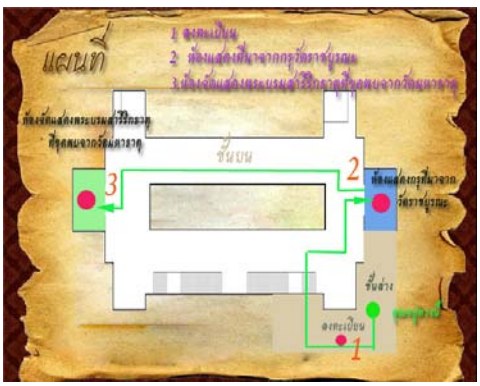

Figure 2 (left) & Figure 3 (right). Depicting the guidance interface and ratification information respectively, as to be shown on computer terminals in the museums

Information on the object will be shown at the computer terminal as the visitor wave the RFID tag at the reader. The information can either be interactive and/or plain text, depending on the appropriate settings. The information can also be customized to the visitor's preference such as children may prefer a cartoon explanation whereas adults may prefer a more in depth details. Example of displayed information is shown in Figure 3.

The design of the interface is to promote the cultural heritage of the museum. Here, the font used is traditional Thai hand writing couple with a parchment as the background to help stimulate an immersive environment. Since the information provided on the screen is to be used for e-learning purposes, it should have a variety of options for viewing. Most obvious is the translation to prominent foreign languages to support core international visitors such as English, Japanese and Chinese. Another frequent application is using sound narration and video content for visitors to listen and view at the same time. The narrated scene, coupled with corresponding sound track, is a great way increase cultural appreciation and induces the immersive feeling for visitors browsing through the music. In case of science museums, interactive flash games and quizzes can be installed on to the computer terminals to add value.

6. Conclusion

The designed prototype is only for the first phase in a total of three phases. Additional theme and modules will need to be developed for scaling to other museums all over Thailand. The database needs to be designed to handle information needs of new types of museums. Vast information will need to be entered into the database, which will take substantial amount of time and resources. However, the key requirement is to achieve substantial cooperation of museum operators in testing and implementing the system. Only when all parties agree the participate will the system operate at its full potential. Once the final phase is complete, the extensive database of museums and its collections will become Thailand's national treasure itself. The added technological innovation will be a big step to increase accessibility to the disabled. The blind will benefit from narrated speeches and the hearing impaired can enjoy extra features provided by video clips, all of which can be activiated automatically with their RFID tags. However, it may require extra equipment like an RFID cane equipped with narrated speech for the blind. The implementation of RFID technology in museums will be a big step towards preserving Thailand's culture and promoting e-learning in Thailand's knowledge society.

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Pali-Thai Dictionary: A semi-automatic approach on form-based to content-based structure

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Abstract: There are several dictionaries which are developed in form-based electronics format. Since these are designed to use only on manuscript dictionary, they are limited on usage in other ways, such as electronic dictionary with word associations, translation, question answering, content retrieval, and so on. Content based dictionary is more flexible to apply to such applications. In this paper, we describe the methodology to transform a form-based to content based structure in Pali-Thai dictionary. This dictionary aims to be an infrastructure for many applications in Buddhism domain.
Keywords: Dictionary Making Process, Form-based structure, Content-based structure, Bali, Thai

Introduction

Digitized Thailand is a flagship project under Thai government which is set up to collect the Thai related resources, such as language resources, art and culture, Thai food, and so on. Pali language increasingly plays an important role as the language which represents a lot of Thai cultures based on religion. **Pali** is one of the Prakrits of ancient India which was spoken in the sixth century before Christ era, and it has been a dead language for upwards of two thousand years. It is created by a combination of the dialects in which the teachings of the Buddha were orally recorded and transmitted. More than 95 percents of the Thai people are Buddhist. Furthermore, there are about six million students in Buddhist-style school. However, a few of Thai people understands Buddhism content clearly since we are lacking of resources between Pali and Thai.

Pali-Thai dictionary is an important infrastructure to enhance the understanding of cultural heritage from one generation to next generation. Previously, all dictionaries are developed for manuscript version. Currently, there is one related Pali-Thai Dictionary in form-based electronic version, which is designed for manuscript dictionary. However, it is inadequate to fulfil the needs on using dictionaries in many applications, such as electronics dictionary with word associations, machine translation, question answering, content retrieval, and so forth. We started this work by making collaboration with Wat Puranawasa to develop the first Pali-Thai content-based online electronic dictionary.

This paper is organised as follows: Section 2 describes the background of Pali language and its linguistic information. Section 3 explains information of the Pali – Thai dictionary of Buddhist term about its format and given detail. Section 4 shows the system design including database design and rule design. Section 5 clarifies the process of extraction system. Section 6 elaborates a discussion. Last, Section 7 concludes this paper and lists up future work.

1. Pali Language

Pali language is an ancient language which belongs to a Middle Indo-Aryan language or Prakrit of India. Pali currently has no native speaker, but it is a language using in the earliest extant Buddhist scriptures, as collected in the Tipitaka (aka. Pāḷi Canon). There is

no specific writing alphabet for Pali, but it was recorded in many languages for example Sinhalese, Khmer, Burmese, Devanāgarī, and Thai [1, 3, 6]

Pali is a very inflected language. The root of a word conveys the basic meaning, and additional affixes modify the meaning. Nouns are inflected for gender, number, and case; verbal inflections convey information about person, number, tense, voice, and mood [7]. For an adjective usage in Pali, it must be in the same gender, number, and case of its core noun. Pali nouns have a gender possessing in a word. There are three grammatical genders: masculine, feminine, and neuter. There are two numbers in Pali nouns: singular and plural. The nouns exhibit eight inflecting cases: nominative case, vocative case, accusative case, instrumental case, dative case, ablative case, genitive case and locative case. There is not only one inflected form but also short form and long form in some cases, but all forms is replaceable for proper utilisations [6].

Nowadays, Pali is learnt to understand Buddhist Scriptures, and is frequently chanted in a ritual context. The main centres of Pali learning remain in the Theravada Buddhist nations of South-East Asia: Thailand, Myanmar, Sri Lanka, Laos and Cambodia [2].

2. Form-based Pali-Thai dictionary

In Thailand, there are several Pali to Thai published printed resources, but electronic document is very rare. There is one Pali to Thai Buddhist dictionary freely provided its electronic data in a word document file [5] which is form-based structure. In total, the dictionary contains 4,383 lexical entries.

Based on word document, authors apply the provided format such as bold, italic, bracket, to represent some specific meanings. Information provided from form-based dictionary can be categorised as illustrated in Table 1. The symbol displayed in superscript is an abbreviation for explaining examples in Fig 1.

Table 1. Information extracted from form-based dictionary

Categories	Topics	Definition	Form Representation
Source word [A]	headword [A1]	Pali language headword	A word in bold
Translation [B]	word translation [B1]	Thai word(s) which correspond to Pali word	Ordinary content without any indication, comma is used to boundary multiple words. Locate near source word.
	descriptive definition [B2]	A long description of a Pali word	Ordinary content but in a long continuous context. Locate near source word.
	direct translation [B3]	A word by word translation from Pali stems to Thai without literate addition	A word represented in between quotes “ ”.
Semantic relation [C]	synonymy [C1]	A synonymous relation	Represented after relation keywords 1. **เทียบ** (comp.), 2. **ดู** (look.), 3. **ดูที่** (look.), 4.**คู่กับ** (syn.)
	antonymy [C2]	An antonymous relation	Represented after relation keywords 1. **เทียบ** (comp.), 2. **ดู** (look.), 3. **ดูที่** (look.), 4. **ตรงข้ามกับ** (ant.)
	hypernymy [C3]	A super class relation	Represented after relation keywords 1. **เทียบ** (comp.), 2. **ดู** (look.), 3. **ดูที่** (look.)
	hyponymy [C4]	A subclass relation	Represented after relation keywords 1. **เทียบ** (comp.), 2. **ดู** (look.), 3. **ดูที่** (look.)
	sibling [C5]	A same hierarchical level relation	Represented after relation keywords **เทียบ** (comp.), 2. **ดู** (look.), 3. **ดูที่** (look.)
Related information [D]	pronunciation [D1]	A pronunciation of *headword* in Thai	A word represented in between brackets [].
	mantra [D2]	A related mantra of the word	Represented in font type Dillenia UPC with size 46. Indent is provided for this information.
	history [D3]	A history of a word	Ordinary content without any indication, undefined form.
	reference [D4]	A doctrine reference from Tipitaka	A font size represented between parentheses ( ).

	other [D5]	Other related information	Ordinary content without any indication, undefined form.

Figure 1 illustrates some examples in Pali-Thai dictionary with the English meaning translated by a linguist [4]. We classify vocabularies into three groups. In Figure 1-a, it obviously clears that we can merely interpret the content by a form. These entries are called *explicit entries*. Figure 1-b and 1-c represents vocabulary which content cannot interpret easily based on form only. These are called *implicit entries*. Vocabulary shown in Fig 1-b represents the content with its encyclopaedic knowledge within itself while Fig 1-c contains related information with other vocabulary. We named the former as self-implicit entries and the latter as related-implicit entries.

a	จิตตุปปาท [A1] [จิด-ตุบ-บาด] [D1] การเกิดความคิดผุดขึ้น [B2], ความคิดที่ผุดขึ้น [B2]	**cittuppāda**[A1] [tʃit-tup-pa : da][D1] the rise of thought[B2], the rising thought[B2]
b	ชุมนุมเทวดา [A1] กล่าวคำเชิญชวนเทวดาให้มาชุมนุมกันเพื่อฟังธรรม ในโอกาสที่พระสงฆ์สวดพระปริตร [B2] ดังนี้[D]: "สรชฺช สเสน่ สพนฺธุ นรินฺท่, ปริตฺตานุภาวิ สทา รกฺขตูติ. ... ธมมสฺสวนกาลิ อยมฺภทนฺตา, ธมมสฺสวนกาลิ อยมฺภทนฺตา.[D2]"	**jumnum-devatā** [A1] summon deities for listening to a dhammic discourse while monks perform chanting paritta mantra [B2] as follow[D]: "sarajjaṃ sasenaṃ sapandhu narindaṃ, parittānubhavo sadā rakkhatūti. ... dhammassavanakālo ayambhadantā, dhammassavanakālo ayambhadantā.[D2]"
c	อกุศล [A1] "ไม่ฉลาด [B3]", สภาวะที่เป็นปฏิปักษ์หรือตรงข้ามกับกุศล [B2], บาป [B1], ชั่ว [B1], ความชั่ว (อกุศลธรรม)[B1], กรรมชั่ว (อกุศลกรรม)[B2]; เทียบ [C] กุศล [C2]	**akusala**[A1] "not smart[B3]", a status that is opposite to kusala[B2], sin[B1], badness[B1] false doctrine (akusala-dhamma)[B1], unwholesome action (akusala-kamma)[B1]; comp.[C] *kusala*[C2]

Fig 1. Examples of various types of lexical entries in Pali-Thai

3. Content-based Pali-Thai dictionary

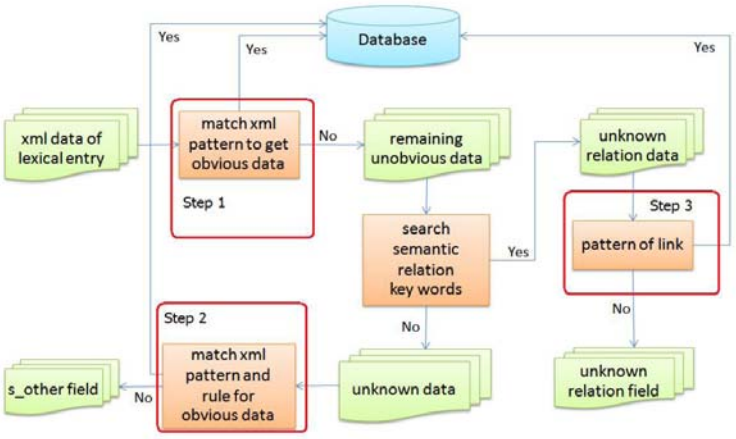

Fig 2. Extraction Process for Pali-Thai dictionary

We attempt to design a content-based dictionary from form-based dictionary. Fig4 illustrates extracting process. Extraction process is composed of three steps which are 1) handle explicit entries, 2) handle self-implicit entries 3) handle related-implicit entries by managing the semantic relation content which refers to other entries. Flow of information extraction process is represented in Fig 2.

3.1 Database Design

Database was designed to handle different information from the source dictionary. All fields with their definition and categorised type are listed in Table 2.

Table 2. List of database fields

Field name	Definition	Entry type
s_entry	headword of source language	Explicit information
t_entry	word translation in target language	
t_def	descriptive information or glossary in target language	
t_direct	word to word direct translation in target language without literation	
s_read	pronunciation of a headword	
s_syn	synonym of headword	Related-implicit information
s_ant	antonym of headword	
s_hypo	hyponym of headword	
s_hyper	hypernym of headword	
s_sibling	sibling of headword	
s_mantra	related mantra script of the headword	Self-implicit information
t_mantra	related mantra script of the translated word or definition	
s_history	history of the headword	
t_history	history of the translated word or definition	
s_reference	Tipitaka reference of the headword	
t_reference	Tipitaka reference of the translated word or definition	
s_sample	example of the headword usage	
s_other	other ungroupable information of the headword	

3.2 Extracting Rule

After the dictionary was manually observed, document was transformed to XML formatted data. With XML format, we are able to indicate a boundary of information. Transfer rules are created based on the XML format. Table 3 illustrates some examples of rules which are applied for classify information into three entry types.

Table 3. Examples of Rule Extraction

Rule No	Definition
1	If font is ***Angsana New*** and size is ***46***, get ***content*** to **s_entry** field
2	If data is in a form ***"[" content "]"***, get ***content*** to **s_read** field
3	If font is ***DilleniaUPC*** and size is ***46***, then system will check length of character in ***content***. -length of character count is greater than 12, get ***content*** to **t_def** - length of character count is less than 12, get ***content*** to **t_entry**
4	If ***content*** contains sequence of Pali in Thai alphabets (for example,ธมฺมสฺสวนกาโล...), Get **content** to **s_mantra**

4. Web based Pali-Thai dictionary

We developed the online electronic Pali-Thai dictionary located at http://lexitron.nectec.or.th/buddha/ . It is designed for providing a structure based dictionary with all possible information from our database. Figure 3 shows an example of lexical entry.

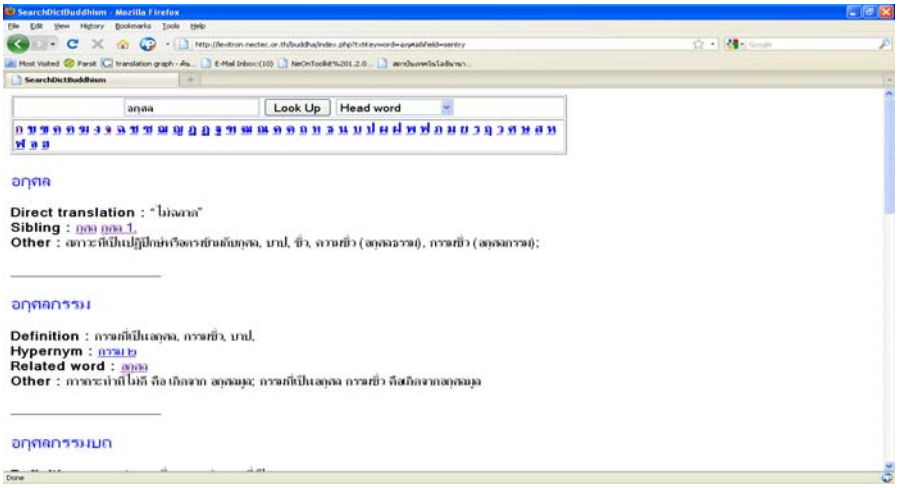

Fig 3. A snapshot of online Pali-Thai dictionary

5. Discussion

Based on the initial 4,383 entries, after we extracted using our process, we found 5,788 entries in total. There are 2,253 lexical entries that are explicit entries. There are 640 lexical entries that are self-implicit entries and 1,967 related-implicit entries. In addition, there are 928 entries that contain both self-implicit and related-implicit form. Consequently, the related-implicit entries generate 1,405 new entries.

Some information cannot be extracted automatically. Those are registered into **unknown_relation** and **s_other** fields. **s_other** field contains data that have no certain XML pattern or ambiguous content, for example, a history of a headword, a history of detail in descriptive information, and other information such as related the Buddhist doctrine of headword or detail. These contents are descriptive explanation which has neither keyword nor strict pattern. **Unknown_relation** field stores lexical entry that has an obvious relation keyword but the given keyword is ambiguous. There is no clue to create rules to handle such relation from a keyword since readers capture their semantic relation based on the meaning and their personal world knowledge.

6. Conclusion and Future Work

In this paper, we design a framework to develop a content-based Pali to Thai Buddhist dictionary from form-based dictionary. Our dictionary is an electronic resource which is designed for other NLP applications. XML format is used to represent lexical entries. Rule-based extraction process is applied in this work to handle explicit entries, self-implicit entries and related-implicit entries.

Since there is some information that has the difficulty on extracting them to the correct database field, it is necessary to analyse the information to gain more structural content, especially in **unknown_relation** and **s_other** fields. Again, we also plan to extend and develop the semantic related dictionary.

Acknowledgements

The authors are grateful to phra Worapong Jotidhammo from Wat Puranawasa who kindly provided us his valuable advice and influence data contribution.

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Thailand tourism Collaborative Commerce (TCC) via XML Web Service

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Abstract: Tourism plays a central role in promoting and preserving Thailand's vibrant culture. While it is not a large part in the national GDP, the tourism industry employs and affects a substantial part of Thailand's population. Because the local tourism business focuses on displaying its traditions and culture, assisting the visibility and accessibility of the local tourism business is a big step towards conserving Thailand's identity. Today's knowledge economy has made information, and the ability to share it, crucial for tourism companies to successfully compete and streamline their operations. The worldwide travel industry has realized the potential mutual benefit of linking information and subsequently founded the OpenTravel Alliance (OTA: OpenTravel) to establish specific standards and methods of sharing between the players in the field. The tourism industry in Thailand can benefit from an efficient link between the businesses involved, especially the lodging, transportation (vehicles) and travel agencies. These businesses are hubs which connects tourist to local attractions and are regularly displaying playing their own part in promoting Thai culture, such as themed hotel rooms and hosting seasonal festivals. An integrated system and standardized information allows for even more activities from each participant to offer more innovative products and services for their customers.

Keywords: OTA, System Integration, Tourism Business, Web Service, XML

Introduction

TODAY'S business environment has become extremely competitive and utilizing every new tool available to ensure that income exceeds expenditure has become routine. The tourism business in Thailand is one of the successful adapters of the new tools, especially in using new information technology to enhance their services. The most notable change from the recent years is the migration of part of their services to the online community. With websites and web services now an integral part of the hotel and rental agencies, some of the best and beautiful web technologies can be found in the tourism industry. Preliminary online bookings and site information, including pictures, directions and local attractions, helps travelers manage their risks and plan their travel before they begin on their journey. It also helps tourism companies manage their resources efficiently and accurately forecast future demands.

Thailand's technological standard for these services, however, is still very fragmented. The problem is due to the fact that each company uses their own communication tools to send information to and from their respective web sites, be it Excel spreadsheets through ftp servers, database link or XML (Extensible Markup Language) messages. Hence a booking from an external third-party web portal cannot be transferred directly to the service provider but must be referred again to the actual service provider to connect with customers.

This missing link between businesses forces the customer into manual hunt for attractions and/or accommodations within the visiting area which is largely inefficient

compare to online electronic search. Businesses in turn lose both the ability to link internally (within business partnerships or affiliates) and provide a holistic access for the customer. An international collaboration, the OTA (OpenTravel Agency), was set up to particularly deal with this problem and they did it by standardizing the specification of XML message for web services.

Before this paper's work, there was no adoption of such standards in Thailand. The work presented in this paper is the first nationwide attempt to apply the OTA standard into Thailand tourism industry along with building the necessary tools to assist implementation.

1. Conceptual Framework

OpenTravel's goal is to enable the global exchange of information within the tourism industry through a common specification to ensure that traveler and business information flow smoothly throughout the whole trip. Founded by a group of collaborating tourism business, including hotels, airlines, transportation networks, insurance businesses and software development companies, OTA's standard is very relevant to Thailand's tourism business making it is a strong case for adoption.

The technology extensively applied in this work is the web service technology to be used by the service providers as a portal to their customers. The web service acts as a medium of communication for the customers to find various hotel accommodations and transportation (vehicles) methods, all in one place with comparable attributes. This integrated approach provides a virtual market place for the providers and customers to meet and share information efficiently.

Various XML message domains used for electronic communication have been standardized by the OTA; however, the standard specifications were designed to support a wide range of tourism, some of which does not exist in Thailand. As a result, only message domains pertaining to Thailand's case will be looked at and applied to the web service developed in this study. The study will also focus on connecting businesses within Thailand, with possible future expansion to handle international clients.

2. Case Studies

SIPA (Software Industry Promotion Agency of Thailand), the responsible government agency for implementing OTA's standards in Thailand, have started a project call "Tourism c-Commerce" to formally handle the implementation process. The process of defining and calibrating the requirements for implementation in Thailand's environment is complete, which includes organizing workshops and seminars with the business owners in Bangkok, Phuket and Chiangmai for market analysis. From this initial phase of study, three domains of messages were selected to be implemented in Thailand, namely hotels, transportation (car rentals) and travel agency message domains. This research is to pick up the process by studying and implementing OTA standard messages in the specified domains as well as building a customized medium to act as the platform for participating businesses to join with one another. The platform in this case is a web portal and UDDI (Universal Description Discovery and Integration) server that will use the developed standard XML messages as the main communication tool. Pilot businesses from all three sectors participated to test system integration and usability.

A study on the OTA has been conducted to look at their process of exchanging information between work systems on a universal specification. The organization has collected data used for the tourism business, such as everyday information needs and business management data. The focus, however, was centered at information used for

online registration and booking. The next step was to specify open messages in the form of XML messages to link and send to other businesses with different platforms. Emphasis was put on response speed, reliability, and information safety for real-time sharing. The corresponding message domains provided by OTA were studied for possible application but, as stated before, Thailand does not use the entire message domains so only the three selected domains were used, carefully chosen for implementation in seminars between business providers and the research team during the initial phase.

The first similarity between these three domains is that they all request information from the client computers hence they all make use of requester IDs (Identification). Secondly, they are all basically the standard industry to accommodate big tourist attraction sites so they are quite valuable to the economic health of a country with big incomes from tourism like Thailand. By being the staple go-to traveling businesses, all three message domains are subsequently large and complex, designed to handle the global network of businesses.

Market analysis was also done to assess possible usage for the three chosen group of businesses, namely hotel, car rentals and travel agencies. Resulting report from the analysis were used to select messages from each domains and choose applicable fields in each messages. It was found that Thailand tourism business is not sophisticated and customizable enough to make full use of OTA standards. Therefore, not all messages and in each domains were used. Also some messages have been reduced or added to match Thailand's requirements such as the nature of local airline services, banking system and transportation methods. However, the changes were minimal to preserve compatibility with original messages.

Another example is the fully customizable room reservation service available in many modern hotel chains. Individual rooms can be selected and allocated to individual names. The comparatively smaller hotel business in Thailand does not support such customization so the messages for this information are subsequently trimmed out.

As for the pilot businesses from the three domains that were picked to implement the standard specifications, the companies from the hotel business were V&M Terrace and Wind Field Resident from Pattaya city. Cosmos Express and Pure Car Rents, based in Phuket province, were pilots from the travel agency and car rental business, respectively. Pattaya city and Phuket province are two of the biggest tourist destinations in Thailand so examples were chosen from the respective places. The pilot samples are also located in different locations throughout Thailand to test the ability to search and integrate nationwide, such as when searching for hotels in Pattaya, results would show only from that region, but if no location is specified, the result would be from all hotels in Thailand.

Experience from these pilot businesses has revealed many issues for actual implementation. Firstly, programming engine support required for implementation in Thailand are .NET, JSP and PHP engines. In the beginning, XSD.EXE from .NET Framework was used to generate Class in .NET engine and JAXB for JSP engines from the XSD (XML Schema Definition) in XML messages. But when read across the platforms, XML messages from .NET engines using XSD.EXE cannot be read by JSP engines. The solution to this problem was to use WSDL (Web Service Definition Language) of the web service instead of XSD schema for JSP engines.

Another issue encountered was difficulties of manual registration of services at the UDDI server. This step requires participating businesses to have technical skills for registration which in turn can become a major barrier to entry for many SMEs. Automatic UDDI registration through web service has been incorporated to fix this problem. This is done by using Microsoft.Uddi.dll, a class library from Microsoft, which calls a function to link and update the UDDI server. The reason for using this particular class library is because the UDDI server used is the Microsoft UDDI server.

3. System Integration and Architecture

With the three domains in mind, a web service was developed to link their businesses for seamless integration. Each individual business can be registered and searched through the web service for comparison with similar service providers. The benefits from this system are two folds as both the end users (customer) and businesses gain from it.

At the outset, the integrated system will replace the current batch system by making bookings real time. The current system without OTA standard works by hotels allocating batches of rooms to various travel agencies to market to customers. With the new system, rather than having to wait until the agencies return the rooms to know room availability, bookings made by travel agencies are notified to the hotels immediately through the web portal where individual rooms can be matched to individual customer, thus updating instantaneously on room availability.

Along with hotels, travel agencies are also empowered by this linkage and take the role of an information hub that pulls available services from the other two domains (hotel and car rental) and bundles them into packages for tourists.

On the consumer side, the integrated system provides the business with market penetration to online customers while the customers in turn gain knowledge about competing services. Because all competing prices are shown in one interface, the integration provides fair competition that leads to comprehensive information sharing from service providers to the users, stabilizing market prices, eliminating inefficient and costly monopolies. The ultimate result is improvement in quality of service and customer satisfaction and at the same time increasing efficiency in the travel business.

The system architecture was designed to internally link information between the service providers in the three business domains with the ability to collect and share the linked information using a universal standard (see Figure 1).

The OTA's standard is in the form of XML messages that can be exchanged between multiple platforms and multiple languages where each system from different business can directly share their information without human interference or interpretation. The ability to switch between different platforms, whether with ASP.Net, Java or PHP, enables the XML messages to be truly universal.

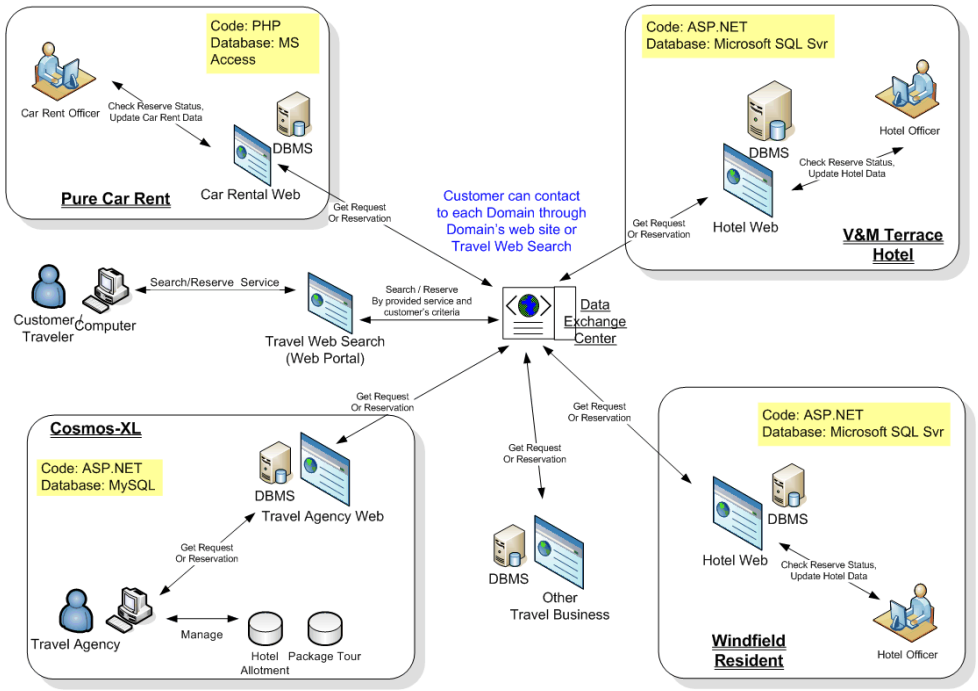

Figure 1. Depicting the system architecture for exchanging information on a universal standard

4. Conclusion

The system specification looks promising for Thailand tourism industry. Pilot companies have shown that the standards can be implemented individually as well as linked together collectively for search and booking purposes. The ability for the XML messages to work on multiple platforms is perfect for a diverse IT environment such as Thailand.

Current obstacles stems from the lack of infrastructure on some parts of the rural areas, mainly the poor access to internet connections. The incomplete infrastructure can slow down the deployment of a full system, which depends on all the parties being connected. In the end, the current project is still incomplete for deployment. Important features for linking with other relevant agencies still need to be developed.

Linkage with vital private sectors like banking and local administration is to be added in later phases of the project. The current system can only notify the providers of payment made by the customer but final payment verification needs to be done manually. Training suitable programmers and pushing for third-party developer support to facilitate use and maintenance of websites and web services is also another challenge that must be addressed. Mutual understanding is very important for the developers to successfully integrate their individual websites.

Future potential lie in the unique Thai tourist attractions which are not included in the OTA standards. Services such as spas can benefit from their own domain set. Thailand's cultural attractions that have little budget can use the system for cheap external linkage, with emphasis on SMEs operating to support the central attraction. The web portal and system integration will help tourist identify and local the local cultural attractions near their accommodations, such as museums, historical sites, indigenous villages and seasonal events. Reaching international standards is also another goal notable for future developments.

The remaining task for the current work process is to move towards expanding the current prototype (Proof of Concept) to give credibility and security of use for the final phase of implementation with the service providers. The partners involved in the whole process include software developers, businesses and standard consultants, SME users and the central organizational agency.

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The development and application of a mobile classroom system for basic services delivery in different culture – An Example of Pattani Malay

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Abstract: In this paper, we present the e-Learning system with the focus on mobile classroom. The system was applied for basic services delivery in Thai Malay ethnic group. We evaluated the performance of the system through a variety of scenarios. The results showed that our system could support up to 200 clients in a general browsing mode.

Keywords: Mobile Learning System, Pattani Malay, e-Learning

Introduction

The ongoing conflict and violence in Thailand's three southern provinces have caused innumerable deaths and injuries to both military personnel and civilians alike. Thai governmental organizations and Non-governmental organization realized the seriousness of this issue and banded together to solve this crisis. Although the government has allocated both financial and military resources to tackle the problem, the result has not been satisfactory.

The center for the study of conflict and cultural diversity in southern Thailand (CSCC) [1] conducted a research to measure the level of trust the locals have with respect to various organizations in the area. Figure 1 shows the outcome of the research. The result indicates that while soldiers and polices have high presence there, locals place them last in terms of trust.

Part of the problems that affects trust is the language barrier. Pattani Malay or Yawi is a dialect most spoken in the provinces of Pattani, Yala, and Narathiwat, and 4 districts in Songkhla. It is the primary spoken language of the Thai Malay ethnic group. It is also a common second language amongst ethnic Thai Muslim; both group constitute the majority of the population in the danger zone.

Presently, government officials including soldiers and polices who cannot speak this dialect face extreme difficulties in communication when working in the area. To earn trust from the locals, speaking their language is a primary step.

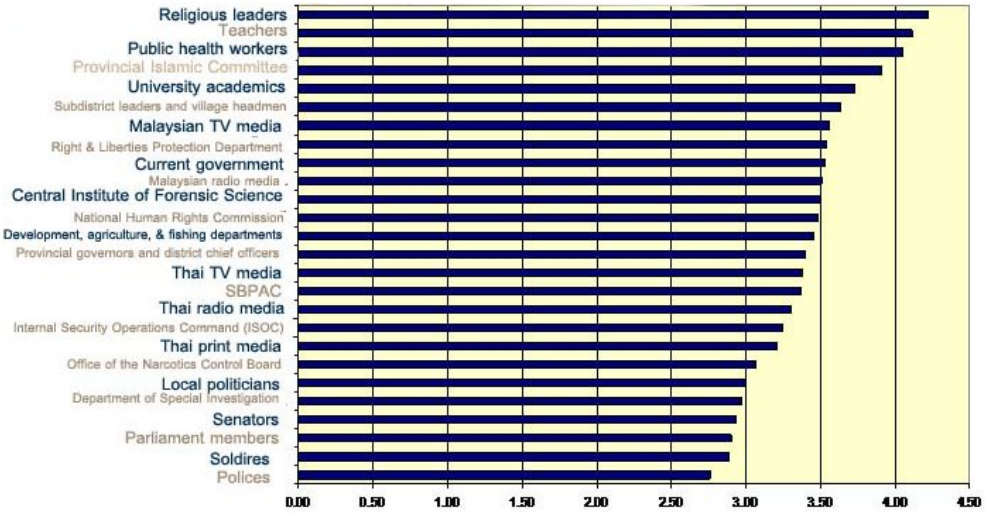

Figure 1. Levels of trust in people in various agencies and organizations.

This paper aims to address the language problem by providing an e-learning framework to these government officials. Due to the mobile nature of their works, we propose a mobile classroom system [2] where lessons could be accessed via mobile devices.

1. Mobile Classroom System Implementation

The Mobile Classroom System (MCS) provides Pattani Malay language lessons in there forms: videos, vocabulary, and quiz. Currently, it contains 15 categories as shown in table 1,that can be access through a mobile device.

Table 1. Lesson categories

1) Greeting and Introduction	2) Date and time	3) Color
4) Places and journies	5) Clothing	6) Vehicles
7) Public service	8) Checkpoints	9) Sickness
10) General characteristics	11) Counting	12) Vocations
13) Food and vegetable	14) Body anatomy	15) Pets

1.1 Learning System Introduction

We use LearnSquare[3] to implement the mobile classroom system. LearnSquare is a Thai open source Learning Management System (LMS). In LMS the user will be able to read, modify and share the source codes of this software. LearnSquare is a client-server based in which a courseware is stored in a server and the users can request the contents through the system. The system responses to those requests by delivering the content to the users. This mobile classroom is a web applications can be used directly from cdrom, a usb stick or from any folder on hard disk without the hassle of configuring system parameters[4]. The system can be used to create a standalone working mobile classroom.

Our current implementation, the MCS allows clients to access Pattani Malay lessons through normal mobile devices. In a client-server based manner.

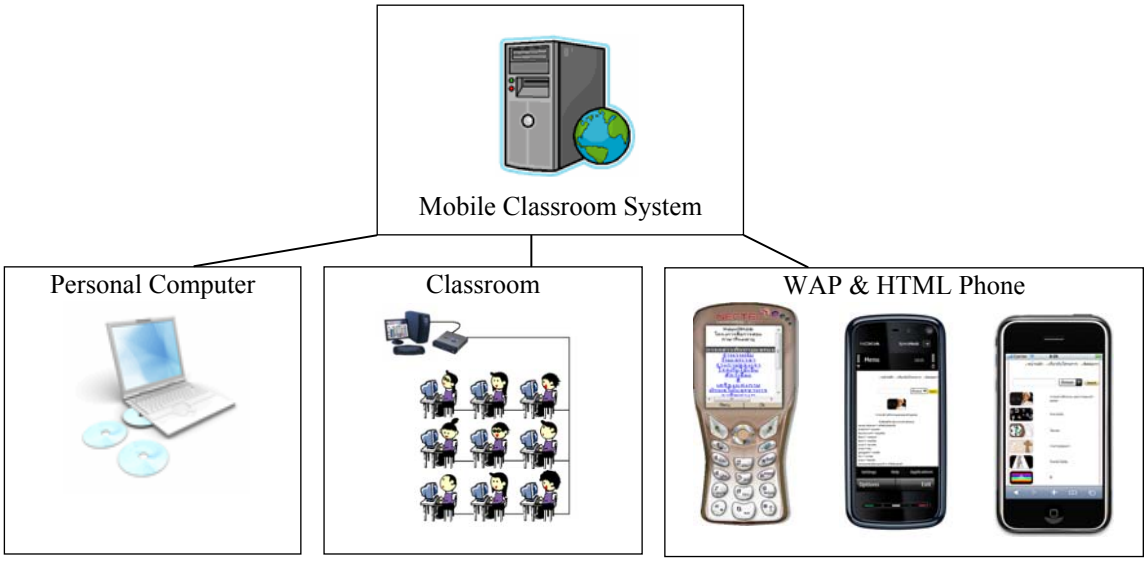

Figure 2. Mobile Device Learning

As shown in Figure 2, MCS allows learners to access lessons through: personal computers, classrooms, and mobile phones. We also take into account of the limitation of device (i.e., mobile phones) and adapt lessons accordingly.

2. Mobile Classroom System Evaluation

We test the performance of the mobile classroom system using a 500GB usb hardisk connected to 3GHz Dual Core AMD Athlon 64 with both 100Mbps network. We simulate client usage scenarios based on the following assumptions:

- Client machine specifications meet the minimum requirement.
- Clients and Severs belong to the same network switch.

2.1 Evaluation Procedures

The following steps are used in our evaluation procedures.

1. Collect data to approximate real usage scenarios including server settings, internet connection, client machines, and type of usages.
2. Study and understand software used for simulation .
3. Write scripts to simulate real usages from the clients.
4. Write scripts that vary server configurations and connection speeds.
5. Collect data.
6. Analyze the results.

2.2 Mobile classroom system evaluation

We use the following software for our benchmarking process

- Webload[5] is used to simulate service requests by using one computer to simulate multiple computers. Using user written scripts, Webload can send multiple requests to a target server with varying data size to simulate various scenarios.

- Vmstat is a linux command. It is used to measure the CPU load of the target server.

To test our system, we collect data from potential users and categorize system usages into four types: browse, explore, study, and download. As shown in table 2, each scenario has different percentage distributions of those usages.

Table 2. Scenario specification

The usage	**Description**	**Scenario**		
		Type 1	**Type 2**	**Type 3**
Browse	Retrieving at least three pages from a single lesson.	50%	20%	20%
Explore	Retrieving three videos from a single lesson using a three-minute gap.	20%	50%	20%
Study	Retrieving one 5-minute length video	20%	20%	50%
Download	Downloading three documents from a single lesson	10%	10%	10%

To ensure a good coverage of real usage behaviors, we control the range of the following variables: usage type, load size, memory, and network. The detail is outlined in table 3.

Table 3. Control variables

Fix variable	**Test value range**
Usage type	Browse, Explore, Study, Download
Load Size (No. of mobile devices)	100, 200, 300, 400
Memory	1 GB
Network	100 Mbps

We analyze the performance of our system based on the following attributes:

- Throughput (Megabyte/sec.): The amount of data transferred from a server to all its clients.
- HTTP request (Hits Per Second): How many requests clients send to the server.
- Script execution time: Time taken to run a simulation script from the beginning to the end.
- Response Time (sec.): Time taken for the server to complete a request.
- The percentage of CPU Usage.

The goal of our performance is to find the balance client load with an acceptable response time. In our case, the acceptable response time is about one second [6]. Among all usage types, we expect the browsing mode to have least effect on the overall response time for each scenario, because the browsing mode only retrieves a couple of pages while other modes require much more data.

Figure 3 shows the result from the browse usage type. The x axis shows the length of the simulation in second. The left y axis shows the server response time in second and the right y axis shows the number of clients. The result indicates that MCS works best (in terms of the response time) when the number of clients is around 200.

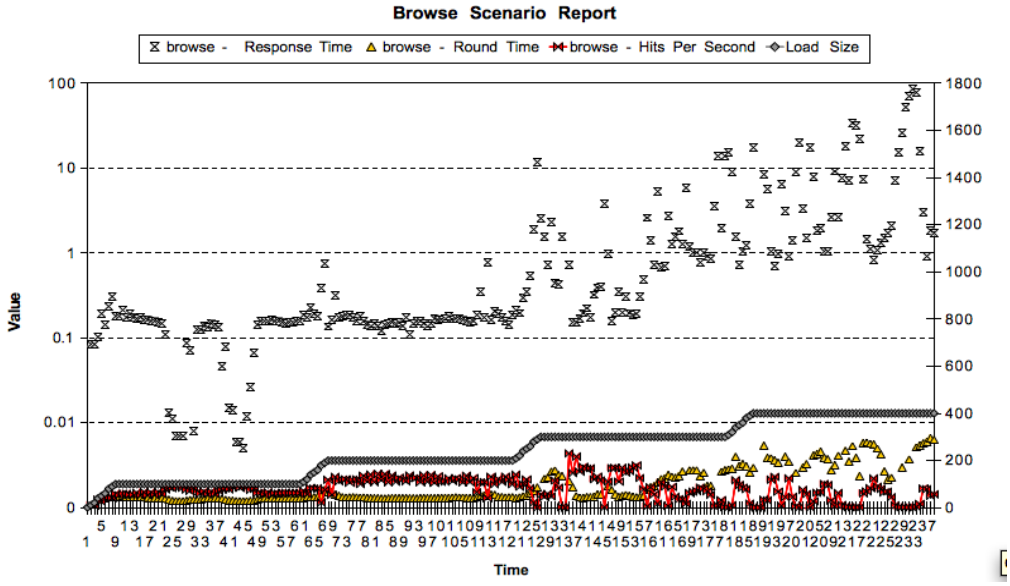

Figure 3. Simulation results

1. The response time for the browse scenario is best suited to measure the server maximum load because it required immediate responses to requests.
2. At 100 Mpbs, the server can only handle about 200 clients because the average data transfer in each scenario is roughly 11 Mbyte/sec.
3. The response time for the explore, study, and downloading scenario will not require immediate responses compared to the browse scenario because theses scenarios do not require immediate response; the file types in these scenarios are video files and pdf files.

3. Conclusion

E-learning techniques and infrastructure can be adapted to use both in and out of classroom by the use of mobile device. In this paper, we apply the infrastructure to disseminate the knowledge about service delivery to governmental personnel working in a danger area who desperately need to get along with the locals but are limited by a language barrier. This paper introduces our mobile learning system. We also discuss possible usage scenarios and present the result from our simulation tests. The results indicate that if we want to ensure a good response times from our system (1 second), the number of clients that simultaneous access our system should be around 200.

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- Workshop 3 -
International Workshop on Design and Experiments of CUMTEL (Classroom, Mobile and Ubiquitous Technologies Enhanced Learning)

Kwok, L.F., Kong, S.C., Charoenporn, T., Hirashima, T., Kojiri, T., Mitrovic, A., Ogata, H., Sornlertlamvanich, V., Supnithi, T., Takenaka, M., Tarumi, H., Thaiupathump, C., Wang, F.L., Yu, F.Y., Yu, Y.T. (eds.) (2009). *Workshop Proceedings of the 17th International Conference on Computers in Education [CDROM]*. Hong Kong: Asia-Pacific Society for Computers in Education.

Call for Workshop Papers

International Workshop on CUMTEL (Classroom, Mobile and Ubiquitous Technologies Enhanced Learning)

1. Brief description of the workshop

Increasingly, technology enhanced learning (or TEL) scenarios are conceived in an integrated perspective beyond certain pieces of software running on single computers and also beyond web-based learning environments for single users. New ideas are centered around combining different software tools, web resources and also new peripherals (non standard hardware such as smart objects and mobile devices) in a way that improves "educational workflows", avoiding discontinuities in the learning processes and in the creation, transformation, aggregation and re-use of learning objects. Classroom, Mobile and Ubiquitous Technologies Enhanced Learning (CUMTEL) are the concrete manifestation of this trend. The potential prevalence of CUMTEL suggests that, in the forthcoming years, there will be a considerable adoption effort of technological innovations in educational practices.

The aim of this work is to provide a forum where international participants can share knowledge on the latest developments in CUMTEL and map out directions for future developments and research collaborations. The series of CUMTEL, the former name was MULE (Mobile and Ubiquitous Learning Environments), workshops started in Beijing, China, December, 2006, at ICCE2006 and the 2nd workshop was held in Hong Kong, August 2007. The 3rd workshop took place in Hiroshima Japan, in November 2007 at ICCE2007 and the 4th workshop was a doctoral student consortium in Taiwan at ICCE2008 in October 2008. CUMTEL 2009 was held in Tokushima, March 26-28, 2009. This will be the 6th workshop on CUMTEL.

2. Basic themes and topics (but not-limited):

- Extending awareness and contextualisation in CUMTEL
- Integration of CUMTEL into broader teaching/learning processes
- Intelligent support for CUMTEL (user modelling, profiling, ...)
- Artificial agents or robots in CUMTEL (architectures, examples, techniques, ...)
- Game design in CUMTEL
- Emotional design and motivational support in CUMTEL
- Domain specific applications (e.g., language learning, mathematics)
- Experimental usage and evaluation of CUMTEL
- Theories of mobile and ubiquitous learning

Kwok, L.F., Kong, S.C., Charoenporn, T., Hirashima, T., Kojiri, T., Mitrovic, A., Ogata, H., Sornlertlamvanich, V., Supnithi, T., Takenaka, M., Tarumi, H., Thaiupathump, C., Wang, F.L., Yu, F.Y., Yu, Y.T. (eds.) (2009). *Workshop Proceedings of the 17th International Conference on Computers in Education [CDROM]*. Hong Kong: Asia-Pacific Society for Computers in Education.

Adaptive Kanji Learning Using Mobile-based Email

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Abstract: This paper describes an adaptive learning system based on mobile phone email to support the study of Japanese Kanji. In this study, the main emphasis is put on using the methods of adaptive learning to resolve one common problem of the mobile-based email or SMS language learning systems. To achieve this goal, our main efforts are made on three aspects: sending the contents following learners' interests, adjusting the difficulty level of the tests to suit each learner's cognitive level and adapting the system to their learning styles.

Keywords: Mobile learning, mobile-based email, learning Kanji, adaptive learning system

1. Introduction

Recent years because of the low price and widespread use of mobile phone email or SMS, a considerable amount of research has been done on using them in language learning [2-4]. And it has been clearly proved that the text messaging service function is very useful for vocabulary learning. However, due to the limitation of the text function, a common problem on these systems has been pointed out by some researchers. For example, Kukulska writes that many of these studies ignored the 'anytime, anywhere' affordances supposedly offered by mobile devices and they usually send texts to users at set times, on set days instead of learners being able to obtain this information when they want it [1]. Mellow even tells us that the texts are sometimes perceived as "mobile phone Spam" [5]. In a word, the learners occasionally are reluctant to accept or study the materials that they received. In this paper, we call this problem "spam problem".

We analyze that the "spam problem" can be accounted for several reasons. The basic reason of this problem is because mobile phone email or SMS is a kind of push mode. Push mode means that the messages are sent by the server instead of requested by the client. Hence, generally the server does not know when the learners want the materials. As a result, they have to be sent at set time. However, we find the essence of "spam problem" is that these systems are lack of adaptability. For example, these systems do not know the learners' interests, so that the learners sometimes have no interest in the texts they received; they also pay little attention on the learners' cognitive level that the materials are sometimes too difficult or too easy for learners; the learners' learning styles are neglected too that the system does not know when is the best time to send the texts. Therefore, in our study we seek to resolve this "spam problem" by applying the methods of adaptive learning.

The rest of this paper is structured as followed: in the first section, we will describe the implementation of this system including the main process of the system and the

architecture of it. Then we will focus on introducing three aspects of the adaptability of our system. Finally, conclusions and future work are summarized.

2. System implementation

2.1 Main process of the system

Our system is based on the JLPT vocabulary lists. The JLPT is a standardized test to evaluate and certify the Japanese language proficiency of non-native speakers. It has four levels. By making use of the JLPT vocabulary, we have created the main function of the system: composing tests of Kanji pronunciation automatically and sending them to learners. But unlike the push mode adopted by many other systems, a request mode is mainly used in our system. And Figure1 gives an example of using our system in request mode whose process can be almost divided into four steps:

- First, the learner should send an empty mobile phone email with a constant subject to the system for requesting a test.
- Then the system will process with the request email and compose a test of Kanji pronunciation based on the learners' information, like JLPT level.
- In the third step, the learner can reply the questions by typing the answers into the brackets and send them back to the system.
- Finally, the system will check the answers, record the information of the test and return back the feedback including right answers, English meanings, and example sentences.

This is what we called request mode. We believe that with request mode learners can fully enjoy the "anytime, anywhere" offered by the mobile device [1].

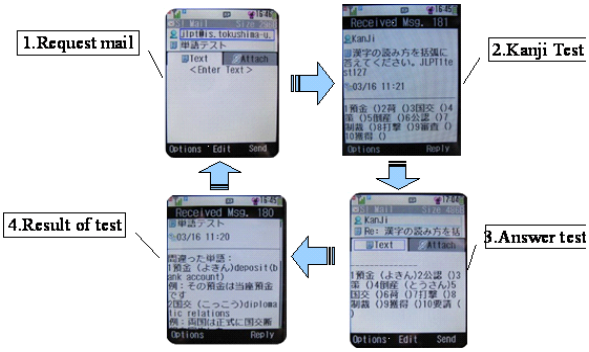

Figure 1 the flow of request mode

2.2 System architecture

Figure 2 shows the architecture of our system. As you see, the system has a hierarchical modular architecture organized on three layers:

(1) Database layer: it consists of words data, learners' info, and tests' logs. We have to mention an additional function of our system that our system is designed to access some RSSs (Really Simple Syndication) of several Japanese big news websites every day such as Asahi news and Yomiuri news. Therefore, besides the words in JLPT vocabulary lists, the frequency of each word and the example sentences can also be obtained with this function.

(2) Adaptive layer: this layer is the model we have built to adapt the system to individual learner and we will introduce it in the next section.
(3) Function layer: this layer includes the main functions of this system, like pushing a test as a reminder, processing with the request mail, composing a test and checking the results of each test. Among these functions, composing a test is the core function of the system. In fact to create a test for a learner, besides his or her JLPT levels and interests, this learner's answer history is also taken into account. Concretely speaking, the words that the learner has answered correctly will not be sent to him or her again and the wrong ones will be sent once more.

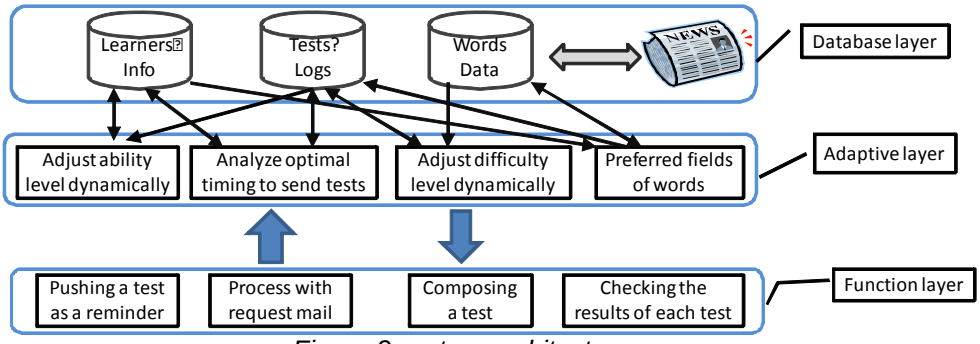

Figure 2 system architecture

3. Adaptive learning system

As described above, we want to use the methods of adaptive learning to straighten out the "spam problem". And our main work has been done on three aspects:

3.1 Correspond with learners' interests

We analyze that one reason of the "spam problem" is that the learners are not interested in the materials which they received. Consequently, in order to make the learners enjoy the materials they received, the system should understand the students' requirements and preferences. For this purpose, we seek to find the answers from the students' learning styles.

In daily life, we find that every learner has his or her special interests in some certain fields. For example, when reading news some people are enthusiastic about sports while some other people prefer to read about politics. And in different fields, the words used frequently differ greatly, like "baseline" "defense" are easy to be seen in the sports news whereas "dispute", "profit" belong to the economic field. Therefore, we provide the learners with some fields, like sports, culture, and so on. Because our system can calculate the frequency of each word in different kinds of news, so the words used most frequently in the learners' favorite fields will be sent to them. Besides, the example sentences are also from these fields.

3.2 Dynamical Adjustment

As mentioned before, in order to make the difficulty level of the tests suit the learners, we send the tests to the learners based on their JLPT levels. However, we find that sometimes there may be a mismatch between the learner's ability level and the difficulty level of the tests. For example, some learners can get 90 points in a test but some others which are in

the same level can get only 60 points or even lower. And the same thing happens on the questions. So even though the tests sent to the learners are according with their JLPT levels, the fact tells us that the difficulty levels of the questions do not suit every learner so well.

To clear up this problem, we propose to adjust both the difficulty levels of the questions and the learners' ability levels dynamically to make the two parameters match each other. In Figure 3 we take the level 2 as an example and as you see, from the JLPT level which is called basic level, we have developed an additional level: dynamic level which is adjusted by the learners and questions' correct rates. So when one learner's correct rate is above 80%, his or her dynamic level will be up and when the learner's correct rate is below 30%, his or her dynamic level will be down. The difficulty levels of the questions are processed in the same way. Therefore, when a test is composed for a learner, not only his or her basic level (JLPT level) is taken into account, but also his or her dynamic level is corresponded with the dynamic level of the words. And by this way the difficulty levels of the tests get adjusted to the learners' cognitions.

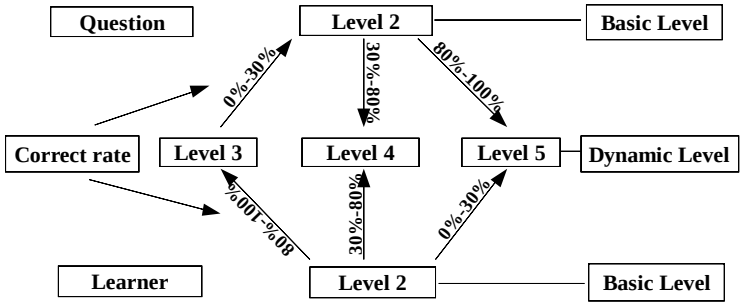

Figure 3 dynamically adjust

3.3 Determine an optimal sending timing

Though we said the request mode can help the learners enjoy the convenience of "anytime, anywhere", we still find that if only with request mode, the learners tend to forget to use the system. Hence, we think that the best way is to use both modes. And in our system the push mode will be improved and taken as a reminder to prompt the learners.

According to Levy & Kennedy's questionnaire, it is very difficult to determine every learner's preferred receiving timing, since every learner has individual demands [2]. However, we find that many learners have their own learning style. For example, the data in Table 1 which comes from the experiment we have done shows one learner's reply times in different periods of a day and from the data of Table 1 we can presume that this learner prefers to receive the tests between 20:00 to 22:00 when he or she may be returning home by train. Thereby, we can speculate a learner's preferred receiving timing by analyzing his or her answer history and push a reminder test to the learner at that time. Even though not everyone has a constant life style, we still believe that in this way we can find out a relatively appropriate time for most of learners.

Table 1 A learner's reply time and times

Reply time	0:00 ~ 7:00	7:00 ~ 9:30	9:30 ~ 11:00	11:00 ~ 13:30
Number of times	0	3	0	0
Reply time	13:30 ~17:30	17:30 ~ 20:00	20:00 ~ 22:00	22:00 ~ 24:00
Number of times	1	1	7	2

4 Conclusion and future work

This paper described an adaptive learning system for Japanese Kanji study via mobile-based email. In our system, we increased three aspects of adaptability of the system to resolve one common problem of the MESLL systems. About future work, we plan to extend our system from Japanese Kanji learning to some other languages learning, such as English or Chinese.

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Enhancing Self-regulated Learning by Using One-to-one Digital Ink eBag with eBooks

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Abstract:

The purpose of this study was to examine the effect of the use of one-to-one digital ink eBag (Tablet PC) with eBooks on students' self-regulated learning, referring to self generated thoughts, feelings, and actions, which were systematically oriented toward attainment of students' own goals [16]. An elementary school started a learning and teaching scheme: one-to-one digital ink eBag with eBooks since 2005. This study investigated whether the use of one-to-one digital ink eBag with eBooks enhanced students' self-regulated learning, inquired the relationship between one-to-one digital ink eBag with eBooks and students' self-regulated learning, and explored the way one-to-one digital ink eBag with eBooks enhancing students' self-regulated learning. The research subjects were 190 students from Grade Four to Grade Six and 103 of them used eBag in their daily learning activities. A self-report questionnaire, based on the relevant part of the Motivated Strategies for Learning Questionnaire, was used to measure students' self-regulated learning and corresponding student interview form were used in the interviews. Research results revealed that the use of eBag could enhance students' self-regulated learning because students utilising eBag used significantly more self-regulating strategies, one of the major dimensions of self-regulated learning. Moreover, this study found that the longer time students spent in using the eBag, the higher self-regulation they could achieved. The General Expectancy-value Model of Motivation was used to analyse the data, finding that the students utilising eBag used significantly more rehearsal strategies and effort management strategies, two key sub-scales of self-regulated learning.

Keywords: mobile learning, self-regulated learning, Tablet PC, one-to-one computing, digital ink, eBag, eBook

Introduction

The use of eBag and eBook was an important discussion recently in Hong Kong. eBag was a digital counterpart to each student's physical school bag [4] while eBooks could be defined as paper books that converted to a digital format to allow information to be displayed on digital devices [14]. An elementary school in Hong Kong supported students to learn with eBooks in one-to-one digital ink eBags in their daily learning activities since 2005.

In the following paragraphs, the critical terms of this study are defined first to outline the scope of the research. One-to-one computing refers to the ratio of at least one computing device for each student or a student used at least one computing device for learning [14]. With the connectively and mobility, one-to-one computing could be also referred to "anytime, anywhere technology for every student" [14]. Digital ink computing means emulating annotation ability on a computer. According to Bargeron and Moscovich's study (2003), annotation in the text materials and documents was an important part of the learning process [3].

Regarding self-regulated learning and eBag, Li et al.(2008) have studied the school which this research investigated, finding that there were many advantages of using one-to-one digital ink eBag with eBooks. One was enhancing students' self-regulated learning, referring to self generated thoughts, feelings, and actions, which were systematically oriented toward attainment of students' own goals [16]. It was because the

use of eBag helped students to identify, record, organise and manage a variety of learning materials effectively.

Pintrich and Groot (1990) studied and examined the relationships between self-regulated learning and classroom academic performance. They concluded that there was a positive relationship between self-regulated learning and classroom academic performance. The students' self-regulated learning could be the indicator of students' academic performance. Therefore, it was significant to conduct a further study on Li et al.'s study of eBag at the same school mentioned before because there is positive relationship between self-regulated learning and classroom academic performance. This study focused on three research questions:

1) Does one-to-one digital ink eBag with eBooks enhance students' self-regulated learning?
2) How does one-to-one digital ink eBag with eBooks related to students' self-regulated learning?
3) How does one-to-one digital ink eBag with eBooks enhance students' self-regulated learning?

1. One-to-one digital ink eBag with eBooks scheme

As showed in Table 1, based on the literature, the target school's eBag scheme could be justified as an one-to-one digital ink eBag with eBooks scheme.

First, it could be a one-to-one scheme because each student in the scheme owned one computer; unlike the situation in other eBag schemes where the eBags were commonly owned by schools kept at schools. Such arrangement made the learning devices could only be accessed by students easily. In this scheme, the eBags became students' "learning companions" because the students owned their eBags as the tools in their daily learning in both school and at home. To make this happened, the target school gained supports from the parents. Parents who volunteered their children to join the scheme were required to purchase a Tablet PC as the eBag and took the full ownership of the eBag.

Second, digital ink was widely be used in that school. In this case, Tablet PC, a pen-based computer, was applied in both teachers and students level which made the advantages in the learning process. For instance, students could use digital ink to draw mind-maps to frame their inquiry and to write annotations or summaries on documents in both Chinese and English with the stylus.

Third, the main idea of the eBag project was the use of eBag and eBook. Students of the eBag classes no longer needed to bring along their textbooks to school because eBooks were installed in their Tablet PCs. In addition, most of the students' homework was in digital format. For the eBooks that school adopted, the digital version of textbooks with multimedia, animations and interactive games, developed by the publishers, were installed in teachers and students' Tablet PC to support teaching and learning in almost all subjects (Chinese Language, English Language, Mathematics, General Studies, Music, Visual Arts and Putonghua) [8]. As a result, these eBag students, the students using eBag, could favour the learning advantages from the descriptions of the literature.

Table 1: Summary of comparing literature review with the target school's eBag scheme

	Literature reviews	Target school's eBag scheme
One-to-one computing	The ratio of at least one computing device for each student or a student uses at least one computing device for learning [6]; Anytime, anywhere technology for every student [13].	Students owned their eBags as the tools in their daily learning in both school and at home [8].
Digital ink	Emulate the annotation ability on a computer [2]; Digital ink could storage persistently in the softcopy of the documents [3].	A Tablet PC, pen-based computer, was applied in both teachers and students level [8].
eBag	A digital counterpart to each student's physical school bag [1].	Students of the eBag classes no longer needed to bring along their textbooks to school as eBooks were installed in their Tablet PCs [8].

	Literature reviews	Target school's eBag scheme
eBooks	Paper books that converted to a digital format to allow information to be displayed on digital devices [6]; Multimedia, hypertext or hypermedia systems could also be added in the eBooks [6].	The digital version of textbooks with multimedia, animations and interactive games, developed by the publishers, were installed in teachers and students' Tablet PC to support teaching and learning in all subjects [8].

2. The General Expectancy-value Model of Motivation

Pintrich, Smith, Garcia and McKeachie (1991) had created General Expectancy-value Model of Motivation with a measurable instrument: the Motivated Strategies for Learning Questionnaire (MSLQ). According to Rotgans, Alwis, and Schmidt's study (2007), the General Expectancy-value Model of Motivation was a widely used to analyse students' motivation and self-regulated learning strategies. The General Expectancy-value Model of Motivation was developed by using a social cognitive view of motivation and learning strategies, with the students represented as an active processor of the information whose beliefs and cognitions mediated important instructional input and task characteristics [10]. The framework was based on the motivational model of expectancy-value with the objective of measuring different motivational components and the use of learning strategies. In this study, the scale of learning strategies would be adapted to analyse since this research was focused on the self-regulated learning. In addition, to have an in-depth study with the research questions, sub-scales with items of rehearsal, elaboration, organization, metacognition and effort management were used.

TableTable 2 listed the scales, dimensions and sub-scales of the General Expectancy-value Model of Motivation [9].

Table 2: The General Expectancy-value Model of Motivation scales and subscales [9]

SCALES	MOTIVATION			LEARNING STRATEGIES	
Dimensions	Expectancy components	Value components	Affective components	Cognitive strategy use	Self-regulating strategies
Sub-Scales	● Control beliefs ● Self-efficacy	● Intrinsic goals ● Extrinsic goals ● Task value	● Test anxiety	● Rehearsal ● Elaboration ● Organization ● Critical thinking	● Metacognition ● Time and place of study management ● Effort management ● Peer learning ● Help-seeking

: Not included in this study because they were not the research foci [12]; [15]

3. Research Design

The research design is discussed in this part. There were 90 students from Grade Four to Grade Six included 103 eBag students who participated in this study.

3.1 Research Approaches

In this research, a case study design was adopted with a quantitative and qualitative approach. There were two main instruments used in this research: self-report questionnaire and student interview form. They were both based on relevant part of the Motivated Strategies for Learning Questionnaire (MSLQ).

3.2 Sampling

The intended target population of this study was 203 students from six classes, coming from Grade Four to Six (named as 4A, 4B, 5A, 5B, 6A and 6B). The three "A" classes (4A, 5A and 6A) were the eBag classes in which one-to-one digital ink eBag with eBooks were adopted. 4A class started using eBag since 2008, 5A and 6A class started since 2007 and 2006 respectively. For the rest of students, they were non-eBag classes and just used traditional paperback textbooks and related course materials.

3.3 Data analysis

The procedure started by crosschecking the data to ensure the validity and reliability of all data. Then descriptive analysis was processed as the foundation for analysing the data to answer the research questions. The aim of this descriptive analysis was to generate quantitative data which described the differences among variables like eBag class,

non-eBag class, year of using eBag, age, etc. In order to find out the correlation between different factors, a bivariate correlation analysis was adopted. The degree of relationship was expressed as a number between -1 and +1 as the correlation coefficient [7]. Finally, the key theoretical framework of this research: the General Expectancy-value Model of Motivation, was adopted to analyse the findings and then answer the research questions. The data from student questionnaires was supplemented with data from interviews.

4. Research Findings and Discussion

The findings of this study are discussed with reference to the three research questions.

4.1 The use of one-to-one digital ink eBag with eBooks enhanced students' self-regulated learning

An independent t-test of the eBag and non-eBag classes and self-regulated learning had been done to see whether there was significant difference between the eBag and non-eBag students' self-regulated learning.

The findings (Table 3) showed that, for the eBag classes, their self-regulated learning with all sub-scales was enhanced by the use of one-to-one digital ink eBag with eBooks but only statistically significant with some sub-scales, like rehearsal strategies and the effort management strategies. The self-regulated learning was enhanced mainly because of using more self-regulating strategies, one of the major dimensions of self-regulated learning ,in their daily use of one-to-one digital ink eBag with eBooks.

Table 3: The effectiveness of the use of one-to-one digital ink eBag with eBooks in enhancing self-regulated learning

	Enhanced by using one-to-one digital ink eBag with eBooks	t-test for Equality of Means		
		t	df	Sig. (2-tailed)
● Cognitive Strategies		1.487	188	.139
■ Rehearsal Strategies	✓	2.437	188	.016*
■ Elaboration Strategies		.137	188	.891
■ Organizational Strategies		.827	188	.409
● Self-regulating Strategies	✓	1.977	188	.049*
■ Metacognitive Strategies		.460	188	.646
■ Effort management Strategies	✓	2.542	188	.012*

✓: *Significant at 0.05 level (2-tailed)*

4.2 The relationship between one-to-one digital ink eBag with eBooks and students' self-regulated learning

This study found that self-regulated learning and the year of using one-to-one digital ink eBag with eBooks was in positive relationship (the correlation 0.129 was significant at the .05 level (1-tailed)). That was, the longer time students spent in using this kind of eBag, the higher self-regulation they could be achieved.

4.3 The ways one-to-one digital ink eBag with eBooks enhanced students' self-regulated learning

This study also provided an empirical base for elaboration of the theoretical linkages between the use of one-to-one digital ink eBag with eBooks and the self-regulated learning. As mentioned, the General Expectancy-value Model of Motivation with survey results and interview data were adopted in analysing the way of using of one-to-one digital ink eBag with eBooks enhanced the self-regulated learning in different sub-scales. The use of one-to-one digital ink eBag with eBooks likely enhanced students' self-regulated learning by enhancing the usage of rehearsal strategies and the effort management strategies. TableTable 4 below was the summary of the findings of the ways of using one-to-one digital ink eBag with eBooks in enhancing self-regulated learning in sub-scales.

Table 4: The qualitative findings of using one-to-one digital ink eBag with eBooks in enhancing self-regulated learning

	One-to-one Computing	Digital Ink	eBag	eBook
Cognitive Strategies				
Rehearsal	Student could view teacher's course materials provided by his/her own computer	Students could annotate on the teachers' course materials provided	Teachers could use software, like, Classroom Presenter, to transmit teachers' notes and handwriting to students' eBag	* No relevant findings in this area
Self-regulating Strategies				
Effort Management	Student could use his/her own computer in their daily learning activities	The feature of digital link provided a learning tool assisting the students to annotate and most importantly, a natural way to input data into their computer while doing the searching and information management	The eBag provided an easy and convenient platform for them to explore more materials and content to extend their learning scope	The use of eBook fostered collaboration and interaction among students; it made learning more funny by the entertaining and educational features, and provided more examples and illustration of the meanings to students by sounds and 3-D animation in the eBooks

5. Conclusion and Limitations

This study found that the use of one-to-one digital ink eBag with eBooks could enhance students' self-regulated learning because of using more self-regulating strategies. Moreover, the longer time students spent in using this kind of eBag, the higher self-regulation they could achieve. The reason of the above mainly because of the eBag students used significantly more rehearsal strategies and effort management strategies than the non-eBag students. Based on these findings, it was suggested enhancing the following skills of the eBag students: (1) summarising their learning materials with their own words by making use of the notes taking or audio and video recording features of their eBag to further develop their elaboration strategies, and (2) using calendar applications to enhance their metacognitive strategies.

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Fantasy in Educational games: they can go together?

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Abstract: This paper explores potential of fantasy in educational games, as a learning facilitator for more successful game in learning. Fantasy is meaningful in educational games in terms of cognitive and emotional aspects. Fantasy requires that it be regarded as one of the instructional strategies. Fantasy can be sorted as one of the design factors, such forms as response, narrative, and creative. This exploration is expected to expand the horizon of designing educational game.

Keywords: fantasy, learning in game, fantasy in game, fantasy and learning

Introduction

Game has a number of potential as a learning environment. To create successful educational games, however, are not easy. A typical pitfall associated with creating and using games is "conflict between educational goals and the characteristics of games" [1]. One of the game characteristics that may conflict with educational goals is the fantastic. As asserted by Alessi and Trollip [1], fantasy may distract learners from the educational goals as they become immersed the fictional world. That is, the more convincing and enjoyable fantasy, the more problematic. This paper, however, explores potential of fantasy in educational game, as a learning facilitator for designing more successful educational games.

1. About fantasy

1.1 Definition of fantasy

Malone and Lepper [8] define fantasy as an environment that “evokes mental images of physical or social situations not actually present.” Psychiatric researchers define fantasy as a “defense mechanism” for the fulfillment of wishes and the resolution of conflict [3] [5]. According to Hume [6], Fantasy is any departure from consensus reality, an impulse native to literature and manifested in innumerable variations, from monster to metaphor. As indicated by Tolkien [13], the reason why we use “fantasy” is, which combines with its older and higher use as an equivalent of imagination the derived notions of unreality, of freedom from the domination of observed “fact”, in short of the fantastic.

As described above, the definition of fantasy could be like this:

Fantasy is an imaginative personal mental process or operation. It is a fictional means for substitute behavior that intends to fulfill human's need by escaping the present.

1.2 Fantasy patterns of expression

Judging from definition of fantasy, fantasy patterns of expression are like Figure 1.

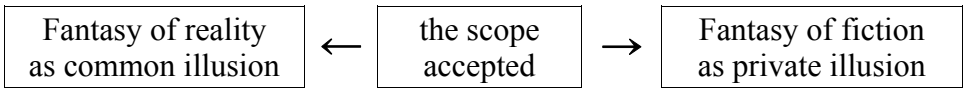

Figure 1 fantasy patterns of expression

1.2.1 Fantasy of reality as common illusion

Games with no fantasies involve only abstract symbols [9]. This pattern of fantasy is to experience mental operation or process based on the real. The real is represented by some specific culture of the related people on the game. The real of learner and designer is made up of their culture and their cognition formed by socialization. Not only do objects or storyline bias in game, by means of the absolutism perspective, but also they have elements of the culture of human so called common illusion. Ego, moral laws, religion, economy, science, and arts called as human culture are shared as common illusion. Common illusion can be separated by a scope such as the world, a country, and a group. The wider scope accepted illusion for communication, the more perceived that it is real. Representations in game reflect designer's view, which is a fusion of their common illusion. Objects and storyline which we have felt authentic or realistic are cultural results. Personally mental operation and process arouse fantasy of reality as common illusion by interacting with real symbols.

1.2.2 Fantasy of fiction as private illusion

This pattern is to experience imaginative mental operation or process so called defense mechanism for the fulfillment of unconscious wishes and the resolution of unconscious conflict [3]. Wishes and needs take one's mental ground. A feeling of satisfaction is begun to escape the present. It provides opportunities to undergo achievements couldn't be gained in actual land. Human are able to meet their needs through fantasy, and then they feel catharsis. That is the point immersed oneself in a game.

1.3 Fantasy, the fantastic

For widening degree of understanding about fantasy as a learning facilitator, we need to separate terms between fantasy and the fantastic. Fantasy is very subjective mental process whereas the fantastic is just factors for evoking fantasy. Game designers can only design the fantastic, not fantasy. Compared to fantasy which involves an overall supernaturally mental operation, the fantastic is rooted in modern reason (idea) through the culture of human [2]. The fantastic applies to epistemological efforts in order to envisage the reality in itself in unclear distinction exists in the nature and super nature [2].

When gamers interact with the fantastic more and deeper, fantasy easily occurs. If the fantastic is based on common illusion, of course, the fantasy occurs more commonly

and arouses sympathy. The fantastic is just a shift of reality, a fiction, and a mechanism for squibbing fantasy.

2. About fantasy focused on design

2.1 Types of fantasy

Generally speaking, fantasy is separated endogenous or exogenous aspect in a game [8]. Considering fantasy as a learning facilitator, however, to sort fantasy in terms of game design as instructional components, fantasy may be classified 3 types as follows.

2.1.1 Fantasy as response

It triggers by fantastic features made by media characteristics, which are so called "bells and whistles". Sometimes it is used a feedback system to gamers for supplying rewards, when a gamer accomplishes the mission, such as sound and message of congratulations, shining images or 3D actions, etc. It is based on behaviorism.

2.1.2 Fantasy as narrative

This is a shift of the first world through learner's cognitive construction. A gamer concentrates on the primary game environments, and then he or she builds in own meaning by inner consistency against new stimuli. So designer's narrative is transformed by his or her narrative maintained their common illusion. Let's suppose that like this. It is provided an explanation to learners about some picture. If let them draw the picture, according to one's explanation, they draw differently by means of their constructs. That is, a learner accepts it founded interpretations grounded personal cognitive constructs. The spacing between the lines of concepts is fulfilled by personal narrative built in own construct. An objective knowledge, however, common illusion can reconcile to learner's special narratives. This is the reason that fantasy and rational thinking have a consensus.

2.1.3 Fantasy as creative

This is to make creatures by interacting with narrative of game. Fantasy as narrative, it becomes to be strengthened by expressing oneself fantasy as one's fantastic. The creation should be depended on its context, so understanding situated environments is prerequisite. If the creature is addressed the missing, misleading, or inaccurate contents in the game, we would be interrupting the flow experience [11]. So this process can encourage their information processing. In second life, to make up of HUD (Head up Display) transforms objects, to generate and to shift their appearance and so on are adaptive instances.

Type of fantasy	As response	As narrative	As creative
The fantastic capable to design	bells and whistles such as a fantastic sound, image, or action, etc.	Interaction user's inner construct with symbols	Freely expressing their thoughts or themselves
point that occurs in consciousness	Sensory functioning, perception	Registration, retention, understanding, reasoning	Applying, expression, motor functioning,

Table 1 comparison about type of fantasy focused on design

2.2 Roles of fantasy as a learning facilitator in game-based learning

According to experimental research on fantasy and learning, learning objects presented in fantastic features lead to increase student's interest and learning [4]. And Malone and Lepper [8] studied fantasy by cognitive aspects of fantasy, and emotional aspects of fantasy.

In addition to these views, considering types of fantasy based on game design as an instructional component, we can find some other concrete aspects about roles of fantasy for enhancing the effectiveness and efficiency of learning.

2.2.1 Fantasy as response

This type connotes Behaviorism. We can apply teaching machine principles to design the fantastic for arousing fantasy as response.

The fantastic given to abet learners formulates the mechanism to evoke fantasy as reinforcement. According to this principle, it is capable to provide planned environments to control their behavior. Thus, it can promote values of education or realize more perfect socialization-this is the "shaping" as social customs.

Following Hume's interpretation [6], "Tolkien meant the refreshing effect of defamiliarization, the newness available to us only after we have freed ourselves from our sense of possessing the familiar (p.16)." And she said [6] that "Realism no longer impacts on adequate sense of meaning to our experience with reality (p. 39)." In contents of fantasy, refreshing effect functions as ventilation of stimuli in intelligence and affect.

Achievement motivation is linked to goals and challenges in game. The nature of achievement motivation is the energizer and direction of competence-relevant behavior [7]. Goals and challenge are main factors in game, which are achieved by suggesting rewards according to the results of learner's activity. Repeated successful experiences give gamer confidence. And then, they may open their fantasy world-we call this situation "immersion." The more achievement happens, the more persistence is guaranteed.

2.2.2 Fantasy as narrative

This type connotes Cognitivism. Especially information processing models provide many ideas to fantasy as narrative. Visual organizers which can be improved the memory include both the public shared fantastic and the private generated symbols, and that are structured information visualization so called "semantic".

Sinatra [12] defines visual literacy as "the active reconstruction of past visual experience with incoming visual messages to obtain meaning (p. 5)". Visual literacy is reproduced from respecting conditions of a personal narrative formed by interacting with the fantastic. This is an inner consistency. Visual organizer in game plays an important role in not only to improve one's memory but also to accept the cognitive structure of the learner. This is an opportunity to modify, reinforce, and complement one's cognitive structure.

Following Merrill [10], the fifth of First Principles in Instructional design is that learning is promoted when new knowledge is integrated into the learner's world. We have to ask to ourselves, does the instruction provide an opportunity for learner to publicly demonstrate their new knowledge or skill? Render it down, Fantasy as narrative enhances learning by facilitating the processing of information with maintaining the cognitive structure, and it will be situated "flow".

2.2.3 Fantasy as creative

This type connotes Constructivism. Reality is more in the mind, that the people construct a reality based upon apperception. The fantastic provides situation to evoke fantasy. Gamer cognizes provided situation and then participates in the narrative. To operate on the storyline is fantasy as creative.

Cognitive flexibility theory provides multiple perspectives with the content. There is not "Tabula Rasa". Constructs always exist as common illusion or private illusion. The fantastic as creative provides chances of participant. By means of building constructs, they create their thoughts and check through the visualization. The more convinced of their constructs, the more cultivated creativity. To express fantasy by creating the personal fantastic-HUD, objects, avatars-, it means that we can not only find concepts formed wrong and have chances to fix it but also check learner's emotional status in terms of psychology perspective. It is important that to formulate a learner's routine of subject matters is. Additionally, active participation generally promotes gamers' co-presence. Co-presence is also one of the main factors of immersion.

3. Conclusion

There are more skeptical views about fantasy, rather a view of the possibility. But when a view in terms of epistemology awareness of real is formed, "THE reality is THEir reality." Problems can arise if author and readers disagree too strongly on their basic assumptions about consensus reality [6]. But realism no longer imparts and adequate sense of meaning to our experience with reality [6]. In this aspect, fantasy is inseparable to learning, so we need to consider fantasy as a design factor.

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Supporting Communicative English Class Using PDAs

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Abstract: This paper describes a student-interactive speaking-listening support system using mobile devices. This system makes use of PDAs (Personal Digital Assistants) as a recording tool. Peer-to-peer interviews and interviews with international students were conducted in communicative English class of 20 university sophomores. The students uploaded the recorded files of interviews to the LMS (Learning Management System) through wireless LAN and shared the files by listening and made summary reports which were also uploaded to LMS. Advantages and disadvantages of the system were discussed. In conclusion, though some weaknesses are pointed out such as battery shortage, instability of wireless LAN, troublesomeness of stylus (small pen), its usability (easy to make recording, easy to upload), mobility, and novelty contribute to successful communicative English class and a combination of PDA and LMS helps make efficient use of class time, and provides effective support for evaluation.

Keywords: Mobile Language Learning, PDA (Personal Digital Assistant), LMS (Language Management System), EFL

Introduction

There are four skills of language learning, i.e. reading, listening, speaking and writing. The aim of language education should be to develop all these four skills in a well-balanced manner. But Japanese students are often said to be good at reading while they are poor at speaking and listening [1]. It is mainly because the emphasis is put on rote memorization and grammar-translation at junior and senior high schools in order to prepare for very competitive entrance examinations of the universities [2]. As for listening, however, it has been introduced since 2006 to assess listening proficiency in the national center test for university (preliminary university entrance examinations administered by the government), so some improvement for listening proficiency is hopefully expected. As for speaking, it is unlikely to happen for universities or any institutes to employ speaking tests at the entrance exams. Therefore speaking, or communicative competence should be much emphasized after they enter the universities to compensate the unbalanced proficiency in four skills. But in reality, it is far to say that there is a sufficient number of communicative English classes at universities. For instance, in the University of Tokushima, a mid-size national university of 6,096, undergraduate students (as of May 1, 2008), there were 33 Communicative English classes of about 20 students (approximately 660 students enrolled) in spring semester 2008.

In addition, it has always been a serious problem for instructors of communicative English class to evaluate the class. Communicative ability is best measured situationally [3]. Traditionally the common method of evaluating communicative competence is to communicate with the students, face to face, one by one or group by group and judge them during the class. Therefore evaluation is a heavy load and uses up class time. Since there usually is only one instructor for one class, he/she has to give the students some self-study type of tasks during evaluation. If the recording is possible in the classrooms such as CALL (computer-assisted language learning) rooms or LL (language laboratory) rooms, they can evaluate by listening to the tapes or recorded files after class. But the number of such rooms is very limited. Furthermore, there is no established method of evaluating speech performances [4]. Such difficulties are one of the reasons why there are not many communicative English classes at any level of education in Japan. But if mobile devices are used as a voice recorder, digital recording of students' voices would be possible, so that the instructors will be able to evaluate after class. So it is hoped the use of mobile devices will help make more effective use of class time, will facilitate communicative English learning process, and hopefully and ultimately will contribute to the improvement of communicative competence of Japanese ESL (English as a second language) learners.

1. System Design

1.1 Materials

Researches on the practical use of mobile technology for language learning have been very active in recent years [5] [6] [7] [8]. As mentioned above, there are four skills of language learning. Mobile technology has been applied to training tools for listening, reading writing skills, which include software and systems installed in PDA, iPod, Nintendo DS, Sony PSP. However, little attention has been paid on the use of mobile devices as a tool to help improve speaking skill. A research on communication support system using companion agent has been reported, but there exist some problems to be solved such as speech recognition and understanding. So it is not in practical use yet [9].

It is reported that motivation is a very important variable for the second language learning [10]. It helps improve English to have a specific purpose when we study it. One of the authors' students, who was expected to go to America in a few months, showed dramatic improvement in her English. In reality, it is impossible for the whole class to go to English-speaking countries. But quite a few international students are studying on campus. There are 259 international students from 28 countries studying at the University of Tokushima as of May 2008. So there must be some way to design the class to make it look like being in the place where English is spoken. Taking the above mentioned elements into account, we have designed class where the students conduct interviews with peers and at the very last stage, with international students.

Collaborative and interactive learning approach of a foreign language has been paid much attention to these past years [11]. Unlike typical traditional ESL classes, which are mostly teacher-centered, our suggested system is characterized by student-interactive-learning. The use of mobile devices makes it possible for the focus in the classroom to be shifted from the teacher to the learner. In this system, interactive-learning consists of two sections: the peer-to-peer interaction and the peer to international student interaction (cf. Figure 1).

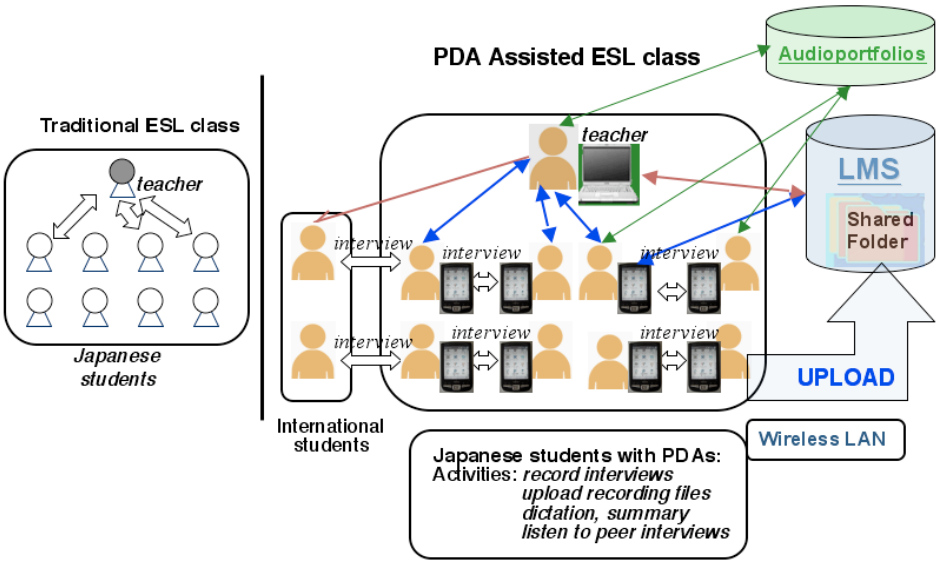

Figure 1 Comparison of the Two Class Types

2. User Study

The target class consisted of 20 sophomore students (11 males, 9 females) who majored in pharmaceutical sciences. Out of total of 15 classes on a weekly bases during spring semester 2007 (April to July), four classes in June were used for the interview project.

2.1 Learning Sequence

(1) *Making Questionnaires*

The students were assigned to make at least 20 questions in English which might be useful for an interview and submitted it to u-Learning system. The instructor made corrections if there were any errors.

(2) *Practice by Listening to the Instructor's Model Reading*

The instructor's model reading of their questions was recorded in the website called Audio Portfolios (http://www.audioportfolios.com/). The students were given an oral practice assignment of the questions made by themselves by listening and repeating after the instructor's model reading.

(3) *Peer-to-Peer Interview*

Each student conducted an interview with his partner chosen by lottery. They made recording of their interviews. After the interview, they uploaded their recorded files (wav. file) to the shared folder in the u-Learning system and listened to each other. At the beginning of the first PDA class, the students received a full explanation about how to use them. PDA class was held four times in total (three peer-to-peer interviews and an interview with an international student). Besides one regular English instructor, four technical staffs stayed in the class to help the students as supporters and trouble shooters.

(4) *Interview with International Students*

Four volunteer international students were recruited beforehand through personal connections. They were all graduate students at the University of Tokushima. The whole class was divided into four groups (five per each group). Each international student got interviews from five students during 90-minute-class.

3. Results and Discussion

After the whole procedures were completed, a questionnaire survey with a five point scale style was conducted.

3.1 The Survey Result

The survey result is shown in Table 1. The highest average score of 4.42 was given when asked whether it was useful to conduct an interview with an international student, 3.53 when asked whether it was fun to use PDAs combined with u-Learning system, 3.32 when asked whether PDA class was useful, 3.21 when asked whether recording of your voice by PDA was useful, while the lowest of 3.16 was given when asked whether listening to the English spoken by the other classmates was useful.

Table 1 The Result of the Five-point-scale Style Survey

The contents of the questions	average points (full satisfactory : 5)
Was recording of your voice by PDA useful for your improvement of your English?	3.21
Was listening to recorded files by other students useful for your improvement of your English?	3.16
Was an interview with an international student useful for your improvement of your English?	4.42
Totally was PDA class useful for your improvement of your English?	3.32
Was it fun to use PDA combined with u-Learning system?	3.53

- Comments from the students about PDA:
  - able to use the Internet wherever we are
  - easy to make a recording
  - handy and convenient
  - quick start-up
  - like a small computer
  - terrific
  - running out of battery quickly
  - troublesome to input by small pen (stylus)

- Comments from the students about u-Learning system:
  - easy to submit assignments
  - log-out too soon automatically when not used

About the use of PDAs with the university LMS, the following advantages and disadvantages were found:

- Advantages
  1) The recordability of PDA helped make an effective interactive learning.
  2) Its usability (easy to record, quick start-up) helped make efficient use of class time.
  3) Its mobility helped conduct interview session smoothly and successfully.
  4) Novelty effect of new technology helped enhance students' motivation.
  5) Digital recording by PDAs and uploading recorded files and summary reports to LMS helped save the instructor's time and labor to carry things like cassette tapes and papers.
  6) Digitalization of both spoken and written English eased the instructor's concern about losing data.

- Disadvantages
  1) Unstableness of wireless LAN, which might not be directly related to PDA function itself, caused loss of class time. Bluetooth might be another alternative to solve this problem.
  2) Short duration of battery and bother of using stylus caused some user unfriendliness.
  3) It was difficult to run the class without cooperation from some technical staffs.
  4) Its implementation is costly. The model used here cost about 60,000yen (US$600) per each. Therefore it might be difficult for this project to be applied in emerging countries.

4. Conclusion and Future Works

The students' free comments show that most students made favorable remarks (6 favorable comments to 2 unfavorable comments). But average satisfactory score on PDA use, 3.32 indicates that they somehow feel negatively about PDAs. In order to pinpoint negative factors, more detail research would be necessary. Since PDAs are not available in many universities, mobile phones are a strong alternative. According to the poll among 333 Japanese university students regarding their use of mobile devices by Thornton and Houser, 100 percent reported owning a mobile phone [12]. Since mobile phones usually function as a voice recorder, they can be used in place of PDAs. Then we do not need extra budget for running an interview class as proposed here. Mobile phone supported communicative English class is in preparation by the authors and is expected to be in progress soon.

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Supporting Japanese Mimicry and Onomatopoeia Learning Using Sensor Data

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Abstract: In this paper, we propose an improved context-aware system for supporting to learning Japanese mimicry and onomatopoeia (MIO) using sensor data. In our two previous studies, we proposed context-aware language learning assistant systems named JAMIOLAS (JApanese MImicry and Onomatopoeia Learning Assistant System). We have used wearable sensors and sensor network respectively to support learning Japanese MIO. On the disadvantage of previous systems, we propose a new learning model that can support learning MIO with the sensor network to carry out context-aware learning mainly in ways of creating context initiatively and detecting context automatically.

Keywords: mimicry, onomatopoeia, sensor, language learning, context-aware learning, ubiquitous learning

1. Introduction

Context-aware computing (Abowd & Mynatt, 2000) will help in the organization and mediation of social interactions wherever and whenever these contexts might occur (Fischer, 2001). Context-aware computing makes it possible to learning foreign language words related to people's feeling more comfortably.

Computer Supported Ubiquitous Learning (CSUL) has integrated high mobility with embedded computing environments (Chen, Kao, Sheu, & Chiang, 2002; Ogata & Yano, 2004). We are focusing on applying CSUL to language learning and are investigating computer supported ubiquitous learning (Ogata & Yano, 2004). We proposed context-aware language learning assistant system called JAMIOLAS (Miyata, Ogata, Tomoo Kondo, & Yano, 2008; Ogata, T. Kondo, Yina, Liub, & Yanoa, 2007; Ogata, Yin, & Yano, 2006) for learning Japanese mimicry and onomatopoeia (MIO) words. The previous two studies used wearable sensors and sensor network respectively to detect the context automatically and achieved certain effect. However, it still cannot meet learner needs. Therefore, in this paper we propose an improved system named JAMIOLAS 3.0 that can support learning MIO by using sensor data.

2. Japanese mimicry and onomatopoeia

Mimicry words are imitating situations and body movements while onomatopoeia shows sounds of something (Ogata et al., 2006). Japanese is very rich in it. It is very important but very difficult to learn because of following aspects:

(1) Explanation: Nearly all of MIO words are just feeling of Japanese.
(2) Translation: Difficult to find the word that has the exactly same meaning in other language.

(3) Writing: Most of MIO words are written in hiragana or katakana (Japanese syllabify), not in kanji. It is easy to pronounce but difficult to understand.
(4) Hearing and Saying: The pronunciation of MIO usually has twice repetitions. It may cause the illusion of hearing and judge the different words as same one.
(5) Meaning: MIO words have many synonyms and much assonance.
(6) Situation: Some are only used in specific situation. For example, "jime jime" means muggy, dump and humid, but it almost be used only in a rainy season.

Most of the MIO words are used to describe the speaker's feeling. In order to know the speaker's feeling, we attempt to acquire user's context with sensor.

3. JAMIOLAS 1.0 and 2.0

JAMIOLAS 1.0 is implemented by wearable sensors called Phidgets (physical widgets)(Greenberg & Fitchett, 2001) and a Tablet PC (HP T1100) . When learning, the learner must wear Phidgets connected to the system, and select a MIO as answer that is most suitable for the situation in the question generated by system. However, when learning, sometimes learners do not know where he/she could learn the MIO. Learner must carry the system when using it, so it is not so convenient.

JAMIOLAS 2.0 use the wireless sensor network instead of wearable sensor, and use RFID to recognize user's position. However, most of MIO words cannot be supported by it, and it can only be used in limited area. For these issues, we propose JAMIOLAS 3.0 to support learning MIO.

4. JAMIOLAS 3.0

4.1 Context and sensor

There are three important aspect of context: Where you are, who you are with, and what resources are nearby (Lee, Oh, & Jeon, 2007). Context includes not only user's location, but also the lighting, noise level, social situation and so on (Schilit, Adams, & Want, 1994). Human being usually gets the feeling from environment by five senses including seeing, hearing, smelling, tasting and touching. It is possible to get such context with sensors. The context can be classified as two types – can be created by computer (scene, sound) and cannot be created by computer (weather).

Table 1. Relationship between body sense, context and sensor

Body sensor	Context	Sensor
Seeing	Light	Light Sensor
	Scene	Image Sensor
Sound	Sound	Sound Sensor
Feeling	Temperature	Temperature Sensor

4.2 Implementation

Figure 1 shows the architecture of system. The weather information and media files are learning stuff in this system. We are using real-time on-line weather service as sensor network. As the feeling is different one by one, the system will use the voting mode to decide the proximate select to the weather or media. We plan to use mobile as client, but for limitation on condition, we have to implement this system on web side at current.

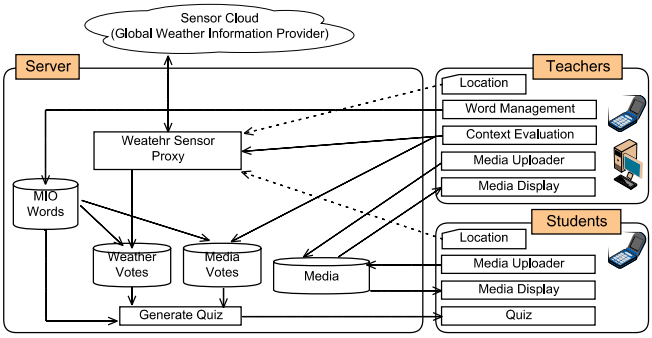

Figure 1. System architecture

4.3 System interface and function

4.3.1 Student's interface

This system mainly supports the following functions for students.

(1) Learning by weather information: There are two modes: Fix mode - system will show uses user's default location, and generate a quiz to ask learner how to describe the current weather with MIO; Tour mode - learner must set the coordinate first. When learner gave a right answer, he/she can view the example and media for each selection or enter the test mode to take a test.

(2) Learning by media: Learner choose a media file and give select a MIO word that is most suitable for this media. Finally there is a test function for learner

(3) Learning in free mode: the free mode likes a media dictionary, user can look up a word and the result is composed of examples and media.

Figure 2 shows a typical learning flow in this system.

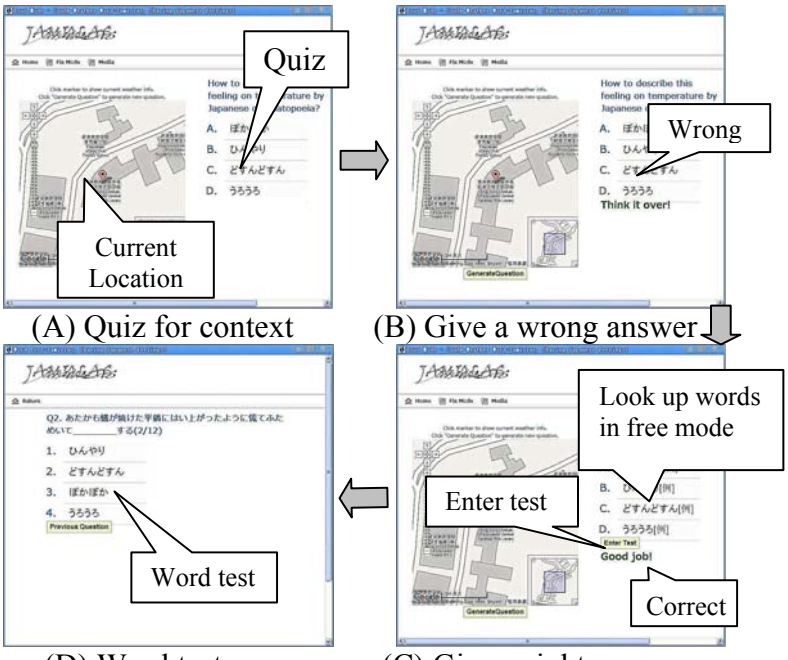

Figure 2. Student's interface

4.3.2 Teacher's interface

It is certain that the teacher can use all the functions for students. Besides, Teacher can have another two functions:

(1) Evaluate weather/media: Teacher can vote a word for weather/media.
(2) Word management: The user who has the role of teacher can manage words.

5. Evaluation

5.1 Method

We have done an experiment to compare JAMIOALS 3.0 to traditional method. After voting by Japanese students, we planned to prepare 10 words as test data in this experiment (Table 2).

6 Japanese learner took the part of student. In them, 1 is living in Tokushima (Japan), 3 are living in Tokyo (Japan) and 2 are living in Dalian (China). They were divided into two groups: one used dictionary first, and another used system. After 20 minutes, they exchanged, and continue to learn for 20 minutes. We put pre-test, mid-test and post-test in this experiment. Finally, they answered a questionnaire that is 5 ranges from 1 to 5.

Table 2. MIO used in the experimentation

Context	MIO
Weather(Temperature)	hinyari, nuku nuku
Scene(Posture of walking)	uro uro, tyoko tyoko, noshi noshi, yochi yochi,
Sound(Sound of animals)	ka ka, ga ga, gero gero, tyun tyun

5.2 Result

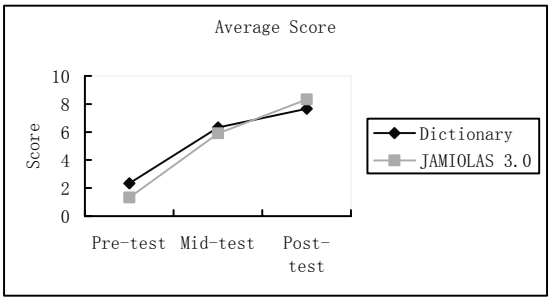

Figure 3. Average Score

On figure 3 the slope of learning with system is larger than that with dictionary. It means MIO is explained with feeling better than with dictionary. After the mid-test, the slope of "system first" is still larger. By feedback, we learnt that when they learnt the words with feeling in this system, they were very eager to know the exact meaning of the word in dictionary. However, when they learnt the meaning of word by dictionary first, they felt that they had already understood the meaning and were not so eager to get the feeling of that word.

Table 3. Result of questionnaire

	Question	Avg
1	Were you able to learn mimicry and onomatopoeia by this system?	4.8
2	Was the answer of presented quiz appropriate to the situation?	3.8
3	Were you able to learn mimicry and onomatopoeia with enjoying?	4.2
4	Is the system easy to use?	4.2
5	Do you want to learn by this system in the future?	4.3
6	Which do you think enhance learning, this system or traditional learning?	4.5

Table 3 shows results of questionnaire. Results of Q1, Q3, Q5 and Q6 show that learning MIO with this system holds promise of learning effect than traditional learning. The result of Q4 shows the interface is suitable for the user's habits. However result of Q2 just shows the biggest problem of learning MIO with feeling, because the feeling is different depending upon the person. Therefore in the future we should seek for a method to make the words more appropriate to the situation.

We also asked the learner to make some comments. Someone said this system is very interesting, they can easily learn the meaning the words in environment, and it is really a good way to explain the MIO words by feeling. There are also some advices from learners. Most of them said when the answer of quiz is given, they can only see right or wrong, but cannot learn why. If the meaning can be shown at that time, it will be more conducive to remember the words. Someone said that in the test, sometimes there are too many questions for one word, it's is because of the current algorithm, and we should improve it in the future. Someone also said the video is not so clear. This problem cannot be solved at present because of the limitation of technology.

6. Conclusion and future work

In this paper, we described an improved context-aware learning system named JAMIOLAS 3.0 that can support to learn Japanese MIO words in a sensory learning by using sensor data. Though the experiment, we can clearly see that this system is effective for learning MIO. However, on the media side, although the media can be explained by system better than by dictionary, through the result and feedback we learnt that the dictionary is still required. With the help of dictionary, learner can learn the words with both of meaning and feeling.

In the future, we will focus on makes the question more appropriate in environment with weather data. And we will also consider how to use multiple condition of weather information. Currently, more and more mobile phones are embedded with sensors, we are considering to use these sensors to support MIO learning. Besides, We should also consider how to introduce the meaning of word into the system properly.

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Supporting Joggers in a Web-Community with Simulation and Annotation Functions

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Abstract: This paper proposes a web-based community environment that supports joggers. The system shows a competitive simulation of multiple joggers who share the same course at asynchronous situation and stored their GPS data of jogging into the database. Joggers are also able to take annotation on the map along with this simulation in order to remember their own improvements of running for the next time. Joggers are given the possibility to detect the improvement area, running way, motivation and so forth in a simulation. This is an ongoing project related to researches of physical skill development. We report the idea, design, and implementation in this paper.

Keywords: Physical Skill development, e-running, Map-based community, Animated simulation, Agent

Introduction

Today's significant concern of Japanese about health might be aroused between government's health promotion law and emerging social issue on metabolic syndrome [6]. People of sedentary lifestyle are recognizing the advantage of jogging gradually in such a situation. Generally, joggers enjoy daily training alone without any explicit purposes on acquiring how to run. However, they might be sometimes whipped up by a sudden motivation for entries in various kinds of race-event. Though the training of such a temporal runner takes place in such a situation, it would not be in an appropriate or effective manner. In any cases, the real-world running race provides a competitive situation to participants. Such a racing situation drives participants to highly motivated mind spontaneously. In addition, joggers sometimes want to know the methodology of running to be improved and learn how to train themselves in order to complete the full distance of the race within a certain adequate time. A conceivable solution to overcome their needs may be in a running community. We have already started a research project of an SNS, social networking service, which supports physical learning to keep motivation [3]. Therefore, this paper tackles to apply such an SNS to support joggers with on-line community site. The system we are developing presents two main functions; an animated simulation on the geographic map and an annotatable space on it.

1. Learning how to run in a community

1.1 Theoretical background

Human motor skill has long history as one of the studying domain [5]. According to Gentile's well-known taxonomy for motor skill, human skill could be divided into two dimensioned space by environmental context axis and action function [2]. There are still four sub-spaces in each by classifying regulatory conditions, intertribal variability, body orientation, and manipulation. Running is one of such human skills appeared in the taxonomy. Supporting system had better follow the taxonomy by detecting the features.

Another presumable discussion for motor skill arises in [1] about "Open skill" and "Closed skill". Regarding concrete illustration of running from this viewpoint, open skill needs for joggers in a field training in the real world because they have to perform against unpredictable accidents such as facing traffic jam and so forth. On contrary, indoor running by treadmill exercise is regarded as closed skill development because joggers can train them freely according to pre-set program without any other expectations. The target style of running belongs to open skill development because joggers of this system train in the field they can exercise in a daily life.

1.2 Running in a real/virtual community

Most of traditional researches in computer-supported education, technology-enhanced learning, computer-supported collaborative learning, and so forth assumed real instructors, teachers, or noble strategy to lead learners to correct answer by the computer program. These aspects, in fact, have strong tendency to physical learning and training domains because they are more skill-oriented [7].

However, recent SNS-based learning offers different scenario to learners. Generally, users in an SNS have horizontal relationship among them and are nonconformist in a sense. They do not have to be aware of each role or position in the real world. Therefore, they can freely explorer in a virtual space and learn something discovered on line. If joggers' friends put notes about their daily training, methods, and topics related to course or advice, they can adopt these articles for their training next time. This scenario does not need the condition that the owner of the adopted article is an instructor. A jogger can make the trial and error along with her/his own thought in this scenario.

In addition, joggers may find companies in a field training. They can keep the friendship to be highly motivated each other. They can also mutually point their weakness or give advices up in the real world. However, they are likely to have unsatisfactory on schedule sharing or selecting course and so forth. In such a case, the virtual sharing space can help their collaboration or competition about jogging. The fundamental idea of this study met this motivation.

1.3 Direction for adequate running skill

In the sports science, some researchers proposed the taxonomy of running. Table 1 and Figure 1 illustrate the typical taxonomy of three types; Ascend, Even, and Descend. Regarding novice and middle level runners, the fundamental strategy of instruction is to enforce runners at even-pace whole through the planned course [4]. Joggers have to train several times with conscious "even-pace" in order to achieve their performance goals such as accomplishment within a targeted time or acquiring ability to run a certain length.

Joggers have no meanings to catch the information about their running without any sensing devices or monitoring tools. Therefore, we adopt GPS (Global Positioning System) sensor and HRM (Heart Rate Monitor) device that can be put directly on runners. Runners upload these data on to the community site via the Web interface. As a result, joggers recognize the position of speed change, the relative pace-change, the character of the training course, and so on in a simulation afterwards.

Table 1 Types of runners

Running type	*Description*
Ascent	Runners of this type save their pace, speed of running at beginning but accelerate the speed gradually until finishing the course.
Even	Runners of this type can keep the pace, speed from the beginning to the end.
Descent	Runners of this type have an oppositional feature against the ascent type.

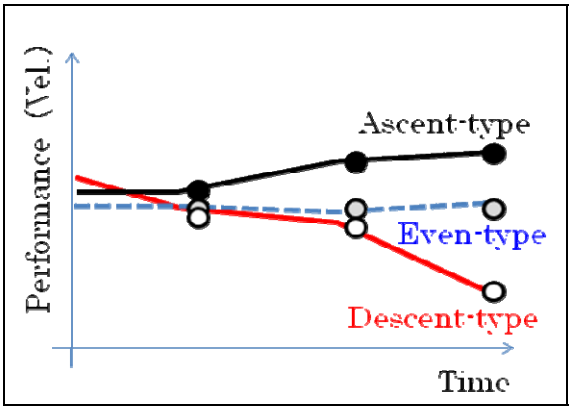

Figure 1 Three typical types of running

2. Functionality

2.1 Animated Simulation

Main objective of this study is to present joggers an environment that can afford to make them realize where they should take effort and how to improve running. In order to meet the needs of such an affordance, the basic idea is to provide an animated simulation to every jogger in a community. We have designed the competitive animation to joggers who share the same course for running but cannot run together at the same time (Ref: Figure 2).

Figure 2 An animation to show the simulation

Avatars of each jogger can show the competition on the Google-Map based on the past running records. They have the arc to show the running direction. The map provides the time information, relative positions, and the replaying speed to a system user. Users can change the replaying speed (i.e. "x20" in the Figure), the position in the race freely as they like. If there are several joggers who train on the same course, they can share the simulation as their reflection. In such a situation, a jogger can be

aware of what s/he must reflect upon by the easier comparison with other joggers. For example, through the simulation, one can remind that all joggers were really not much different during the first half but they differed a great deal of velocity on the second half. Even if only one jogger sets a running course and does not share it with others, s/he can compare her/his latest record with some of stored records in the past. In this way, joggers can identify their grown-up history by the self-comparison in this simulated environment.

2.2 Annotation on the map

There are some community sites that have the blog function for running. However, most of them do not provide the function that users can take notes on the map directly. The system we made implements this function originally (ref: Figure 3). It brings somehow meta-cognition for each jogger because s/he can review from objective viewpoint.

Figure 3 Annotation space on the map

Joggers can point the position on the map during replaying their running records by mouse and take notes directly there. For example, this function is useful for a jogger to remember the position to brace against the fatigue at next time running. Furthermore, the jogger will be able to check the running difference from the past time around this position. In this way, joggers can improve themselves by the simulation and annotation on the map.

3. Design and implementation

3.1 GPS data and the simulation

Since the system works under the GPS records, joggers have to wear the GPS tool during running. This project adopted the series of products of “Garmin forrunner”. Suunto’s GPS tool that a jogger can also wear is adopted, too. The sampling rate to detect the geographic position is about 10 seconds with the running mode but it depends on the satellite measurement. This tiny product has many fundamental functions for training. In the database, the pair of latitude and longitude record with relative wrap-time for each user identified by training-id are stored. The distance calculation of real-world is available from the data for each interval. In addition, the system also automatically calculates the distance and velocity for the map representation to implement the running simulation because it adjust the scale and replaying speed.

3.2 System implementation

The main part of this study is developed on the Flash by ActionScript because it has an strong advantage in utilizing Google-Map with animation of multiple avatars. The system automatically adjusts the scale of the map-area due to the distance of simulated avatars. Avatars are preset for each system-user but not limited because a user can upload her/his own picture to the system and set that as the avatar.

The flash content is embedded in the web-content generated by OpenPNE3 (http://www.openpne.jp/). OpenPNE by Tejimaya is one of well-known open-source program for SNS in Japan. It is realized by PHP script with relational database such as Sun-MySQL. It has fruitful functionality, blog, my friend, footprint and so forth, as well as MySpace or Facebook or other famous SNSs.

4. Summary and Future implications

This paper described the design and implementation in an ongoing research project that supports joggers with competitive environment and annotation functions. The virtual competition can be realized with GPS data of the real world training. We have already developed the system and set up for the trial use by volunteer subjects. Some test joggers have already give us positive feedbacks.

Since this project has not completed the evaluation of the developed system yet, the effects by the animated simulation and annotation would be reported after that. We are also planning to extend this study by way of introducing agent-based scenario to promote the training successfully.

Acknowledgements

This work was partially supported by Grant-in-Aid for Young Scientists (B) No.20700641 and Scientific Research (A) No.19200055.

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The One-to-One Groupware for Supporting Collaboration Learning on Web

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Abstract: This study proposes a one-to-one groupware CELL to support collaboration learning on Web in one-to-one environments. It was found that the groupware was indeed useful in supporting students in their efforts to search the Web autonomously while simultaneously engaging in joint integration and reflection on the emerging search results. In addition, this study identified three discovery patterns in the use of the groupware and found most student groups demonstrated the iterative envisioning discovery pattern.

Keywords: Collaborative learning, discovery pattern, one-to-one groupware

1. Introduction

Although Web searching is usually undertaken as a solitary activity, studies of Web searching revealed that students often search jointly for information to accomplish their group tasks [1][2]. Collaborative Web search may afford advantages such as division of responsibilities for search tasks, an awareness of group members' search processes and results, and the persistence of co-search activities [3]. Recent studies [3][6][7] focused specifically upon collaborative Web search while discovery involves not only searching, but also the integration of, and reflection on, the web search results contributed by participants. In addition, collaboration discovery can improve the quality of discovery [4][5]. As more and more learning resources become available on the Web, supporting collaboration learning on Web becomes increasingly exigent and essential.

The one-to-one environment can provide individual Web discovery. However, the one-to-one environment supporting collaboration learning on Web requires a social-technical mechanism that facilitates interactions among students [8], enabling them to contribute, share, integrate, and reflect upon diverse web search results contributed by all participants. This study therefore proposes an integrative groupware mechanism which utilizes both personal mobile computers and a shared display to support students in a group to advance their understanding, addressing the open-ended problems in one-to-one environments.

2. The design of one-to-one groupware

This study involved the development of a one-to-one groupware CELL (Contributing, Exchanging, and Linking for Learning) to support collaboration learning on Web in one-to-one environments. Figure 1 displays the CELL groupware environment that

supports the collaboration learning scenario. The design of CELL groupware emphasizes the importance of collaborative knowledge creation activities in which students join together to reflect upon the knowledge set they have found on the Web. Recent study [9] has pointed out the use of "knowledge maps" improve the quality of argumentation among participants in collaborative learning environments. The CELL groupware in this study thus provides a "group mind map" tool as the main workspace in which all participants can reference to and tightly integrate with visual and textual resources (i.e. web search results and ideas) contributed by any participant to support collaboration learning. The group mind map is displayed on both personal mobile computers and the shared LCD display, in support of both autonomous personal Web searching and joint collaborative discussion activities. The CELL groupware facilitates synchronous interactions on these resources, since the personal mobile computers and the shared display are synchronized to show the changes in the group mind map made by any participant.

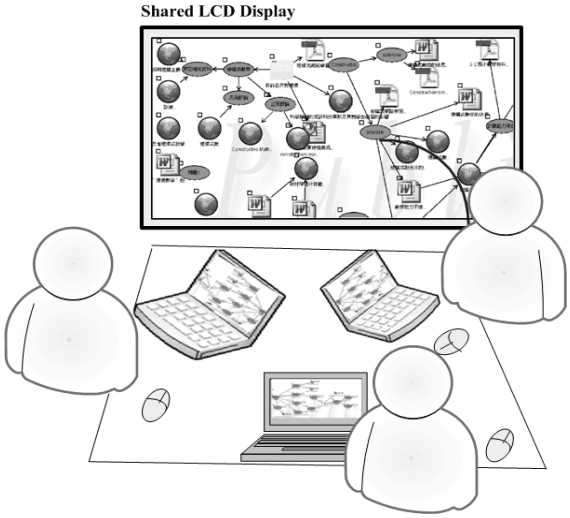

Figure 1. The one-to-one CELL groupware environment

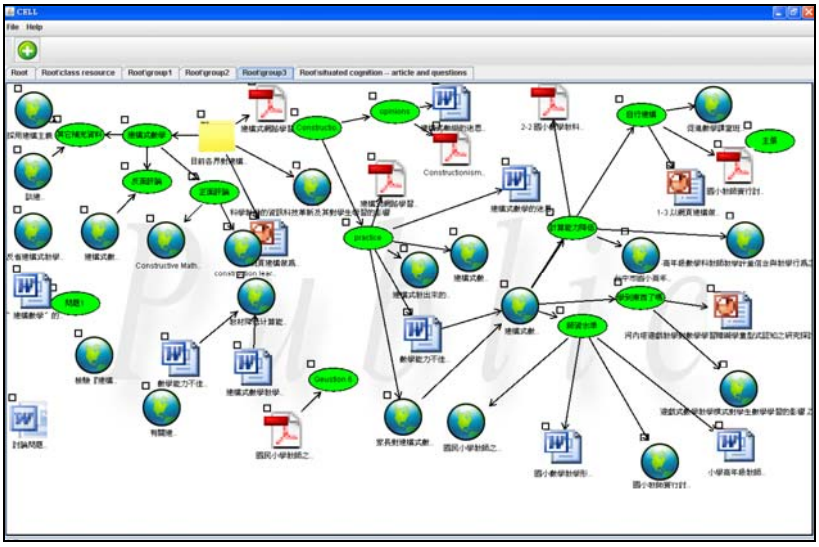

Figure 2. Diverse nodes on the group mind map

Figure 2 displays a group mind map constructed by a student group during a Web collaboration learning activity. The CELL is a client/server groupware application that enables students to work individually and collaboratively in the following ways:

- Individual search and contribution: Each student can search the Web freely using a personal mobile computer and can contribute any type of web search results to the

group mind map. The web search results include web pages (shown as earth icons), and any type of document files (such as MS Word, MS PowerPoint, and PDF). Each student drags the nodes of web search results from his/her personal mobile computer onto the group mind map.

- Exchange of web search results: Students can easily exchange and share web search results with their peers. They access the shared web search results through their personal mobile computers by double-clicking the nodes of web search results on the group mind map.
- Collaborative integration and reflection: Students can organize and integrate information collaboratively by performing group mind mapping activities. When they study the web search results, they can propose a concept node (shown as an oval icon) on the group mind map to decompose the problem. They can also propose ideas on specific web search results by adding a comment node (shown as a square icon) on the group mind map, or propose diverse ideas on a comment node added by others, which led them to further develop a shared understanding, refine a concept, or generate a new idea. In the meantime, students can clarify the relationship between these resources (i.e. web search results, concepts, and commands) on the group mind map by linking resource nodes.

3. Method

The CELL groupware maintained log files that recorded group mind mapping activities such as who added a node and who linked two nodes. This study thus involved analyzing the log files to determine the participation of each student in a group, i.e. how many times each student contributed and linked nodes in the Web collaboration learning activities. The participation analysis was conducted to confirm whether the CELL groupware facilitated students to participate both autonomously and jointly in the Web collaboration learning activities. In addition, two independent researchers (coders) analyzed the content of nodes to determine what exploration strategies students frequently applied in the Web collaboration learning activities. The inter-coder reliability (74%) indicated that the analysis was adequately reliable. This study further adopted the sequences analysis to investigate the discovery patterns of student groups in the Web collaboration learning activities. The discovery patterns were represented as strategy transition diagrams which contained all of the strategies and the transition probability between any two strategies. It was hoped that the strategy transition diagrams could reveal the discovery patterns of student groups within the Web collaboration learning activities.

4. Results

Table 1 shows that all members of student groups contributed resources to their group mind maps with instances ranging from a minimum of 8% to a maximum of 64% contribution percentages in their respective groups. Student A of group 1, student E of group 2, and student K of group 3 contributed significantly more concept nodes and node links than did other members of their group. Examination of the activity videos showed that most concept nodes and node links were added after face-to-face dialogue among group members -- by this member of each group. Such activity revealed that group members engaged frequently in face-to-face discussion and concentrated collaborative activity on Web content. Table 1 also displays that group members contributed at least 4 web search results and 2 comment nodes in their respective groups. Since Web searching

and the commenting were performed on each individual's personal mobile computer, the contributions of web search results and comment nodes each represented an individual autonomous action. The participation analysis therefore reveals that the CELL groupware facilitated students in a group to contribute both autonomously and jointly in exchanging and linking diverse resources during the Web co-discovery activities.

Table 1. Individual contribution in groups

G1	Student A	Student B	Student C	Student D	Total
	49%* (12/5/30/57)	15% (7/8/2/16)	17% (14/3/1/19)	19% (10/2/15/14)	100% (43/18/48/106)
G2	Student E	Student F	Student G	Student H	Total
	64% (21/21/17/44)	8% (5/2/0/5)	17% (11/2/0/14)	11% (4/6/1/7)	100% (41/31/18/70)
G3	Student I	Student J	Student K		Total
	18% (8/4/0/11)	19% (12/2/0/10)	63% (28/6/7/40)		100% (48/12/7/61)

*Percentage of individual contribution in each group (Number of web search result nodes/comment nodes/concept nodes/node links)

In addition, after the content analysis of nodes, two independent researchers found that students frequently applied the following eight strategies to collaboratively learn on Web, as described below:

- *Issue:* Students identified an unsolved issue in a complex problem.
- *Position:* Students presented his/her position on an issue.
- *Argument:* Students argued and asserted his/her personal position and understanding of the problem.
- *Reference:* Students added a web search result to the group mind map from their laptop computers.
- *Viewpoint:* Students proposed and added a sub-direction that helped to frame the complex open-ended problem. This viewpoint also served as a node on the group mind map for integrating and reflecting upon several related resources.
- *Question*: Students proposed a question that they needed to confirm for certain Web content. This question was added and attached to a specific web search result in their group mind map.
- *Re-voice*: Students applied this strategy to re-voice and extract the content of a web search result in their own words.
- *Temporary hub*: Students used a node to group related information temporarily.

Table 2. The frequency of strategies applied by student groups

	***I**ssue*	***P**osition*	***A**rgument*	***R**eference*	***V**iewpoint*	***Q**uestion*	***R**e-**V**oice*	***T**emp.hub*
G1	29	3	4	43	41	0	2	3
G2	15	11	11	41	19	3	32	1
G3	4	6	9	48	8	0	7	0
Total	48	20	24	132	68	3	41	4

Table 2 lists the frequency of each type of strategies applied by student groups. *Reference* and *viewpoint* strategies played important roles in the Web collaboration learning activities. There were six strategy transition diagrams of three student groups in the two Web collaboration learning activities. This study found three main types of discovery patterns (strategy transition probability < 0.2) in these transition diagrams as follows:

- Iterative envisioning discovery: There exists a cycle between *Reference* and *Viewpoint* in four transition diagrams. These student groups continuously searched the Web to gain deeper understanding of the open-ended problem from a specified viewpoint. At the same time, the web search results also introduce new viewpoints to these students groups which, in turn, inspire them to explore the problem from these new viewpoints. The viewpoints and interlinks between these viewpoints, i.e. the discovery framework that indicated the direction of Web discovery and student understanding of the open-ended problem, were continuously revised while students discovered the Web.
- Fixed framework discovery: There exists a significant direct transition from *Viewpoint* to *Reference* in a transition diagram. A student group framed the discovery framework continuously by proposing viewpoints only at the initial stage of discovery. The student group discovered the Web according to these preconceived viewpoints.
- Framework development impediment: There exists an isolation of *Viewpoint* from other strategies in a transition diagram. The student group did not develop a framework to discover the Web. The student group discovered the Web arbitrarily and drew their search results into the collaboration learning activity.

5. Conclusions

This study found that the one-to-one learning environment, together with the use of the CELL groupware, was useful for supporting not only individual Web searching and participation but also joint discussion and reflection to advance group understanding of open-ended problems in the Web collaboration learning activities. Students demonstrated rich strategies to collaboratively learn on Web. It was found that the group mind map-like groupware developed by this study allowed students to apply strategies to reflect upon, integrate and make meaning of the collective web search results and ideas collaboratively. In addition, this study identified three discovery patterns in the use of CELL groupware. Although the teacher did not interfere in the Web collaboration learning activities, most student groups demonstrated the iterative envisioning discovery pattern.

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- Workshop 4 -
International Workshop on SPECIAL (Strategies for Practical integration of Emerging and Contemporary technologies In Assessment and Learning)

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Call for Workshop Papers

International Workshop on SPECIAL (Strategies for Practical integration of Emerging and Contemporary technologies In Assessment & Learning)

Information and communication technologies to date have advanced to a state in which an increasing diverse range of tools can be constructed or are already easily accessible and available for supporting learning and educational assessment in a wide variety of ways. These tools can be built on contemporary technologies such as Web-based e-learning systems, intelligent tutoring systems, mobile hand-held devices, interactive games and multimedia simulation environments. There are also educational tools built on emerging technologies such as Semantic Web, Web 2.0, immersive virtual reality environments, personalized and adaptive platforms, interactive podcasts, context-aware systems. The possibilities, opportunities and innovative ideas of applying these contemporary and emerging technologies to education are enormous and virtually boundless. However, simply adopting advanced technologies in the classroom or e-learning systems, or a blending or both, is not necessarily or automatically beneficial to the learner in the educational context. Technologies need to be meaningfully integrated to the daily educational tasks such as face-to-face lessons, formative or summative assessment, practice of skills and techniques, problem solving, critical reflection, collaborative case studies, and other forms of learning that are carried out in practice. Pedagogies and assessment strategies have to be well conceived, adequately planned, and properly implemented in order to ensure the realization of true benefits of technology use.

The core theme of this workshop is on the practical strategies for integrating technologies in assessment and learning. It aims to bring researchers and educators to a forum under this theme, through which practices and experiences are shared, critical reflections and thoughts are debated, challenges and opportunities are explored, and innovative ideas are generated and exchanged.

Topics of Interest

Topics of interest include, but not limited to:

- Strategies for using assessment and learning systems
- Pedagogical application of Web 2.0 tools
- Integration of social networking practices to learning
- Instructional models that incorporate emerging technologies
- Practical use of automated assessment tools
- Strategic deployment of mobile learning tools in the classroom
- Use of location-aware devices to enhance educational values in field studies

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Automated Systems for Testing Student Programs: Practical Issues and Requirements

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Abstract: Many universities have developed automated systems to assess the correctness of students' programs. Such systems are of tremendous benefit in enhancing the teaching and learning of computer programming, particularly in providing prompt and useful feedback to students. On the other hand, most of the existing systems for automatically testing students' programs suffer from limitations that bring about some pedagogical issues in their use in practice. These issues may bring about educationally undesirable effects that can substantially compromise the benefits of such systems. This paper reviews the cause of these issues, describes their pedagogical implications, and discusses the need and requirements for an improved approach to the automated testing of student programs.

Keywords: practical issues of automatic assessment, program correctness, program testing, program validation, requirements of automated assessment system

Introduction

For many students, learning of computer programming is not easy. It requires students to do a lot of practice and programming exercises. To assist students in their learning and to help them rectify their mistakes, instructors have to assess students' programs and provide prompt feedback to students. However, the administration and assessment of programming exercises are known to be tedious and error-prone [1, 3]. To relieve these problems, many universities have developed software systems to perform these tasks automatically [3, 5, 8]. In addition to saving the time and effort of the instructors, these software systems have proved to be very helpful in motivating and enhancing students' learning [2, 8].

Assessment of student programs falls into two broad categories: static and dynamic. Features subject to static assessment include coding style, suspicious code pattern (that may lead to errors), quality metric (such as code complexity), code design and structure, and similarity (for detecting plagiarism) [1, 2, 5]. Program behaviour that is subject to dynamic assessment includes functional correctness (whether the functional requirements are met), efficiency (such as run-time requirements), testing effectiveness (e.g., whether the associated student test set is valid or adequate), and memory management (such as de-allocation of reserved memory blocks) [1, 4]. Among these, no doubt, functional correctness, or simply *correctness*, is commonly considered a most important attribute of student programs, particularly in elementary programming courses.

The most common way to assess the correctness of a program is by means of testing. However, many existing systems for automatically testing student programs suffer from some technical limitations may bring about educationally undesirable effects in teaching and learning. This paper (1) reviews the dominant approach in automatic testing that cause these issues, (2) examines their pedagogical implications and

importance, and (3) proposes requirements for an improved approach to address these issues. Sections 1–3 below are devoted to the above discussions, respectively, and Section 4 concludes this paper.

1. Approaches for automated testing of student programs

In simple terms, a program is considered correct if it passes all the test cases, that is, if its output in every test run is considered correct. An output from the program under test is called an *actual output*, while an *expected output* refers to the output as required by the program specification, or equivalently, the output produced by a correct program. When assessing students' programs, the instructor normally knows exactly what the expected outputs are. Thus, in most of the existing automated student program assessment systems, the correctness of output is usually determined by using the *program output comparison method*, which works by comparing the actual output texts with the expected [1]. Systems that adopt this method include ASSYST [4], BOSS [5], HoGG [6] and PASS [8].

In elementary programming courses, the mainstream exercises that students work on are text-based programs, in which both the inputs and outputs can be treated as text strings. The basic approach of the program output comparison method is to match the actual and expected output texts character by character [1, 3, 5]. With this approach, the actual output is considered correct if and only if it is exactly the same text string as the expected output. This approach sounds natural and actually works in a lot of cases, but in other cases it proves to be too primitive. For example, it fails when the actual output differs from the expected merely by an extra space or carriage-return. In such a case, the instructor would have a hard time convincing the student that his/her program is really wrong when the two outputs are hardly distinguishable to the human eye. While in principle there can be legitimate ground to demand for full conformance to an exact output specification due to special needs of the application domain, typical elementary programming exercises are designed for daily uses when such precision is not inherently necessary, if not for testing by automatic means.

The problem of excess or missing characters in outputs might have been relatively straightforward if only whitespaces (such as spaces or newlines) or pre-defined characters (such as dots or hyphens) are involved. Almost all existing systems incorporate certain capabilities, either by default or configurable by the user, to filter out such characters. However, this simple filtering strategy is still unsatisfactory. For example, the same character may carry different meanings, depending on context. A space splitting a word is very different from an extra space between words, and a dot '**.**' can mean a fullstop or a decimal point. Therefore, filtering out all spaces or dots may lead to unwanted results. A slightly better filtering strategy should be "localized" to certain parts of the output string [7]. PASS [8], for instance, allows the removal of whitespaces at the end of every line.

In short, the dominant approach for automatically testing students' programs is by matching the characters in output texts, often in ways enhanced by some ad hoc rules, such as filtering certain characters and ignoring the case of characters [7]. Two notable exceptions that employ advanced techniques will be discussed in Section 3.

2. Practical pedagogical issues arising from character matching

In many instances, the character matching approach rejects a program which produces "slightly incorrect outputs" in the same way as it does to a completely incorrect program. When a program that implements a correct algorithm is rejected as incorrect due to "minor" or "insignificant" (sometimes "invisible") deviation of its output format, there might be many pedagogically undesirable consequences. First, as explained in Section 1,

the instructor would have a hard time convincing the student that his/her program is really wrong. Indeed, had the assessment been done manually, the instructor might not actually have imposed the same penalty. Thus, in such situations, the automated assessment is perceived as at least inconsistent or inappropriate, if not "unfair".

Next, students could easily get frustrated when their "otherwise correct" program is rejected by the automated system. Some spend a great deal of time fixing these "minor problems" to satisfy the automated system instead of working on the core algorithms and implementation. Such efforts are seen to be "wasted", further adding to their frustration.

Evidently, instructors are not unfamiliar with these unpleasant experiences, either. To avoid the trouble, instructors tend to over-specify the exercises with unnecessary details of output format [3]. They also warn students in advance, at the release of assignments, that even minor output deviations will not be tolerated in the assessment. The "warned-you-before" strategy can be effective in reducing the potential number of student complaints after assessment, but the core pedagogical side effects of students' frustration, "waste of effort", etc., are still there.

Specifying very precisely the program outputs and insisting strict conformance requirements have the positive effect of making crystal clear what exactly are expected to be correct or otherwise, reducing the possibility of subsequent misunderstanding. However, such a strategy also suffers from some other pedagogically undesirable consequences.

First, defining an overly detailed problem specification can be time-consuming. Instead of focusing on the design of the exercise to achieve the intended learning outcomes (such as the ability to write a loop or to perform sorting), the instructor may be distracted or overwhelmed by the precise output formatting considerations. More importantly, some kind of programming exercises may never be chosen because they cannot be easily specified as precisely as the instructor wishes. Thus, students' learning experience will be unnecessarily constrained to fit the requirements of automatic testing.

Furthermore, very precise problem specification invariably means that excessive details are included. Consider the following problem:

"*Write a program to solve a quadratic equation given its coefficients as input.*"

The above specification would probably suffice if the student programs are to be tested manually. For example, suppose that the test input coefficients are 21, 31 and 8, respectively, which represents the quadratic equation:

$$21\,x^2 + 31\,x + 8 = 0$$

And suppose that the instructor provides the following sample (expected) output:

"`The roots are -0.33 and –1.14`"

Then the human tester can easily see that the two outputs below are equally correct:

"`Roots are: –0.333333 or –1.142857.`"

"`Solutions = –1.1429, –0.3333`"

Obviously, these two outputs differ from the expected output in many aspects, such as the descriptive words, precision and ordering of the roots, and the presence/absence of a trailing fullstop. To the human tester, these aspects are all relatively irrelevant to the problem, which aims at exercising students' ability to code the quadratic equation formula. In fact, students whose programs produce these two outputs actually exhibit their ability in formatting the numbers to a higher precision, even though the instructor only requires the numbers to be correct to 2 decimal places. Again, these students may be "penalized" by a naive automatic testing system that rejects their programs as incorrect.

To tighten the specification, the instructor may impose the additional requirements:

"*Your program output must follow the exact format as the given sample output, using exactly the same words and characters except for the two numbers that represent the roots. The two roots must be displayed in ascending order and correct to 2 decimal places*."

We consider these extra requirements neither essential for the exercise to achieve the intended learning outcome, nor pedagogically satisfactory, as elaborated below:

(1) The problem becomes unnecessarily much more complicated, thus easily causing distraction and confusion. The weaker students can be intimidated by these details.

(2) While providing a sample output helps to illustrate an acceptable way of presenting the output, confining the sample as the only allowable template implicitly suggests that it is "the best", when in fact it is the result of somewhat arbitrary choices.

(3) The additional requirements are very restrictive. Forcing strict conformance actually inhibits students' creativity and freedom in designing their own (equally correct) output presentation, which constitutes part of the joy of their learning.

(4) Though verbose, the additional requirements are still inadequate. For example, the output format when the equation has repeated roots or no real root are still missing. While specifying these cases explicitly can partly solve the inadequacy problem, these further specifications actually disclose unintended hints to students on how the problem can be decomposed into subproblems (to handle the specified cases), which constitutes part of the solution that students should have come up with on their own.

Naturally, we are not suggesting, nor can we claim, that the above list of issues is exhaustive. (On the other hand, we are certain that these issues are quite common.) Rather, our intention is to highlight the importance and practical need to address these pedagogical issues that are aggravated, if not solely caused, by the use of existing character matching approaches for automatic testing of student programs. To conclude this section, there is a need for more sophisticated techniques to establish the correctness of a student program while accommodating adequate flexibility for the instructor in defining the specification.

3. Requirements for an improved approach

Clearly, the root cause of the issues discussed in Section 2 lies in the primitive nature of the character matching approach for determining the correctness of student programs. We anticipate an improved approach to possess the following characteristics.

(a) Fundamentally, it must support a systematic means (not just ad hoc rules) for the specification, identification and detection of "legitimate variations" of outputs (outputs that differ from the expected output but are still treated as correct) [6].

(b) It must be widely applicable to many different classes of programming exercises, such as those typically appearing in popular textbooks for programming.

(c) It should be able to check correctness using coarse-grained correctness criteria (such as allowing the whole word "`Solution`" to be used in place of "`Roots`") as well as fine-grained criteria which consider character-level matches.

(d) It must be flexible enough to be configurable in different settings to suit widely different educational objectives and a variety of teaching and learning styles and preferences. For example, an instructor may insist on the correct spelling of all words, whereas another instructor may tolerate slight misspelling (say, accepting the word "`Solutons`" for "`Solutions`") and yet is mindful of number precision.

(e) It should support an easy-to-use front-end interface for interactive manipulation and exploration by the instructor, as well as batch mode scripting to increase efficiency.

(f) Ideally, it should provide a means for the instructor to incorporate past experience to improve its capability and efficiency to distinguish correct and incorrect programs.

Again, the above list may not be complete, but it serves as a starting point for developing and evaluating new automation approaches and the prototypes that implement them. In this regard, we are now examining a newly proposed approach reported in [7].

In the literature, two automatic systems are reported to employ more sophisticated approaches for program output comparison. CourseMarker [2] allows the user to specify regular expressions (regex) for pattern matching the output strings. For example, the regex "`134\.(6|57)|135`" successfully matches the numeric values of 0 to 2 decimal places: "`135`", "`134.6`" and "`134.57`". Regex can be very powerful in matching a string with a large number of variations, but is not easy to learn and use correctly.

Jackson [3] uses the pattern-matching facilities provided by the parser tools lex and yacc. He expresses the lexical rules as regex so that the output strings can be parsed and compared according to custom production rules in a yacc specification. Thus, powerful scripts can be devised for advanced matching of outputs that accommodate high flexibility. However, Jackson's approach demands high proficiency with these parser tools. Moreover, to express and debug complex lex and yacc rules can be brain-teasing and error-prone.

4. Conclusion

Undoubtedly, automatic student program assessment systems are of tremendous benefit in enhancing the teaching and learning of computer programming [1, 8]. On the other hand, in many of these systems, the dominant use of the character matching approach for judging the correctness of student programs has brought about a number of pedagogical issues. To address these problems, we have initiated a research for an improved approach that hopefully retains the benefits of automated assessment systems and yet reduces their negative educational effects. This paper has identified some essential requirements of such an approach, and elsewhere we have reported our preliminary proposal [7]. Substantial further work is anticipated to bring our goals within reach.

Acknowledgements

The work described in this paper is supported in part by a grant (project number 123206) from the Research Grants Council of the Hong Kong Special Administrative Region, China.

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Concept Mapping for Collaborative Knowledge Construction in Distance Learning

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Abstract: Integration of social networking practices makes it possible to create a learning community in international settings. In order to meaningfully integrate this kind of technology, it is essential to assess what is actually being achieved among participants. This paper proposes a method to utilize a concept map in an on-line discussion. The result indicates that it can be used for the purpose of reflecting that collaborative knowledge is being constructed during and after the discussion.

Keywords: CSCL, concept map, knowledge construction, distance learning, mentor

Introduction

Information and communications technology to date has advanced to a state in which tools for face to face communication are already easily accessible for supporting a social community. Integration of social networking practices makes it possible to create a learning community in international settings by using high-quality video conferencing system. In order to meaningfully integrate this kind of technology, however, it is essential to assess what is actually being achieved among students in classroom situations.

Our research project has realized an international multi-point connection among four countries in Asia (Japan, Korea, China and Thailand) in order to create a TEFL (Teaching English as a Foreign Language) class in cross cultural communication. Through our practice of synchronous (real-time) and symmetric (two-way) communication using high-quality video conferencing system (Nishinaga et al., 2005)[1], (Nishihori et al., 2007)[2], we have noticed that the problem mentioned above still needs to be solved: to capture the transient, on-going process of students who are participating in global interaction. It is necessary to connect all the participants in synchronous-symmetry distance learning to the extent that all the participants can perceive what is actually being achieved during their interaction.

1. Project Progress and Literature Review

We have devised collaborative tools for a TEFL class such as Chat'n'Debate (chat system), Culture Box (questionnaire and opinion poll between two countries) (Fig.1) and Multi-culture Box (questionnaire and opinion poll among three or more countries) (Fig. 2)

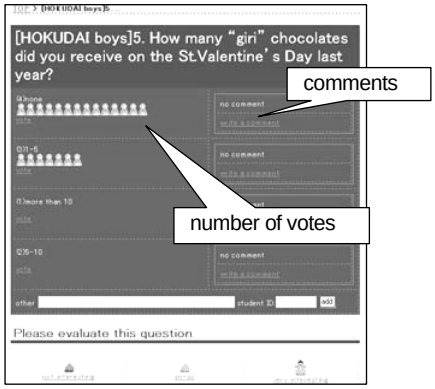

Fig 1. Culture Box

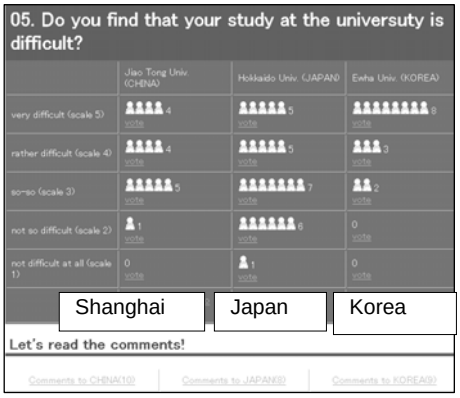

Fig 2. Multi-Culture Box

in order to visualize collaborative interaction between two or more sets of students in a global class. Culture Box and Multi-Culture Box were constructed for an on-the-spot questionnaire with voting and comments. These tools have been immensely useful in seeing the various differences in opinions being formed.

The students' reactions, however, suggest to us that it is important to make all the participants realize what is being achieved through their discussion all the way through this process, not simply at the end. This paper discusses whether visualization of collaborative knowledge construction can be attainable by the concept map devised by our research team.

In the literature concerned, visualization tools have been reported as having positive effects on knowledge construction in a classroom setting, especially with regard to content-specific visualization (Fisher, et al., 2002)[3]. Furthermore, collaborative knowledge construction has been analyzed through conflicts in a jigsaw-type classroom (Lao, et al., 2008)[4]. Our concern has been focused on collaborative learning spaces such as Wiki and their supportive nature to motivate students to construct knowledge (Chua, et al., 2008)[5]. Collaborative concept mapping is useful as a tool for social thinking, conscription devices, and inscription methods (Roth & Roychoudhury, 1992)[6]. Many collaborative concept mapping tools have also been developed. KMap is a collaborative concept mapping tool with multimedia contents (Gaines & Shaw, 1995)[7]. This tool makes it possible to share concept maps including text, audio and movie via LAN. In addition, Knowledge Soup has various functions such as collaborative concept mapping, communication function and sharing proposition (Cañas, et al. 2001)[8]. This tool derives propositions from concept mapping and sharing. Moreover, users can provide comments and questions about the propositions.

Models of collaborative concept mapping have been proposed following cooperative learning whose five basic criteria (Johnson et al., 1994)[9] form its objective (Tifi & Lombardi, 2008) [10]. The five basic criteria of Cooperative Learning are positive interdependence, individual accountability, face-to-face promotive interactions, the use of collaborative skills, and team self-assessment.

This paper proposes a method based on the criteria mentioned above. Among these criteria, individual accountability, the use of individual accountability and team self-assessment must be achieved in our project, since the other two are not applicable in a distant class. While participants are engaging in an on-line discussion, common understanding and individual differences can be captured at a glance on the concept map to be shared by all of them. On-going discussion to construct collaborative knowledge can also be seen by all the participants.

2. System Design

We have developed a concept map as shown in Fig.3. This tool, developed for collaborative knowledge construction, has the following functions which have been split into two groups.

(1) Functions for Mentors
   a. Chat b. Adding a Keyword (in a different color for each proposal)
   c. Moving a Keyword d. Adding a Link
   e. Adding a Linking Phrase (in a different color for each proposal))
(2) Functions for Students
   a. Chat b. Adding a Keyword (separated by color by proposal user)

The individual proposal is clearly indicated by a colored keyword. Participants can recognize their own contribution and a picture of this contribution as part of the entire class. If a participant depends on others, there is no sign of contribution in this colored map. Moreover, interaction is facilitated because the visualization of contribution promotes the feelings of the other participants as if they were part of a face-to-face interaction.

The Mentor user plays a role in constructing a concept map. Participants join in a discussion using the chat and propose a keyword (a node of the concept map). Keywords can be moved anywhere and a link between them can be added together with a linking phrase. Student users are requested to mainly focus on their discussion. If a user adds a keyword, this appears at the upper-left corner of the window shown as "Start". The Mentor user can move this and add a link between keywords. Linking phrases can be added on the top left.

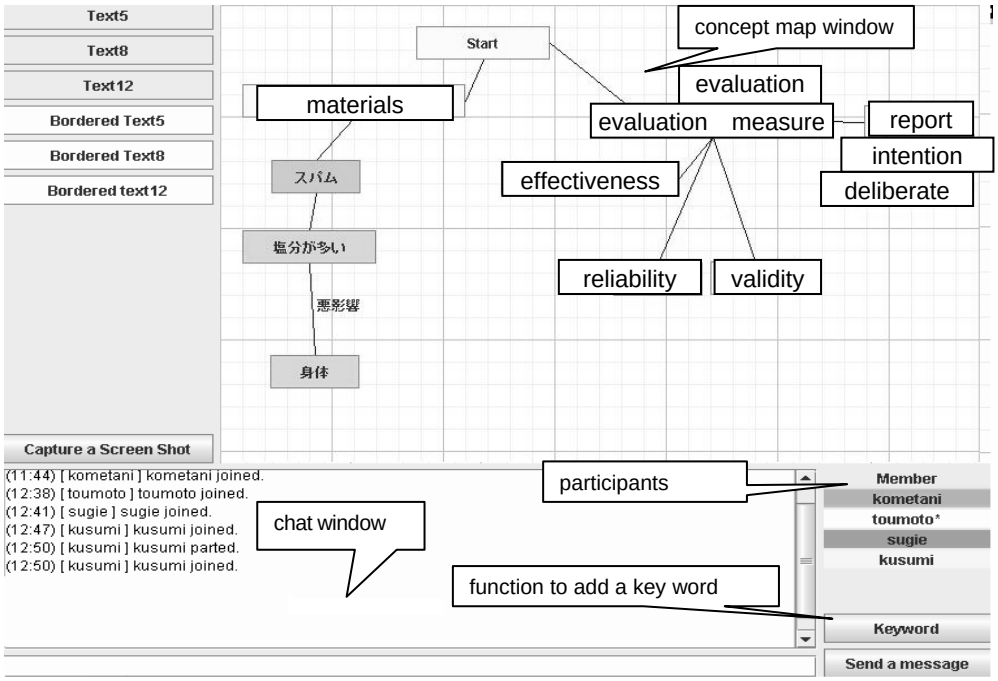

Fig. 3. Interface of collaborative knowledge construction tool

3. Data Collection & Analysis

3.1 Method

The experiment was undertaken on July 13, from 13:00 to 14:00, 2009, by Hokkaido University, Waseda University and Tokyo University of Science in Japan. Three participants who are students, one from each university, joined the experiment. The author played the role of a mentor. The concept map played a supplementary function for the main focus, an on-line discussion whose topic was how to create a comfortable laboratory. The discussion was conducted in Japanese.

After the experiment, a questionnaire was distributed to these students. They awarded a numerical score for their reaction based on the modified five-point Likert scale:

5 "Chat and concept map" is much better, 4"Chat and concept map" is better,
3 More or less, 2 "Chat only" is better and 1 "Chat only" is much better.

3.2 Results

Fig. 4 is a produced concept map which shows accumulated collaborative knowledge. We can see both the on-going discussion and the total picture of the discussion process. This process can be reflected from the upper left, i.e., the beginning by a keyword, towards the bottom of the concept map. We can then see the panorama of constructed collaborative knowledge. From colored keywords, we can see how individual knowledge has been integrated.

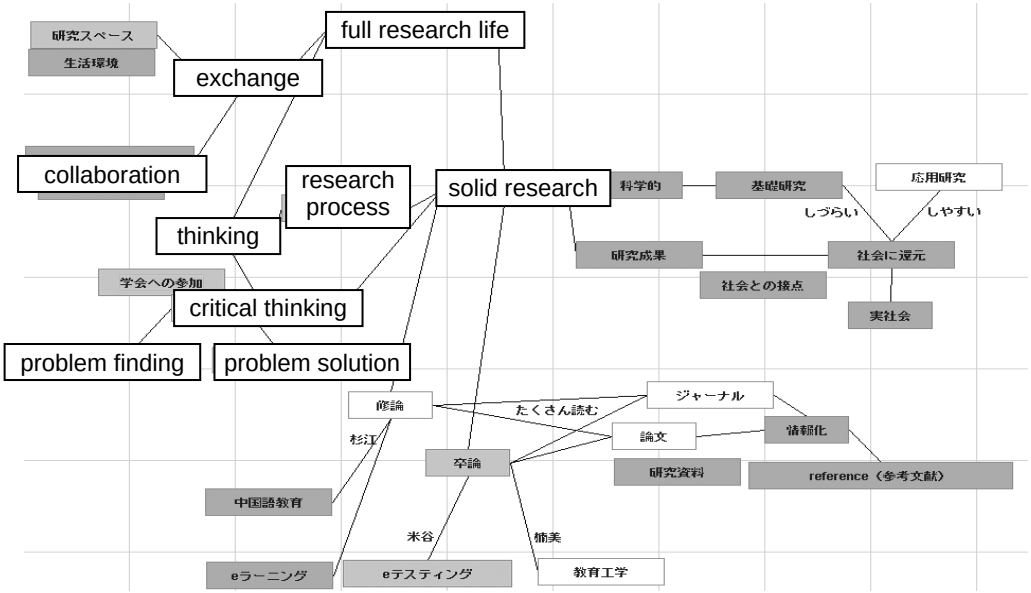

Fig. 4. Production from collaborative knowledge construction

Table 1 shows what the participants preferred. In particular, item (2) and (3) have gained the highest score of 5. Participants prove that the concept map is very useful in the on-line discussion to see the overall structure of discussion and, at the same time, their individual contribution to it as well as others' contributions.

Table 1. Results of questionnaire

Questionnaire Item	Average Score
(1) Recognizing my contribution in the discussion	4.7
(2) Recognizing other's contributions in the discussion	5.0
(3) Understanding the structure of discussion	5.0
(4) Recognizing the distance of my keyword from the discussion theme	4.3

(5) Feeling that others and I have common understanding	4.3
(6) General reflection upon the discussion	4.3

The combination of chat and the concept map is proved to be fairly useful for general reflection upon the discussion, since it indicates common understanding and how far away an individual keyword is from the discussion theme.

4. Conclusion & Future Considerations

In our previous projects, although we devised collaborative tools for TEFL class, the students' reactions suggest that it is important to make all the participants realize what is being achieved through their discussion. This paper described how a concept map can be used in order to show an on-going discussion with the results of our first experiment in Japan using Japanese. The results show that the system can be used for the purpose of reflecting upon what is being achieved through discussion.

Since there are some limitations in our experiment, however, our future work will be focused on the solution of the following points: to increase the number of participants, to conduct a trial in an international situation, and to incorporate this system in our synchronous-symmetry video conferencing system. In terms of functions, we plan to further develop a system that allows all the participants to be able to construct the concept map without any assistance from a mentor in their collaboration.

Acknowledgements

This study is supported by Grant-in-Aid for Scientific Research (B) No. 20300274 from Japan Society for the Promotion of Science.

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Digital Storytelling as an Assessment Tool in the Primary School English Language Classrooms – Potentials & Challenges

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Abstract: In the recent years, there has been a shift from traditional methods of classroom assessment to more flexible, alternative assessment formats that measure higher level thought processes (e.g., critical thinking), range of skills, and capabilities. Most assessment methods fulfil two assessment purposes – assessment of learning (summative assessment) and/or assessment for learning (formative assessment). The main distinction between these methods is that the former determines the status of learning and the latter aims to promote greater learning. This case study research outlines the issues on the fitness of purpose, validity, reliability, and equity in the use of digital storytelling approach as an alternative assessment for the lower primary pupils (i.e. aged 7 and 8) in an ICT-enriched learning environment. The findings imply the importance of a change in the epistemology of the teachers to focus on assessment to enhance pupils' learning than just a status check. It also calls for better planning, communication, and training among teachers. In addition, a balance of summative and formative approach of assessment might be necessary in a highly structured and efficient educational system that focuses on high-stake summative assessments.

Keywords: Formative and Summative Assessment, ICT, Digital Storytelling

1. Introduction

Research studies in education have shown that information and communication technologies (ICT) coupled with the necessary pedagogical strategies engage students to learning critical and creatively problem solving skills [5][6][7]. However, whether these ICT tools could be used to engage students in such higher-order type of thinking skills depends on how they were being used in the classrooms. ICT is not a panacea to the learning in schools. Like any tool in the learning environment, it can be used well or poorly, and care and experience are needed when using it [4].

In addition, there should also be a shift from traditional methods of classroom assessment to more flexible, alternative assessment formats that measure higher level thought processes (e.g., critical thinking), range of skills, and capabilities. This paper is our initial and preliminary exploration (from February 2008 to April 2009) of the use of digital storytelling [9] as a constructive and an assessment tool to engage, facilitate and measure the learning of English Language for the lower primary pupils. It also looks into

[1] Beacon Primary School is one of the six future schools under the FutureSchools@Singapore Project. This is a collaborative project between the Ministry of Education (MOE) and Infocomm Development Authority (IDA) of Singapore. The main aim of these schools is to look into how information communication technology could be seamlessly integrated and facilitate teaching and learning.

challenges faced in the implementation of using the digital storytelling approach as an assessment tool in the school setting.

2. Literature Review

2.1 Digital Storytelling

"Clearly we are increasingly visual in our orientation towards communications. Reading and writing literacies are adversely affected, as each generation sees the screen as a preferable expressive medium. However, the inherent values of textual communication begin to become stronger by contrast, just as the strength of recitation and musical orality became stronger with the dissemination of literacy" [9]. Bull and Kajder [2] and Lambert [9] propose the use of digital storytelling as a strategy to engage learners in writing. According to Bull and Kajder [2], a digital story consists of a series of still images combined with a narrated soundtrack to tell a story. They reiterate that the focus in the language arts classroom should be on the writing and communication process rather than technical effects. Digital storytelling could be used as a constructive tool to engage pupils in higher order type of thinking skills as it could help pupils to 'visualise' their writing, develop creativity, and facilitate the learning of technological literacy, including the embedding of the voices of the pupils. However, it would also be necessary to design an appropriate approach to assess pupils' learning through the use of digital storytelling.

2.2 Assessment Design

According to Abrami and Barrett [1], Kubiszyn & Borich [8], and Gipps [3], there has been a shift from traditional methods of classroom assessment (e.g., Multiple Choice Questions, True and False) to more flexible assessment formats that measure higher level of thought processes (e.g., Problem Solving, Critical Thinking). Digital storytelling used for assessment purpose parallels the shift from a quantitative tradition of assessment to a more qualitative approach. The digital storytelling approach could serve as an alternative mode of assessment to better measure pupils' higher-order thinking skills and various abilities. In this paper, the use of digital storytelling as an assessment tool (both formative and summative) would be examined for its fitness of purpose, validity, reliability, and equity (*email the second author at tay.leeyong@bcps.sg for the detailed rubrics*).

3. Research Design

A case study approach [10] is used to report the implementation of the digital storytelling as a form of alternative assessment to determine and promote further learning among the pupils. The issues and challenges during its implementation are also highlighted. The data collection procedures of this study included the followings: (1) Reflection notes by the authors; (2) Lesson observations; (3) Notes of meetings with teachers and the authors; and (4) Pupils' produced artefacts.

A total of 240 Primary 1 pupils (aged 7 in 2008) were involved in this school wide initiative for 9 months (Term 2 to 4). Pupils started off with working in pairs and subsequently worked individually. On an average, each pupil had at least 2 hours per week to work on their digital stories in school. All work were done in school.

4. Preliminary Findings & Discussions

4.1 Implementation of Digital Storytelling – Its Potentials

The main objective of the digital storytelling was to allow pupils to demonstrate their higher order type of thinking skills in their digital creations through a constructivistic approach. The digital stories created by the pupils would be assessed both formatively and summatively, that is, to facilitate further learning and also assess the outcomes of their learning, respectively (*see Annex 1 for the Partial Digital Storytelling Rubrics*).

The lesson plan/idea was a very simple one, that is, to use a presentation software to create a digital story by lower primary pupils (Primary 1 and 2, aged 7 and 8) with text, digital images, and sound recordings. Pupils were given a series of tasks prior to the completion of their digital storytelling assignment. The tasks included brainstorming for ideas in groups or pairs for profiles of characters, drafting of story outlines and finally recording their narration of the stories. The teachers will provide the necessary feedback for improvement when pupils have completed the various tasks at different times. The completed digital stories were then "published', as in shared on the school network to their peers in class, to their parents and/or visitors. This mode of sharing completed work facilitates ease of access among pupils, a plaftorm to appreciate and evaluate one another's work, and also another form of formative type of feedback and assessment.

This process of translating their ideas into text and colourful visuals excited them. In addition, it spurred them on to develop a story about their created characters/experiences. With the use of information communication technological tools to present their stories, pupils could easily create and refine their stories, and learn from each other while work was still in progress. During those lessons where pupils viewed the stories created by their peers shared through the school network, pupils were clearly motivated and encouraged to make improvement to their own draft stories and sharpening their writing skills. In recording the narration of their stories, pupils did multiple readings and recordings till they felt satisfied with their readings. This process encouraged pupils to self evaluate their own reading against a given checklist and as a result, improve upon their reading skills. The completed digital stories gave pupils a sense of satisfaction, pride, and accomplishment as they readily shared their stories with peers, teachers and even visitors to the school.

On the whole, pupils were observed to be very engaged during the lessons with the use of the Tablet PCs and the presentation software to create their digital stories. Pupils also learned how to use the technology during the creation process. School administrators and other teachers who observed the lessons also confirmed this point. Pupils were also observed to be much better behaved during the lessons because when they were gainfully engaged. Hence, there was minimal disruption during lessons.

As for the assessment aspect, the assessment rubrics was constructed by the teachers who were directly involved with the implementation of this initiative. The rubrics were communicated to all teachers involved during structured meetings and went through a few rounds of refinements before it was finalised, however would still be subjected to further refinements. The issues of fitness of purpose, validity, reliability, and equity would also be discussed in the following sections.

4.2 Digital Storytelling as a form of Assessment – Its Challenges

In this section, the issues and challenges faced during the implementation of digital storytelling as a form of assessment would be discussed in relation to the purpose of fit, validity, reliability, and fairness/equity as outlined in the literature review section.

4.2.1 Purpose of Fit

The intended purpose was to use both formative and summative approaches towards the assessment of the digital stories created by the pupils, that is, both the assessment for learning and the assessment of their learning. The focus was to use this assessment to further enhance the learning of the pupils and also evaluate what they have learnt. Although the use of the digital story telling approach managed to engage pupils and allowed them to continuously improve their works, the assessment focus by the teachers was more summative than formative in nature. The clear descriptors, describing the end state for each stage of the writing process, found in the rubrics facilitated the summative assessment of the digital stories. From our observations, the interviews with the teachers involved, and the triangulation among the authors, the findings seem to suggest that the assessment structures, especially the national assessment philosophy and approach were not conducive for the teachers to employ a more formative assessment approach. The current national examination system for primary schools is still summative in nature and this assessment system has been implemented with great success over the past three decades. In addition, the teachers involved also reflected that they were not very proficient to carry out the formative assessment approach and it was more time-consuming as personalised feedback was required. Through the interviews, teachers generally believe the benefits and potentials of taking a more formative approach in using digital stories to assess the learning of their pupils but in terms of practice they were observed to be otherwise.

4.2.2 Validity

As mentioned in the literature review section, for formative type of assessment, it is about the consequences on whether further learning has taken place as a result of the assessment. Feedback is an important step in formative type of assessment. When used the right way, it could lead to further learning [11]. The teachers involved provided feedback to the pupils but they felt that it was too time consuming and that they would require more training in how to provide useful feedback that would lead to the pupils' further learning. However, the rubrics developed by the teachers seemed to be a good instrument in bringing out the validity for the more summative assessment of the digital stories.

4.2.3 Reliability

Reliability was another major issue during the summative assessment of the digital stories created by the pupils. Through the examination of the artefacts (i.e., the digital stories), lesson observations, and the interview with teachers, there were discrepancies on how the assessment tasks were being presented to the pupils and ultimately affected the consistency of the final product (i.e., the digital stories). There were vast differences in the digital stories presented by the pupils at the end of the project among the eight classes. In addition, as there were no formal meeting to walk through the assessment criteria with the teachers resulting in teachers having different ideas, concept, and approach towards the implementation of the digital storytelling process. There were no standardisation meeting at the early phase of implementation so the assessment criteria (the rubric) was also interpreted differently among the teachers involved and so the varied standards of products created by pupils. Hence, inter-rater consistency was being compromised. Although Stobart [11] argued that formative assessment is student-referenced and there is no need for consistency, the teachers had different interpretation of the assignment task and the rubrics which did impact on the reliability of this assessment tool.

From the current socio-cultural context of assessment and the expectations by the society, reliability in terms of uniformity in the assignment tasks, assessment criteria, and inter-rater consistency are still very necessary to ensure fairness.

4.2.4 Equity/Fairness

In order to allow for pupils of all background (e.g., social economic) to do equally well and provide equal opportunity for all pupils to demonstrate the skills and knowledge being assessed, all information communicative technological tools were provided by the school during the official curriculum hours. Pupils who needed more time to complete their work could always stay back to use the computers in the computer labs. Pupils were given time to practise their computer skills, thus the problem of prior computer skills and knowledge was minimised.

5. Conclusion

This preliminary case study of the use of digital storytelling as an assessment tool highlighted several interesting and critical issues for further considerations for research and curriculum innovations in the area of assessment and the use of information communication technology in schools. This case study highlighted the importance and influence of the socio-cultural context. The decades of highly structured and efficient system of mainly summative approach of assessment has a considerable impact on how formative type of assessments could be carried out in the schools. It would take time for the schools, teachers, and pupils to learn and get used to the more formative forms of assessment through an iterative implementation approach. Teachers would not only need to have a change in their epistemological beliefs towards a more formative nature of assessment, they also require the necessary knowledge and skills so that their practices could be transformed to bring out the essence of formative assessment, that is, to promote further learning among our pupils. Ultimately, a more pragmatic way is to have a good blend of both formative and summative approaches to facilitate further learning of our pupils and to determine what they have learnt. Both approaches have their values to serve different assessment purposes and if used well, would be able to measure pupils' range of skills, efforts, progress and accomplishment.

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Evaluating E-learning by Using Kirkpatrick's Four Levels Model

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Abstract: This study examines the effectiveness of e-learning in Hong Kong. Kirkpatrick's Four Levels Model is the most widely used model for measurement of effectiveness for training program. Initial methodology has been proposed to measure the effectiveness of e-learning program. We implemented Kirkpatrick's model to measure the effectiveness of e-learning. Experimental results have shown that students are satisfied with e-learning programs. The e-learning programs are more effective in courses at the fundamental level. Students' academic results are significantly improved in these courses. However, the current e-learning programs fail to achieve some overall objectives of the schools. This study provides baseline data for schools in Hong Kong to set their strategic direction of e-learning.

Keywords: effectiveness, e-learning, evaluation, Kirkpatrick's Four Levels Model.

1. Introduction

Recent advances in information technology enable the development of e-learning, which has a number of advantages. It has become a global trend in education. To develop an e-learning program, a lot of resources are required. As a result, it is important to measure the effectiveness of individual e-learning program. Unfortunately, the effectiveness of e-learning program has not yet been thoroughly studied in Hong Kong. Initial methodology has been proposed to measure the effectiveness of e-learning [4]. Leung proposed to measure the effectiveness of e-learning by using Kirkpatrick's Four Levels Model [3].

This study fully implements the Kirkpatrick's model to evaluate the effectiveness of e-learning in Hong Kong. In addition, we try to identify critical factors for success of an e-learning program. The study shall provide some useful information for schools to set their strategic direction of e-learning.

2. Kirkpatrick's Four Levels Model

It is very important to evaluate the effectives of the training program. A number of models have been proposed [6]. Kirkpatrick's Four Levels Model is currently the most well-known and most widely-used model for measurement of effectiveness of training programs. It is first proposed by Donald Kirkpatrick in 1959 [3]. The Kirkpatrick's model contains 4 levels (Fig. 1), which are disjoint from each other. The four levels of Kirkpatrick's model are defined as [2][3]:

- Level 1 Evaluation – Reactions: It measures how participants in a training program react to the training program. Typically, participants evaluate the training program in different aspects. It provides some feedbacks for improvement of the program.
- Level 2 Evaluation – Learning: It measures the extent trainees have advanced in their skills, knowledge, or attitudes. Level two evaluation often involves conducting a test before the training (pre-test) and a test after the training (post-test). The knowledge gained can be measured by comparing the results in the two tests.
- Level 3 Evaluation – Transfer: It measures how the trainee's behavior is changed by the training program. It studies how the knowledge gained can be applied to daily operations. Level 3 measurement is more difficult, as the behavior is intangible.
- Level 4 Evaluation- Results: It measures the overall effectiveness of the training program to the business objectives of the organization. In the commercial case, we can measure the change in sales volume or profit gained, etc. Level 4 measures the value added to the organization by a training program.

Level 1: Reaction	How did the participants react to the training program?
Level 2: Learning	To what extents do the participants improve their knowledge, skills and change their attitudes as a result of the training program?
Level 3: Behavior	To what extents do the participants change their behavior when they return to the workplace as a result of the training program?
Level 4: Result	What benefit does the organization get as a result of the training program?

Fig. 1. Kirkpatrick's Four Levels Model

According to Kirkpatrick [3], every training program must start with level one. If resource allows, the evaluation can be further extended to other levels sequentially. Information collected from prior levels will serve as a base for next level. The individual level provides a checkpoint in a training problem. They are equally important in the model. Kirkpatrick's model is widely used in the industry [2].

Despite that e-learning was developed in 1990s [1], Leung first proposed to measure the effectiveness of e-learning program by Kirkpatrick's model one decade later [4]. However, Leung implemented only the first two levels. Besides, there are a number of shortcomings. Leung conducted a small scale experiment. Only one course with around 80 students was evaluated. Moreover, the course is for postgraduate students, who are usually more mature and self-disciplined. Leung evaluated the effectiveness of e-learning programs by comparing the assessment results of two batches of students. However, these two batches of students had different academic backgrounds, work experiences, and scores in their undergraduate studies. Therefore, their academic results cannot be compared directly.

3. Measuring the Effectiveness of E-learning by Kirkpatrick's Four Levels

We evaluate e-learning programs based on Kirkpatrick's Four Levels Model. It is believed that differentiation of evaluation occurs between programs [6]. The evaluations must be aligned with the objectives of the training programs [5]. The four levels are modified to fit e-learning model in academics. Instructors and students from the Department of Computer Science in City University of Hong Kong have been invited to participate in the study. Five courses were involved in this project.

Table 1. Difficulty Level of the Courses

Course	**1**	**2**	**3**	**4**	**5**
Diffculty Level	Fundamental	Intermedia	Fundemenatl	Intermedia	Advanced

Table 1 shows their difficulty levels. Five courses were taught by different instructors. Some classes are conducted purely in traditional mode, i.e., classroom instruction only. Some classes are conducted in hybrid mode, i.e., classroom instruction with supplement of e-learning program. Same materials are delivered in both modes. The students in different classes for same course take the same exam.

Level 1 Evaluation – Reactions

Level 1 is probably the most frequently used measurement, because it is the easiest to be implemented. In our study, we measured students' satisfactions to e-learning program by questionnaires. 200 students are invited to participate in the level 1 evaluation.

Table 2. Average of Students' Satisfaction for the Courses

Course	1	2	3	4	5	Mean
Traditional Mode	3.5	3.6	3.3	4.1	3.9	3.7
Hybird Mode	4.1	3.8	3.7	4.0	4.2	4.0

The students rate individual items in their learning programs. The scores are indicated in a 0 to 5 scale, where a score of 0 means strongly dissatisfied and a score of 5 means strongly satisfied. As shown in the Table 2, the students receiving hybrid mode education get an average satisfaction score of 4.0, while the students receiving traditional mode education only get an average satisfaction score of 3.7. The t-test shows that students receiving hybrid mode education demonstrate greater satisfactions (p-value = 0.036 at 0.05 significance level). Table 3 gives more details about students' satisfaction with e-learning program. Students are most unsatisfied with the course scheduling and support in learning. The schools need to address these issues in order to improve the overall satisfaction.

Table 3. Students' Satisfactions for Individual Items of the Courses

No.	Question	Average Score
1.	Do you satisfy with the facilities in learning?	4.2
2.	Do you satisfy with the support in learning?	2.7
3.	Do you satisfy with the course scheduling?	2.5
4.	Do you satisfy with the workload of the course?	3.2
5.	Do you satisfy with the course design, i.e., content, syllabus, etc?	4.3
6.	Do you satisfy with the learning activities, i.e., coursework?	4.1
7.	Do you satisfy with the assessment system for the course?	3.9
8.	Do you satisfy with the teaching of the instructor?	4.4
9.	Do you understand the materials in the course?	3.9
10.	Can you self-control the learning pace?	3.8
11.	***Overall satisfaction of the course:***	***4.0***

Level 2 Evaluation - Learning

In level 2 evaluation, tests are usually conducted before and after the course to determine the knowledge gained in the course. However, it is not feasible to conduct a test for a course before the course. Instead, we compare academic results of students who are taught in different modes. Two groups of students with similar academic backgrounds are selected to join the evaluations. The assessment results of these two groups of students in some selected common courses are analyzed (Table 4). 16.75% students in courses with hybrid mode get A-grade, while only 11.32% students in courses with traditional mode get A-grade. However, t-test suggest that there is no strong evidence to show that the students in courses with hybrid mode get a better result (p-value = 0.06, rejected at 0.05 significance level).

Table 4. Number of A-Grade Students in the Courses

Course	1	2	3	4	5	Mean
Traditional Mode	7.11%	15.40%	11.21%	13.40%	9.5%	11.32%
Hybrid Mode	26.00%	16.20%	17.50%	15.85%	8.20%	16.75%

Taking the difficulty level of courses (Table 1) into consideration, it is found that the effectiveness of the e-learning is affected by the difficulty level of the courses. The students in courses with hybrid mode have advantages in the courses at fundamental levels. However, the students in courses with hybrid mode have no advantage in the courses at advanced level. They may even get poorer results than students in course with traditional mode. The improvements in the courses at intermediate levels are not significant.

Level 3 Evaluation - Behavior

Level 3 evaluation measures the transfer of students' behavior due to the program. We focus on how students' attitude been changed by e-learning programs. Pre-course questionnaire survey and post-course questionnaire survey have been conducted. We focus on some tangible measurements, such as time spent for courses and the attendance rates.

Table 5. Students' Time Spent Per Week in the Courses

Course	1	2	3	4	5	Mean
(A) Other courses in traditional mode (hours)	6.6	6.7	6.6	6.8	6.5	6.64
(B) This course in traditional mode (hours)	6.7	6.5	8.5	6.6	6.7	7.00
(B)-(A) Time difference for traditional mode	0.1	-0.2	1.9	-0.2	0.2	0.36
(C) Other courses in traditional mode (hours)	6.5	6.8	6.7	6.5	6.6	6.62
(D) This couses in hyrbid mode (hours)	9.3	7.5	8.9	7.4	7.1	8.04
(D)-(C) Time difference for hybird mode	2.8	0.7	2.2	0.9	0.5	1.42
(D)-(B) Time increase for e-learning	2.6	1.0	0.4	0.8	0.4	1.04

We measure the average time spent in the courses per week (Table 5). For the students who study the courses in traditional mode, they spent an average of 6.64 hours in other traditional courses while they spent an average of 7 hours in the courses under investigation, which yield an increase of 0.36 hour. This increase is mainly caused by the Course 3. T-test cannot identify any significant difference between the time spent in the course under investigation and other courses with traditional mode.

For the students who study the courses with hybrid learning mode, they spent an average of 8.04 hours in the courses with hybrid mode while they spent an average of 6.62 hours in other courses with traditional mode. There is a significant increase of 1.42 hours. T-test shows that the students spent more time on courses with hybrid mode than traditional mode (p-value = 0.018, at 0.05 significance level). The students studying courses with hybrid mode spent averagely 1.04 hours more than the students studying courses in traditional mode. T-test shows that the students spent more time on courses with hybrid mode programs (p-value = 0.03, at 0.05 significance level).

Kirkpatrick's model [3] suggests we should conduct evaluation based on the results of prior levels. The results in level 2 suggest that the behaviors of students in the courses at different difficulty levels are different. We compare the students' time spent in courses at different difficulty levels. We find that the students in the courses at fundamental level tend to increase their time spent significantly. However, the increase for students in the courses in intermediate level and advanced level are less significant.

As shown in Table 5, there is a strong correlation of time spent in the courses with traditional mode and time spent in the courses in hybrid mode. In other words, the students' time spent on individual course depends on the nature of the course. Similar to the students in courses with traditional mode, the students in course 3 also spend significantly more time in course 3 with hybrid learning mode. We have interviewed the students. The students in course 3 generally found that this course was difficult. Therefore, they spent more time in the course. Moreover, the students in the courses at fundamental level found that the e-learning tools could help them a lot in studying. Therefore, they spent more time on e-learning. In particular, they found the instant feedback system is most useful in their studying. However, the student in the courses at other levels found that the e-learning tools were less useful. Therefore, they paid minimal effort to the e-learning activities to satisfy the requirement set by the instructors.

We also compared the students' attendance rates in the courses (Table 6). T-test cannot find any evidence to show e-learning programs can improve students' attendance rates. Similar to the result in level 2 evaluations, the students' behaviors vary a lot in different courses. We have setup some focus groups to analyze students' attendance rates. We find that students enjoy a large degree of freedom. They choose what to attend based on their needs. If they believe that e-learning activities is helpful, some of them would rather attend less classroom instruction sections and involve more on e-learning systems. However, if they believe that instructors' lecturing is effective to them, they will attend more classroom instruction sections. Their attendance rates of individual course are affected by many factors. The e-learning system fails to improve the attendance rates.

Table 6. Students' Attendance Rates in the Courses

Course	1	2	3	4	5	Mean
(A) Traditionl Mode	64.3%	59.3%	61.4%	60.1%	62.5%	61.5%
(B) Hybrid Mode	54.2%	60.2%	59.8%	62.3%	75.2%	62.3%
(B)-(A) Attendance rate increased for e-learning	-10.1%	0.9%	-1.6%	2.2%	12.7%	0.8%

Level 4 Evaluation – Results

Level 4 evaluation measures the success of the training program by some common indicators, such as, market shares increase, sales increase, cost reduced, quality improved, etc. Education in Hong Kong is regulated by government. The government has the absolute control on education policy, for example, number of students, the rate of school fee etc. Therefore, these figures cannot reflect the success of a school in Hong Kong.

We can measure the success of e-learning programs by purely comparing of their academic results. The academic result for individual course has been studied in level 2. The overall academic results for the school are difficult to be measured. We can also measure the success of the alumni of the universities. However, it takes a long time to complete. Owing to the time constraint, we cannot conduct this study in the current study. At last, we decide to measure the success of the e-learning program from another view. We interview the instructors to understand the effectiveness of the e-learning.

The instructors generally considered that the e-learning is not flexible enough. The systems were unable to be customized for their courses. On the other hand, the e-learning programs increased the workload of instructors. The instructor needs to spend time to prepare e-learning activities. However, the instructors do not observe significant improvement in some indicators, such as, students' attitudes, time management skill, learning interests and academic results. Therefore, the utilization of e-learning in the courses is still low, and students are not actively involved in e-learning.

5. Conclusion

Kirkpatrick's Four Levels Model has been widely employed for measurement of effectiveness of training programs. We have implemented the Kirkpatrick's model to measure the effectiveness of the e-learning programs. We found that students receiving e-learning together with classroom education demonstrate greater satisfaction and they get a better academic result at fundamental courses. However, the current e-learning programs fail to stimulate student's learning interests.

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Group Learning Modeling for Blended e-Learning: the Role of its Influencing Factors

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Abstract: Group learning is an essential component for organizing cooperative learning or collaborative learning, and it is important for implementing CSCL (Computer-Supported Collaborative Learning) as well. In this paper, we introduce an empirical approach for simulating a group learning model based on its influencing factors which have been extracted from our previous study. The architecture and a generic model of a group learning process are presented, and a model of a group learning process is devised for a blended e-learning environment.

Keywords: Group Learning, a classroom-based learning environment, a web-based learning environment, influencing factors, online learning, e-learning

INTRODUCTION

The factors influencing the performance and effectiveness of a group learning process are defined as the influencing factors of group learning in this study, such as group task, group composition, group communication, group interaction, group structure, and group evaluation. McGrath proposes a paradigm to analyze group interaction, which presents a framework based on it, i.e. "INPUT → PROCESS → OUTPUT" for analyzing the role of the group interaction process [1]. The INPUT component includes individual-level factors, group-level factors, and environment-level factors. The OUTPUT component includes performance outcomes and other outcomes. This paradigm manifests the different influencing factors of GL (Group Learning). However, it does not clarify how many influencing factors are involved in the different components. Hackman and Morris develop a framework to explain the relationship among the focal input variables, the group interaction process, the summarizing variables, the critical task contingencies, and group performance and effectiveness [2]. Three categories of variables are involved in this paradigm, i.e. effort, performance strategies, and knowledge and skill. Hackman and Morris consider these three categories of variables are the most proximal causes of group task effectiveness. Similar to McGrath's paradigm, this framework can be described as an "Input-Process-Output" sequence for different types of tasks [1].

These variables can be considered as the influencing factors of a group learning process. However, they do not explicate how many influencing factors are involved in this process. Some researchers, such as Jaques and Reynolds, also mention the influencing factors of a group learning process. However, they do not introduce the influencing factors of them systematically [3][4] .

The influencing factors were identified in this study through analyzing them according to the previous researchers' work from literature. Therefore, the literature was chosen as samples for our analysis. The decision whether or not to choose literature is dependent on whether they introduce or mention the influencing factors of group learning in a systematic manner.

Content analysis is used as a research method for examining the influencing factors of group learning. Therefore, the coding system of content analysis should be developed first. In this study, a primary coding system including the fundamental influencing factors of group learning is developed first. This coding system was an open-ended one that means the new influencing factor could be added to the coding system when it was found in the literature [5]. The data were collected from the samples (35

books and 1 journal paper) and SPSS is used for analyzing them. Each influencing factor was analyzed according to its frequency and percentage. 62 influencing factors were extracted and clustered based on a group learning process [5].

1. A MODEL OF A GROUP LEARNING PROCESS

1.1 The Architecture of a Group Learning Process

The architecture of a group learning process according to a conventional group learning process is described at Figure 1 [1]. This is the five-level architecture of a group learning process.

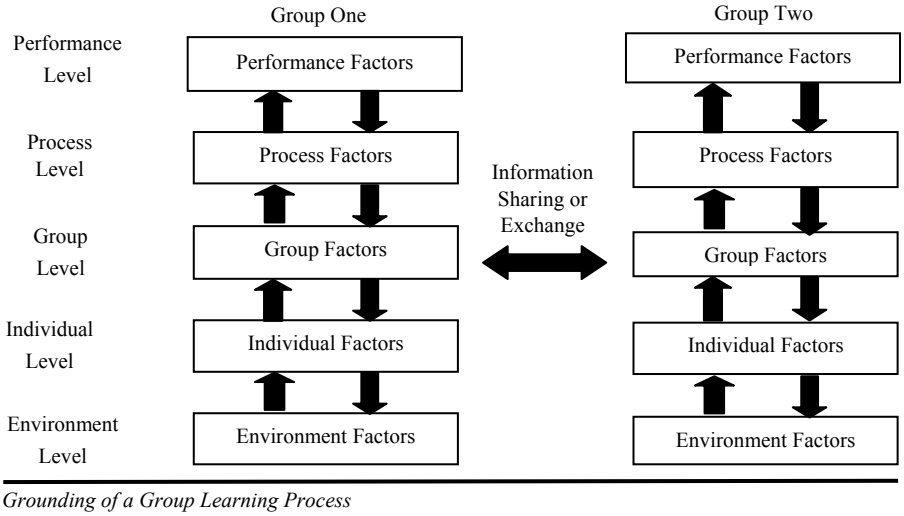

Figure 1. The architecture of a group learning process

The influencing factors of group learning are combined and described at this architecture of a group learning process. These influencing factors of group learning can be categorized into five levels for a group learning process, i.e., environment level, group level, individual level, process level, and performance level. The unidirectional arrow indicates the information flow, which expresses the process of information delivering. Bidirectional arrow means the information is exchanged or shared between different groups, e.g., group one and group two. Grounding of a group learning process is the foundation, which is related to some theoretical, ideological, or political issues.

1.2 A Generic Model of a Group Learning Process

A generic model of a group learning process is described in Figure 2. It presents the relationship of different components of a group learning process. This generic model is developed according to the architecture of a group learning process and the framework of group learning [1][2].

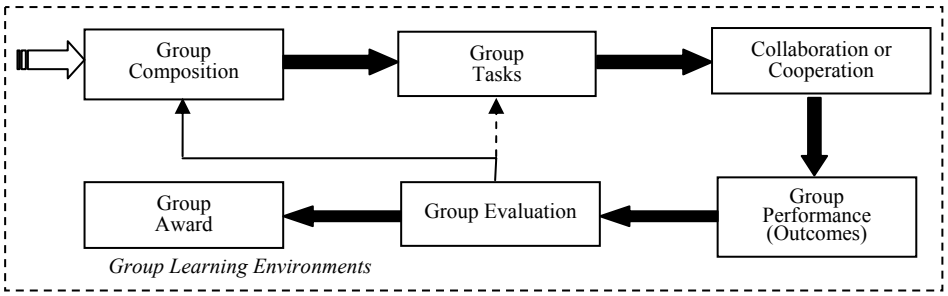

Figure 2. The generic model of a group learning process

1.2.1 Group Composition

Group composition is a part of the works to form a group. Group organizer (tutor or students themselves) should take into account the characteristics of membership of group, their ability, group

size, and role playing. When a group is formed, its categories should be determined first. Two kinds of group categories can be used to organize group, which are heterogeneous and homogeneous. Empirical studies claim that heterogeneous group is much more effective than homogeneous group [10][11][3]. Therefore, individuals in a group should be carefully chosen according to their ability, characteristics, identity, attitude, motivation, and experiences in order to suit the requirement of a heterogeneous group.

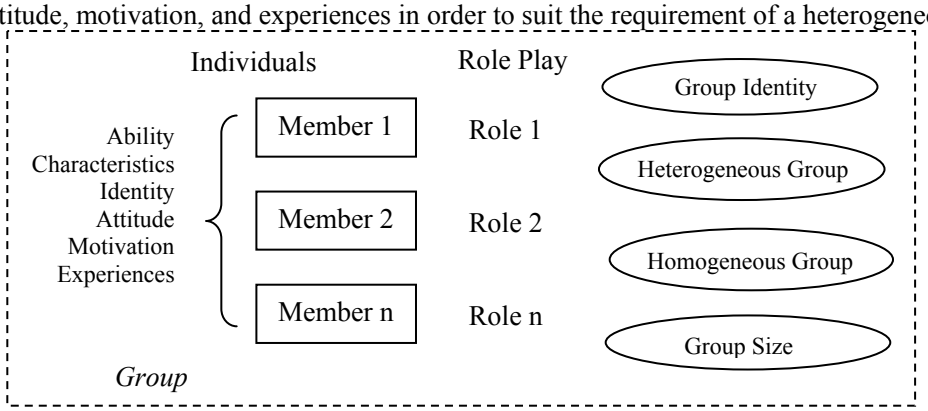

Figure 3. The elements of the group composition stage

1.2.2 Group Task

The task can be defined as a set of rules that must be followed to accomplish a goal. Complex tasks consist of several mini-systems, each having a sensing, a testing and an effecting function [13]. Group members typically share a set of expectations about proper approaches to the task, and to some degree the group enforces member adherence to those expectations. This norm can be used to manage and coordinate group members' behavior: Everyone should know how things should be done, and everyone does them that way [3].

1.2.3 Collaboration or Cooperation

Group participants are working collaboratively or cooperatively to find out a solution to the task. At this stage, students are working together for planning, materials searching, data collecting, data analyzing, writing, and team work presentation. Collaboration/cooperation stage can be described at Figure 4.

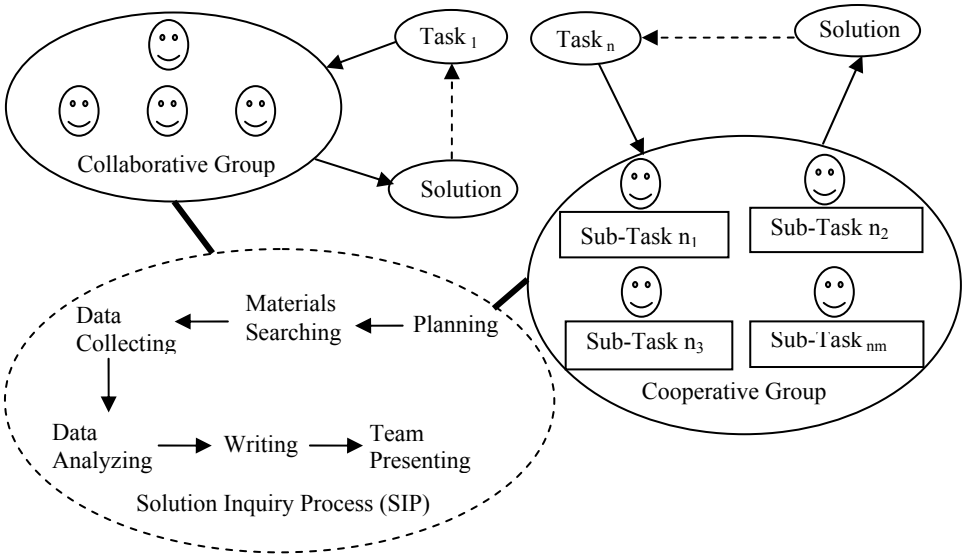

Figure 4. The collaboration/cooperation stage

When group members collaborate/cooperate each other, communication, discussion, and interaction will occur simultaneously. Lots of collaborative/ cooperative methods are explored, such as STAD (Student Teams-Achievement Divisions), TGT (Teams-Games-Tournaments), TAI (Team Accelerated Instruction), CIRC (Cooperative Integrated Reading and Composition), learning together, complex

instruction, JIG (Jigsaw), and JIG II (Jigsaw II) [13][14]. These methods can be used to organize group learning in practical educational field.

1.2.4 Group Performance or Outcomes

Many concrete representations of group performance or outcomes can be found in a group learning process, such as presentation, reports, quality of performance, speed to a solution, number of errors, member satisfaction, group cohesiveness, and attitude change [1]. All of them can be considered as the output of a group learning process. Therefore, they can be assessed in order to evaluate the performance of a group.

1.2.5 Group Evaluation

Group performance or outcomes need to be evaluated, especially for group learning in schools or colleges and universities. Group members want to know the grading of their efforts which can be provided by the results of group evaluation. Meanwhile, lots of their credits are connected with the performance of their group learning.

1.2.6 Group Awards

Group awards can reinforce group members' motivation and promote their Endeavour on a more effective performance. A certain proportion of effective group can obtain award according to the results of group evaluation, e.g., the top 2 groups, or top 3 groups can get awards.

1.2.7 A Group Learning Environment

At least three environments can be used for group learning, i.e., a classroom-based environment, a web-based environment, and a blended e-learning environment. The main characteristics of this environment are FTF (Face to Face) and online approaches are combined together.

2. A MODEL OF A GROUP LEARNING PROCESS IN A BLENDED E-LEARNING ENVIRONMENT

A model of a group learning process in a blended e-learning environment according to the generic model of a group learning process is presented in Figure 5.

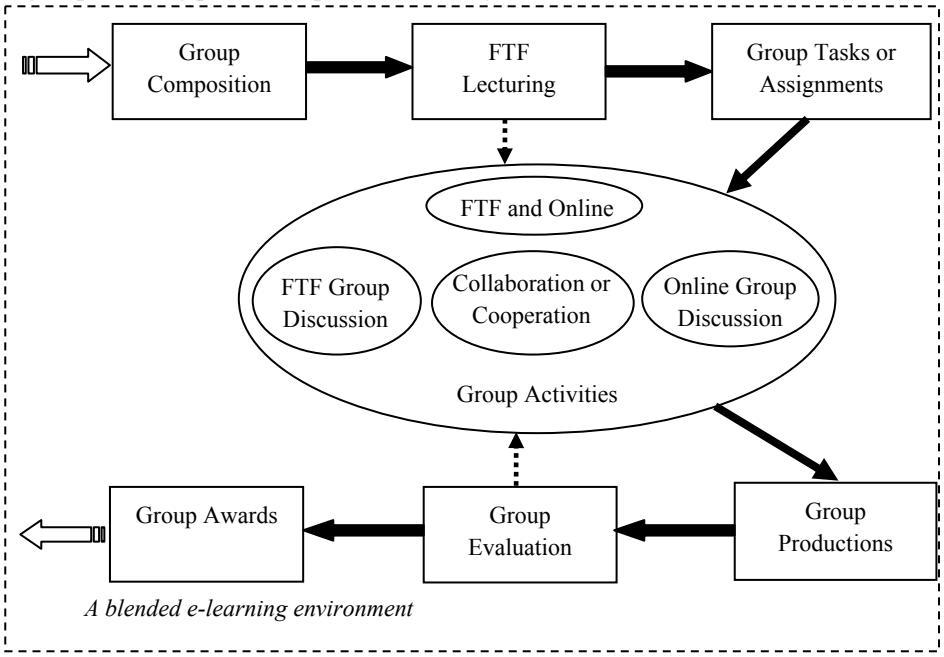

Figure 5. A model of a group learning process in a blended e-learning environment

This model includes eight components, i.e. group composition, FTF lecturing, group tasks or assignments, group activities, group performance or outcomes, group evaluation, group awards, and a blended e-learning environment.

3. Conclusion

Group learning is popularly used in schools for organizing students learning activities. It is an essential component for CSCL as well because cooperative/collaborative learning should be running in groups. This paper discusses how to simulate a group learning process based on its influencing factors, and this is a new way for exploring how to simulate a group learning process. In our previous study, we have identified 62 influencing factors and they are applied in this work [5]. The architecture, a generic model and a model of a group learning process were simulated in this study and they would be utilized for clarifying how a group learning process works.

Acknowledgments

This paper was supported by National Educational Project for "Eleven-Five" Planning (No. DCA080147), Guangdong Social-Science funds for Educational Research Project (No. 07SJZ003), and SRF for ROCS, SEM

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Towards an ITS for Decision Making on Managing Palm Oil Plantations

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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 design of an Intelligent Tutoring System that will be embedded within an active Management Information System (MIS). With the ITS embedded within the MIS, users will be presented with real-life management scenarios and practice with actual operational data. This would help them improve their decision making skills and help them make more effective decisions in their work area. We discuss the architecture and use-case scenario for DM-Tutor (Decision Making–Tutor). We also include plans for system evaluation and future work.

Keywords: Embedded ITS, decision making, architecture, use-case scenario

Introduction

Intelligent Tutoring Systems have been very successful [4] and have resulted in high levels of motivation and learning in many areas researched [11]. ITSs have been build in various teaching and learning domains, SQL-Tutor [10], KERMIT [15], CAPIT [7], CIT [9], UML Tutor [1] and many others. However to date, very few attempts have been made to integrate or embed ITSs into existing systems. This area of research has a lot of potential, especially in increasing the effectiveness of life-long education and training at workplaces [12]. As the saying goes, systems are only as good as the people that use them. It is rather pointless in having good information systems if the users of the systems are not able to fully utilize them. ITS features are ideal for providing tutoring or training to one or many people at the same time. Where other training methodologies such as CBT (computer-based training), WBT (web-based training) and multimedia-based training have encountered limitations in this area [2], ITS could still have the advantage of being able to provide continuous and effective work-place trainings to users and organizations.

Some of the attempts made to embed intelligent learning techniques into existing systems include the Macsyma Advisor [5] which was developed to assist users in using Macsyma, the algebraic manipulation system. Macsyma Advisor focused on assisting rather than training, which meant the user may not have learned how to solve problems unassisted in future. Embedded Training System (ETS) [3] was developed and integrated with an existing Complex Information System for military tasks and operations. The goal of ETS was to train users on military based scenarios. ETS however was not robust enough to handle variety of student's actions and behaviors within the system.

Excel Tutor [6] was developed to work on top of Microsoft Excel Spreadsheet software program. Excel Tutor provided descriptive explanations and interactive guidance

for students to solve excel problems. Excel Tutor provided a higher learning outcome for students. Another similar research was Personal Access Tutor (PAT) [14] which was added into MS Access to help students build reports and forms. Although the students seemed to like PAT, the system has not been fully evaluated.

This paper presents the design and architecture of DM-Tutor (Decision Making-Tutor) that will be embedded into a MIS (Management Information System) to train users on effective decision making. The MIS for palm oil industry [13] provides an integrated software solution for managing oil palm plantation operations. The MIS modules provide for resources management, finance and accounting management and other management concerns. The aim of the MIS is to achieve management objectives of optimum profit and balanced operations costs. Managers carry out yield and cost related analyses using the operational data contained within the MIS database. As the information is highly domain-specific and requires detailed knowledge of the domain and the MIS, managers who are new to the domain or to the MIS face difficulties in making accurate and well defined analyses. This in turn affects the management and operational decisions they would make.

The paper is organized as follows. In the next section we discuss the architecture of DM-Tutor. Section 2 discusses the use-case scenario and section 3 presents conclusion and future work.

1. DM-Tutor

The architecture of DM-Tutor is unique because it presents an ITS embedded within an actively used system, the MIS. Figure 1 presents the architecture of the MIS with DM-Tutor and its components embedded within it .The MIS [13] by itself is a web based system and is accessed via the web browser. When user logs into DM-Tutor for the first time, s/he gets a brief description of the system and the problem solving environment it provides. A log is used to record users' actions in DM-Tutor.

Student Model: Constraint based modeling (CBM) [8] approach is used to model the student. Student is modeled by looking through the student's solution and comparing student's solution to the ideal solution. Student model contains student profile that is updated every time s/he uses the ITS. Progress is tracked and the area that s/he requires more help in is identified and retained by the system.

Pedagogical Module contains contextualized instructions relevant to the scenario-based problem solving strategy, potential solutions and relevant hints to guide students/ users. The pedagogical module interacts closely with the MIS database to provide view of operational data in relation to the scenario-based problem solving. Pedagogical module observes student's action in the interface and acts to it accordingly, by giving appropriate feedback.

Domain Model is represented in the form of constraints [8]. A Semantic Portal developed for the palm oil domain provides additional information in various forms. Using semantic technology, the portal gathers useful and relevant information from the WWW to provide helpful information; based on DM-Tutor user's previous query or doubts. The gathered information would be made available to the user when user logs in the next time.

Interface Module for DM-Tutor is unique as it presents the integration within the MIS system. DM-Tutor's users are able to view MIS operational data to simulate real plantation management decision making. The main window of DM-Tutor is divided into 4 areas.

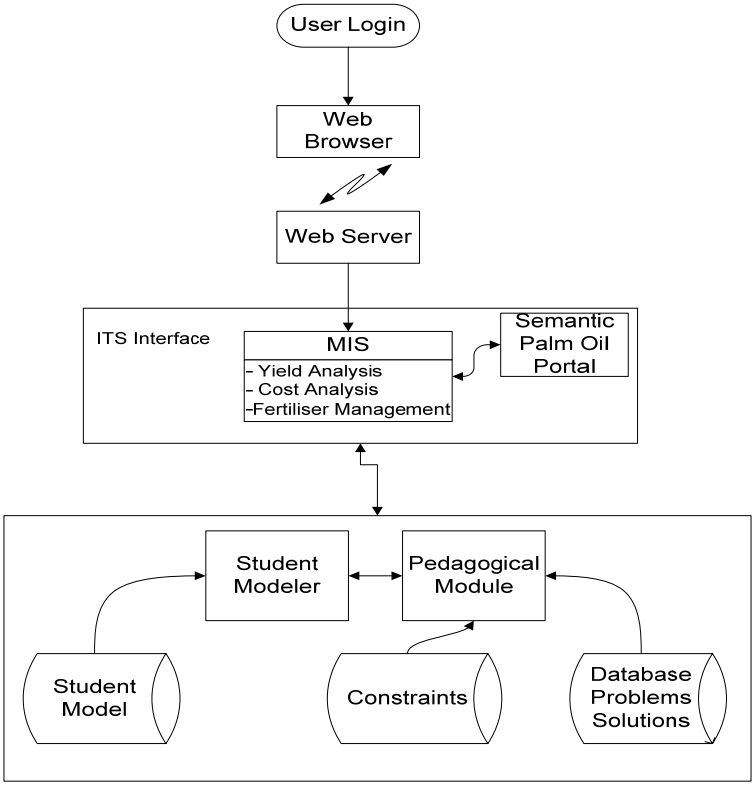


Figure 1: Architecture and main components of DM-Tutor

The top pane displays the given problem; middle pane is workspace area, bottom pane displays relevant view of MIS database and a side pane to display DM-Tutor feedback messages. This design is aimed at reducing memory load of students. Interface module handles communication between system and user.

2. DM-Tutor Use Case Scenario

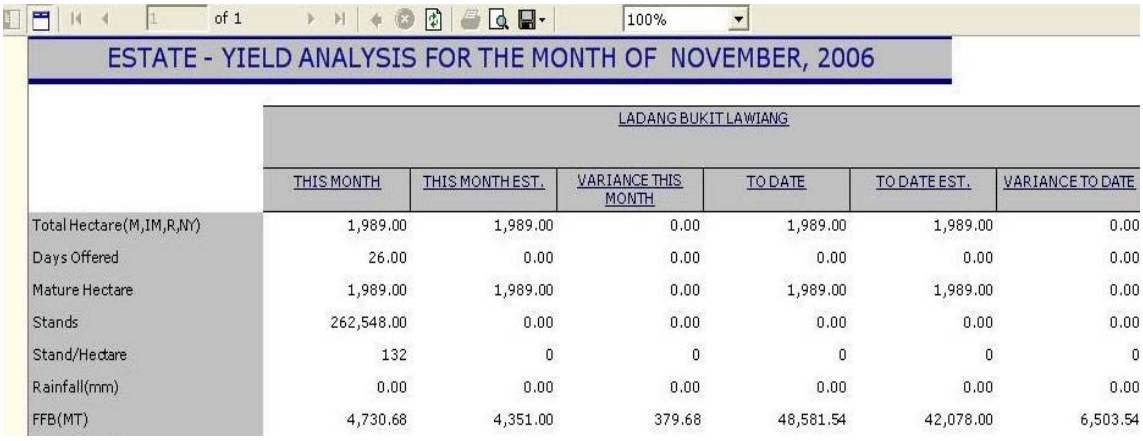
The objective of DM-Tutor is to train users on making effective decisions related to their management area. For palm oil industry managers to make good yield related decisions they have to first know how to do effective yield analysis. Below is a set of example questions DM-Tutor would provide to users and appropriate user/student actions for this scenario.

Question 1: Identify yield for estate: Ladang Bukit Lawiang

The bottom pane of the working area displays screen shot of the yield table to determine if the user can identify yield for the palm oil estate for a given time period (as the first step). Figure 2 shows a screenshot of the MIS yield table, where yield is labeled as *Fresh Fruit Bunch in Metric Tonne* (FFB(MT)). Student has to enter value of the yield in the workspace provided.

Question 2: List the factors that contribute to yield production in an estate

User has to list the factors contributing to yield in the workspace area provided. The factors include rainfall, fertilizer consumption, labor utilization and vehicle usage. This question is to gauge the level of understanding the user has of the domain and of the MIS.



ESTATE - YIELD ANALYSIS FOR THE MONTH OF NOVEMBER, 2006

	LADANG BUKIT LAWIANG					
	THIS MONTH	THIS MONTH EST.	VARIANCE THIS MONTH	TO DATE	TO DATE EST.	VARIANCE TO DATE
Total Hectare(M,IM,R,NY)	1,989.00	1,989.00	0.00	1,989.00	1,989.00	0.00
Days Offered	26.00	0.00	0.00	0.00	0.00	0.00
Mature Hectare	1,989.00	1,989.00	0.00	1,989.00	1,989.00	0.00
Stands	262,548.00	0.00	0.00	0.00	0.00	0.00
Stand/Hectare	132	0	0	0	0	0
Rainfall(mm)	0.00	0.00	0.00	0.00	0.00	0.00
FFB(MT)	4,730.68	4,351.00	379.68	48,581.54	42,078.00	6,503.54

Figure 2: Sample Yield Table.

Question 3: Compare the yield of different fields of the estate. Estimate potential yield of the estate and calculate yield gap for each field

As plantation estates are made up of several fields and management actions are mostly carried out at field levels, user has to access the actual yield (Y_a) data of relevant fields. Figure 3 shows screenshot of yield map from where user can obtain the yield data of different fields and compare the yield for several production periods. Yield at above 90th percentile of the estate production is considered as potential yield (Y_p). User has to list both field number and yield in the workspace provided. Next, user has to estimate potential yield of the estate and fill in the box provided for potential yield. Lastly, user has to calculate yield gap (using the formula below) for each field and enter this information as well into the provided workspace, using the following formula: Yield gap = $Y_p - Y_a$

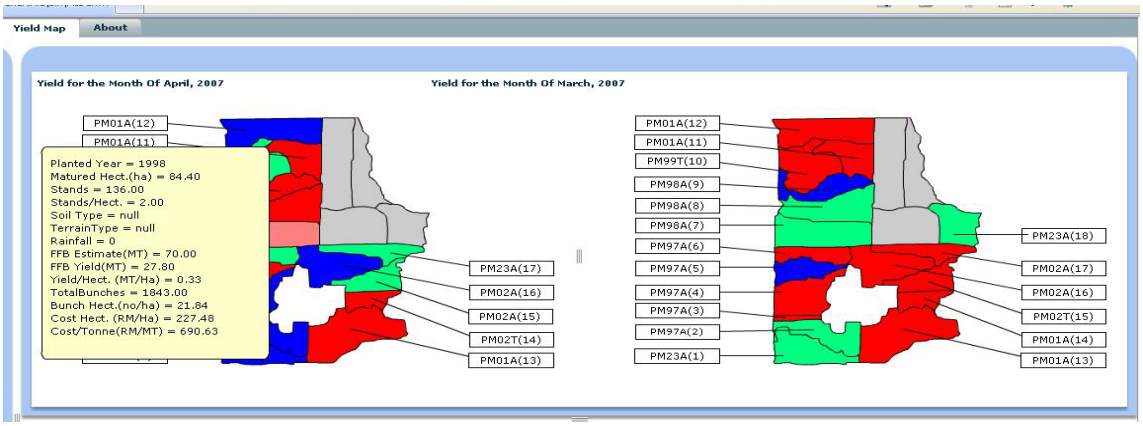


Figure 3: Yield comparison between fields within an estate.

Question 4: Identify the low performing field(s) and recommend steps to improve yield of the field(s)

Where yield gap is highest, the field is considered as low-performing and that is the field where management action is most needed to improve yield. As the final step, the user has to identify and name the field(s) that is/are not performing well and in the workspace provided give his/her suggestions to improve yield for the non-performing field(s), based on the earlier understanding of the factors that influence yield production. DM-Tutor compares the user's solution to the ideal solution contained within DM-Tutor's knowledge base and gauges the level of accuracy of the user's solution and gives feedback to the user. If the user's solution is inaccurate DM-Tutor would provide relevant feedback and guide the user through the accurate steps in yield analysis and decision making.

3. Conclusion and Future Work

DM-Tutor is a work-in-progress and when completed would be a very beneficial research in many aspects. This would be the first time where a constraint based tutor is being embedded within an existing system and it also would have a very practical benefit of providing life-long workplace learning anywhere and anytime. We have planned for DM-Tutor to be evaluated by users of different levels: managers in palm oil industries, trainee managers and novices. Upon completion of DM-Tutor we hope to be able to present users' evaluation of our system and our belief of the potential of ITS in increasing workplace efficiency.

Acknowledgements

The first author thanks RANN Consulting, Malaysia for funding this research.

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Workshop Proceedings of The 17th International Conference on Computers in Education

ISBN-978-986-84735-5-3

Publisher
Asia-Pacific Society for Computers in Education,
Jhongli, Taiwan

Editorial Managers
Wai Ying Linda KWOK
Man Hin Cyrus KWAN

Printed in Hong Kong
Year Published: November 2009

Co-organizers

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