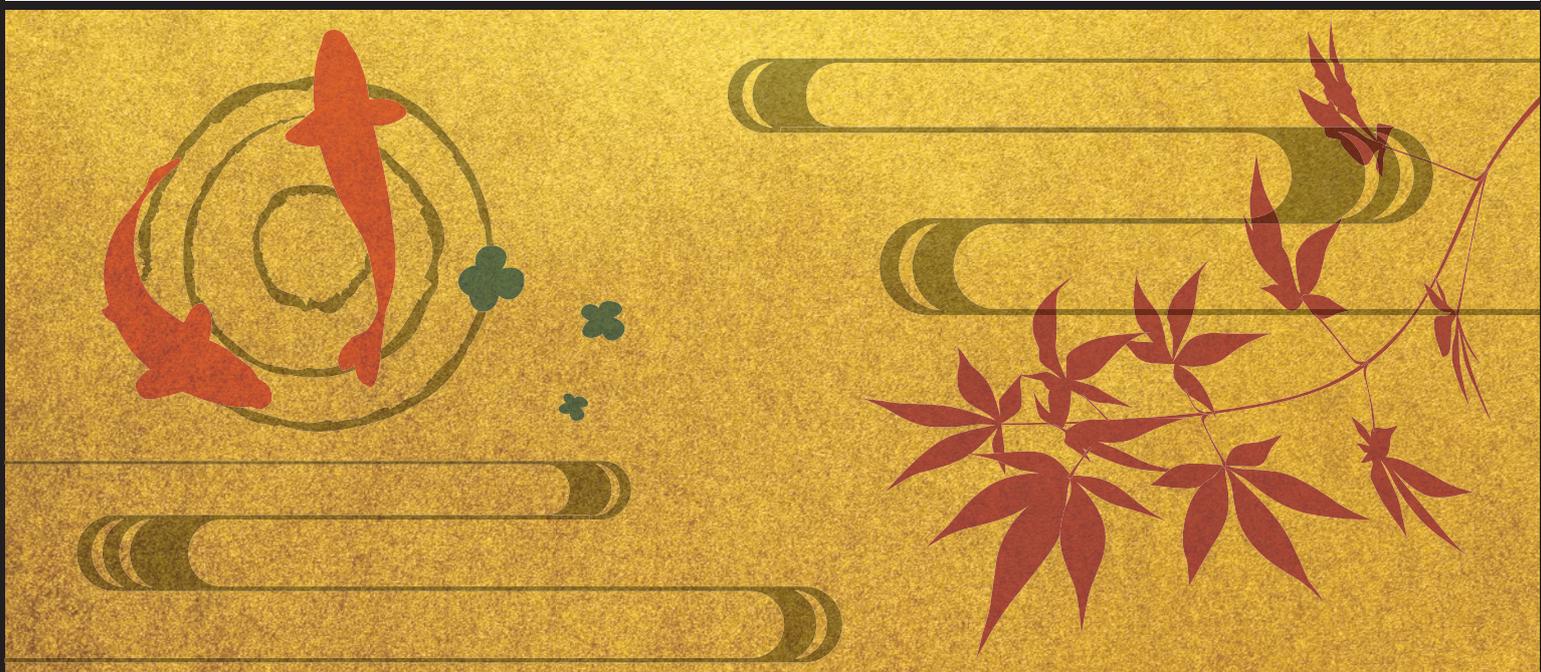




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**Doctoral Student Consortium (DSC)  
Proceedings of the  
22th International Conference  
on Computers in Education  
ICCE 2014**

**November 30, 2014 - December 4, 2014  
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## PREFACE

This volume contains the Doctoral Student Consortium (DSC) Proceedings of the 22nd International Conference on Computers in Education (ICCE 2014). For this year, the DSC brings together PhD students working in the broad research areas of computers in education in the following six sub-themes: Computer-Supported Collaborative Learning and Learning Sciences (CSCL/LS); Advanced Learning Technologies, Open Contents, and Standards (ALT/OC/S); Classroom, Ubiquitous, and Mobile Technologies Enhanced Learning (CUMTEL); Digital Game and Digital Toy Enhanced Learning and Society (GTEL&S); Technology Enhanced Language Learning (TELL) and Practice-Driven Research, Teacher Professional Development and Policy of ICT in Education (PTP).

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

A group of senior PhD students (Jiangshan SUN, Tieh-Huai CHANG, Xinghua WANG, Jueqi GUAN, Kousuke MOURI, Songran LIU, Susanna NORDMARK, Kyu-Dong PARK, Yiling HU, Anmei DONG, Qiang MIAO, Fang-Chen LU, Mei-Jen Audrey SHIH, Akiko KAI, Kai Wing CHAN, Mei Lick CHEOK, Yin HAN, Wai Ying KWOK, and Boon See TAN) who were recommended by the APSCE Special Interest Group Chairs were invited to be the organizers of this prestigious event. This group of senior PhD students were guided by the DSC Chairs. The DSC chairs helped oversee the whole process of organizing the DSC and provided guidance along the way. With a strong sense of responsibility and enthusiasm, this highly dynamic group has been successful in organizing the DSC.

This year a total of 10 papers were finally selected and included in the proceedings. Each selected paper went through a rigorous blind review by independent peer reviewers to ensure high quality work. We hope that the papers in the proceedings on various research topics will stimulate more research ideas and discussions among the young researchers. We would like to thank all the invited mentors in making this year's DSC a highly successful event.

On behalf of editors  
Ben CHANG  
Weiqin CHEN  
Xiaoqing GU

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# Circuitously Collaborative Learning Environment to Enhance Metacognition

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**Abstract:** This paper reveals the design of an ongoing research that investigates the effectiveness of an alternative learning environment Circuitously Collaborative Learning Environment (CirCLE), which is designed to enhance metacognitive awareness on the learning processes in mathematical word problem (MWP) solving environments. We perform the research based on the hypothesis that a student will be encouraged and can reflect his own thinking when he practicing a role of an inspector together with receiving appropriate feedback to revise his solutions.

**Keywords:** Metacognition, problem solving, peer assessment, collaborative learning

## 1. Introduction

In a usual collaborative learning environment, students have opportunities to share and are engaged in discussion to take responsibility for their own learning (Gokhale, 1995). However, research in Computer-Supported Collaborative Learning (CSCL) showed that it is difficult to clearly define the interaction between the initial conditions of collaboration and learning outcomes. Moreover, collaboration leads to positive outcomes only when students engage in knowledge-generative interactions, (Dillenbourg & Jermann, 2007), to say that, it is not effective in noncompetitive groups or inactive students. To solve mathematical problems, it is necessary for students to think on their own cognitive strategy to understand deeply how the problems solved. Therefore, in this study, we propose an alternative learning environment, namely Circuitously Collaborative Learning Environment (CirCLE), which provides chances for participants to learn actively to solve algebraic mathematical word problems, in which students learn to solve MWP's by translating context problems into mathematical notations. There are a lot of research established that metacognition is also linked to mathematical capacities (Veenman & Spaans, 2005; Kramarski & Mevarech, 2003). For instant, Teong (2002), knowing when and how to use cognitive strategies is an important determinant of successful word problem solving. Two key components, which are used to compose CirCLE, are a management strategy, named Peer Inspection (PI) strategy, and a communication media, named Inferential Diagram (ID). We intentionally design them to support students' metacognition by providing chances to reflect their cognition and rethink their learning strategy. The detail of PI and ID will be revealed in the rest sections.

## 2. Peer Inspection Strategy

PI is counted as a *formative peer assessment*; peer feedback is given while the learning is actually happening, helping students plan their own learning, identify their own strengths and weaknesses, target areas for remedial action, and develop metacognitive and other skills (Topping, 2009). The aim for designing PI is to be a learning management strategy for raising the learning of students both as

assessors (reciprocal teaching (Palincsar & Brown, 1984)) and *assesseees* in meta-level through modified peer assessment activities. The modified peer assessment activities in PI are composed of three main stages;

- i) *Problem providing*: Nakano, Hirashima, and Takeuchi (2002) mentioned that it is important to consider the differences of problems in understanding the problems deeply. In PI, to encourage students to focus on their own problem, a teacher, therefore, provides distinct problems for each student.
- ii) *Peer selection*: Each student will be assigned to inspect suitable works of peers by their learning performance; high performance (HP), average performance (AP), and low performance (LP), to simulate an environment that he/she can learn effectively. For example, for LP students who have no idea how to start, at least two correctly complete examples (If there is no correctly complete solution, a teacher will provide) should be assigned to them to let them follow or learn how to solve problems correctly and they also can use those examples as keys for inspecting assigned solutions of other peers.
- iii) *Peer feedback*: Challenging feedback corresponding to students' performance are also important (Mevarech & Susak, 1993), e.g., an HP student should receive feedback to against his idea, which will make him rethink on his own solutions. AP and LP students should receive properly correct feedback as guidance to revise their solution not to confuse them.

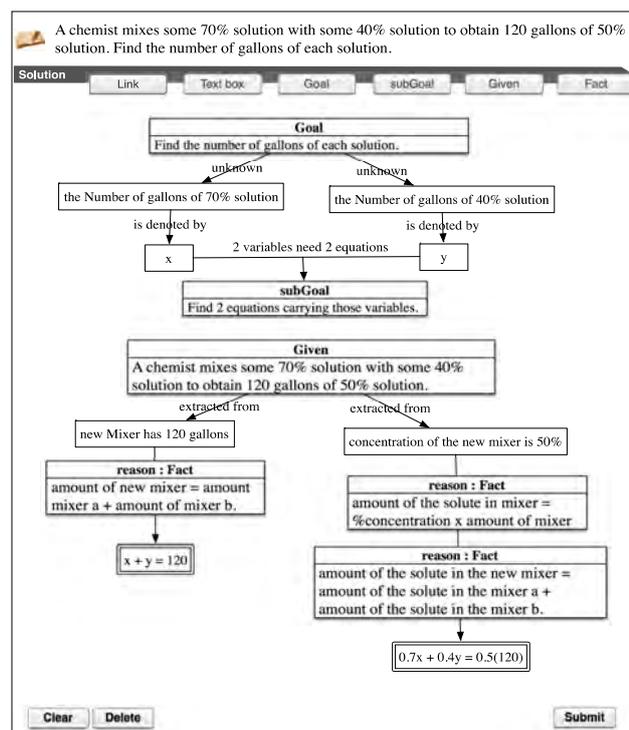
Furthermore, in this research, we also propose Initial Diagram (ID) as a solution method to be a communication media among participants to support and enhance potential of PI. The detail of ID is revealed in the following section.

### 3. Inferential Diagram

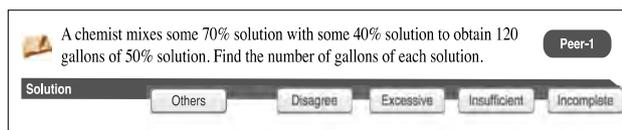
Perceptual inferences can be made more easily than symbolic inferences (Koedinger, 1991), therefore we design ID as a tool to externalize steps of inference when students solving MWP. It is used as a communication media among participants to reduce the complexity of commenting process and to foster students in reflecting their thinking process when solving MWP. This section illustrates some examples of how to provide solution of MWP using ID and how a student comments via ID.

#### 3.1 Providing a solution of MWP using Inferential Diagram

To encourage a student to aware of solving MWP, we propose solution method, called Inferential Diagram (ID), in which a student has to explicitly state any information or statement by expressing its source or reason why he need it. In the user interface of the proposed system, see the figure 1(a), there are six necessary buttons; 1) 'Goal' button is used to state a problem goal, 2) 'subGoal' button is used to state sub-goal of a problem, 3) 'Given' button is used to illustrate information given, 4) 'Fact' button is used to refer common fact, theorems, common rules, or axioms, 5) 'Text' button is used to state reason or any other statements, and 6) 'Link' button is used to create a link between information nodes. To illustrate the relation between information nodes, a student can put any text box on the link. See figure 1(a), the diagram could be



(a)



(b)

Figure 1. Providing solution using Inferential Diagram; (a) student interface and (b) peer interface

interpret as follows, ‘the Number of gallons of 70% solution is denoted by x’, ‘Since, there are 2 variables (x and y), then 2 equations carrying those 2 variables are required’, ‘The problem gave that the mixer has 120 gallons and because there is the fact that “amount of new mixer = amount mixer a + amount of mixer b” and from the assumption, then the equation could be formed as  $x + y = 120$ ’, etc.

### 3.2 Commenting peer’s solution via inferential diagram

It is not an easy task for some students to comment on peers’ works. Therefore, ID is designed to support students in this task. In CirCLE, by using ID, we provide five example comments as options; i) ‘I do not agree with an Information in node A’, ii) ‘I do not agree with an Information in node A’, iii) ‘Does this reason make sense?’, iv) ‘Insufficient Information to infer A’, and v) ‘Incomplete solution’. The difference between the student interface and the peer interface are the command buttons; see figure 1(b) comparing to the figure 1(a). To indicate that, for example, if one does not agree with information in a node-A, he can click on the node-A following by clicking on ‘Disagree’ button. In addition to provide an opened comment, a student can use the ‘Other’ button to add additional comments. To construct connections between previous and new knowledge, metacognitive questions, such as, ‘what are the similarities/differences between the problem you are assigned and the problems you have to inspect? and why?’ and questions, such as, ‘what are the strategies/tactics/principles appropriate for solving the problem and why?’, will be used to criticize students during their learning process.

## 4. Circuitously Collaborative Learning Environment

Since, in CirCLE, students are not directly assigned to work in group, but in a class of specific topic in which all students have the same goal, the students share their solutions anonymously, they comment peers’ solutions, together with receiving feedbacks from peers’ inspection, then, revise their own solutions using those comments and experiences from inspecting peers’ works, therefore the term ‘Circuitously Collaborative Learning’ was used.

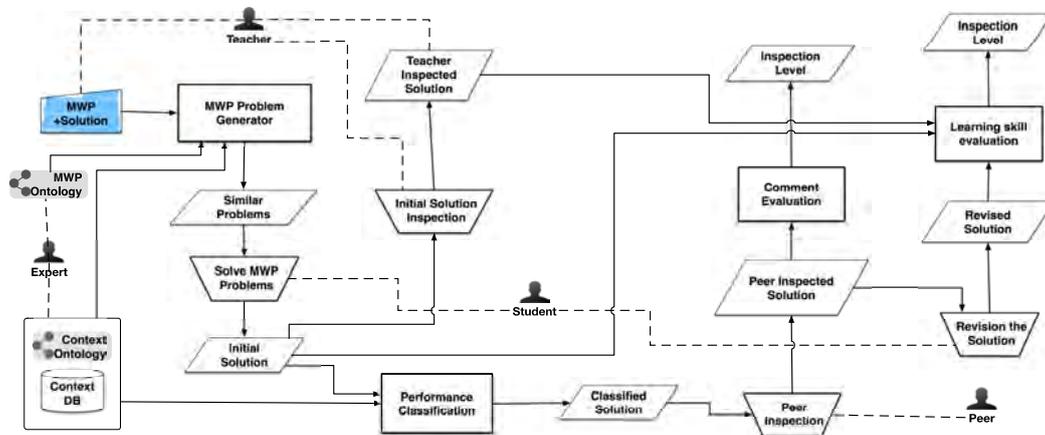


Figure 2. Architecture of Circuitously Collaborative Learning Environment

The system architecture is designed as shown in figure 2. A teacher initially provides some questions to the system and then the system generates similar problems and distributes the generated problems to students. In CirCLE, each student is assigned to solve distinct MWP individually. The initial solution of which students submitted to the system will be used to classify students into three classes, as mentioned in the section 2, for assigning peers. Once peers are assigned, any peer is required to give comment or feedback on other students’ work. Each student has an opportunity to revise their work from what he/she learnt from peers’ work and what they gained from peers’ comments. The system is expected to evaluate students’ learning skill from initial solution and revised solution, and it is also expected to evaluate student’s commenting skill by learning from teacher inspection. An expert in the system is a facilitator providing knowledge base to the system.

## 5. Methodology

The participants will be eighth-grade students (including boys and girls). All classes will study MWP in algebra unit. The main purpose of this course is to develop students' understanding in MWP solving. In particular, students; (i) can set up or pinpoint the goal of a problem, (ii) know what they have and do not have, (iii) think of strategies and can choose the most appropriate strategy for solving the problem, and (iv) can verify the consistency of the solution.

The instructional methods will be as follows: control group (CI+TS), group A (CI+ID), group B (PI+ID) and group C (PI+TS), in which CI and TS stand for 'Classical Instruction: a teacher gives explanation and show some examples' and 'Traditional Solution' respectively. The study will utilize two measures for the pre-test and post-test: (i) mathematical test; and (ii) metacognitive questionnaire, which is modified from the 'metacognitive self-regulation' subscale of the MSLQ (Pintrich & de Groot, 1990).

## 6. Research Expectation

In this research, we aim to develop a computer-supported learning environment, which supports students' self-learning regulation to motivate students' metacognition. To accomplish our goal, we propose ID, which is expected to assist students to depict and reflect the whole process of solving MWP and PI, which simulates a learning environment for students to realize varieties of solutions and support them to learn from pro and con of other strategies comparing with their own strategies. Consequently, by using PI and ID we compose an alternative learning environment, CirCLE, which is designed to encourage a student's metacognition by supporting a student's self-regulated learning and reflecting his learning process. It is aimed that students can learn more effective and deeply understand MWP and they can be enhanced their metacognition via CirCLE.

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# Cycling Student-Centered Digital Materials as Model of Enhancing Active Learning Environment

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**Abstract:** This paper provides Cycling Student-Centered Digital Materials (CSCDM) as a model of enhancing active learning environment. The paper introduces three learning phases, Form, In-form and Re-form (FIR) with the 6E model; Engagement, Exploration, Explanation, Elaboration, Evaluation, and Evolution as a learning guide for elementary students in Japan to enhance their motivation and relevance. The CSCDM is designed for twofold; a) to provide intrinsic motivation and learning contents for effective-active learning environment of language and cross culture awareness; and b) Task directions to serve as the learning guide to place student in role more on a long-life educator than on conventional classroom. Within this framework, authors applied the CSCDM design for 5th grade elementary students in an experimental group. The implementation of this study includes three phases; forming digital materials with student-centered engagement, in-forming groups' presentation and correction of languages used, and re-forming new learning contents based on international partner requested topic. Questionnaire in before and after form illustrated the results of CSCDM phases. The results showed a significant learning gain improvement for experimental group with CSCDM method than for control group without it.

**Keywords:** Cycling student-centered digital materials - active learning - Learning cycle - conventional constructional style

## 1. Introduction

A significant body of research on different learning strategies supports the effectiveness of learning approaches in increasing student learning and achievement. These learning strategies include student-centered learning (SCL) and learning cycle (LC). The researchers found that the SCL is a learning environment where students assume responsibility for both identifying and monitoring individual learning goals and selecting means to support their learning (Michael J. Hannafin, Janette R.Hill, Susan M. Land, and Eunbae Lee, 2014). Karplus and Thier (1967) developed the Learning Cycle in 1967 for the Science Curriculum Improvement Study (SCIS). This inquiry-based teaching approach is based on three distinct phases of instruction: 1) exploration provides students with firsthand experiences with science phenomena; 2) concept introduction allows students to build science ideas through interaction with peers, texts, and teachers; (3) concept application asks students to apply these science ideas to new situations or new problems. A popular version of the learning cycle is the 5E Model: Engagement, Exploration, Explanation, Elaboration, and Evaluation (Bybee, 1997). The LC can result in greater achievement in science, better retention of concepts, improved attitudes toward learning, improved reasoning ability, and superior process skills than would be the case with traditional instructional approaches (e.g., see Abraham & Renner, 1986; Beeth & Hewson, 1999;). However, in order for students to accomplish the learning strategies that lead to active learning environment in learning English and cross culture skills, they may need trainings and to learn subject through their own study. This is especially difficult to be utilized at elementary schools in Japan.

In order to strengthen an effective training and guide so that student would engage in new challengeable learning environment, the proposed Cycling Student-Centered Digital Materials (CSCDM) phases named Form, In-form and Re-form (FIR) conducted to enhance students' attainment of knowledge through participating and cycling approach in the 6E model. The FIR phases allowed students not only to engage in student-centered learning activity with teacher's positive interaction, but also to challenge new learning on their own pace and be more metacognitive. In this study, students had opportunity to interpret and re-form their creativity and insightful thinking process into new learning approach with international partner as following;

- The CSCDM processes are used to provide not only intrinsic motivation in science (Hanuscin & Lee, 2008), but also the instructional purpose for learning based on effective-active learning environment of language and cross culture awareness.
- Task directions are served as the learning guide to achieve higher learning outcomes for both summative and formative goal in order to place student in role more on a long-life educator than on conventional classroom.

To evaluate the effectiveness of using CSCDM 6E model to enhance active learning environment of English and cross culture awareness, two research questions are posed for pedagogical objectives;

1. What learning attitude will students develop via CSCDM 6E model?
2. What will students learn of language and culture both explicit and implicit in the CSCDM 6E model?

## 2. Methodology

Drawing on the active learning environment of learning cycle, this study demonstrates the 6E of CSCDM and its FIR phases in cross-culture classes at an elementary school in Kitami city in Japan. Thirty students participated. They formed 6 groups and engaged in cross-culture project. Then for each phase, they needed to develop their learning approach according to the task directions. The purpose of this paper is to describe how we developed and implemented the CSCDM three phases illustrated in 6E model in elementary cross-culture class. Though we present this approach from our perspective as educators, we also suggest directions for research regarding the impact of this model comparing with the 5E model presented by Bybee (1997). Figure 1. shows both LC and CSCDM approaches.

### Form phase

This Form phase is based on two concepts of instruction: (1) the *concept engagement*, which provides students with opportunity in engaging in student-centered active learning, connecting their past and present learning experiences, and being motivated in effective-active learning environment; (2) the *concept exploration*, which provides students with opportunity to investigate and develop their contents with different technology tools and solve problems. Each group was to interact and clarify their contents. By exposing these concepts, students were able to experience in variety of roles such as; innovators, self-developers, problem-solvers, co-thinkers, challengers, meaning-makers, and active producer.

### In-form phase

This In-form phase is based on two concepts of instruction: (1) the *concept explanation*, which allows students to compare idea with ideas of other group in an interactive learning environment. Teacher works on target mother-language sentences. The Assistant Language Teacher (ALT) checks target English sentences. This is the time in which the teacher connects students' knowledge to the target contents; (2) the *concept Elaboration*, which provides students with opportunity to extend their contents in cross-culture project. By exposing these concepts, students were able to expand their learning approach and their ability of English communication and cross-culture awareness.

### Re-form Phase

This Re-form phase is based on two concepts of instruction: (1) the *concept Evaluation*, which allows students to exchange feedback with international partner, learn new method, and evaluate their own contents; (2) the *concept Evolution*, which provides students with opportunity to re-form their strategy

based on international partner requested topic. The international partner requests new culture topic. This is the time in which new learning cycle task takes place. By exposing these concepts, students were able to reflect, and challenge in new learning situation on their pace. On the other hand, this study provided another sub-concepts as following;

1. it transforms learner's outcome from understanding materials (Sutherland, 1996) to developing and contributing learning material,
2. it transforms learner's engagement from cooperative learning (Johnson, Johnson, & Smith, 1991) to cooperative educator,
3. it assists elementary school teachers to improve student's co-thinking ability (Byrd, 2008) up to contents-developing ability.

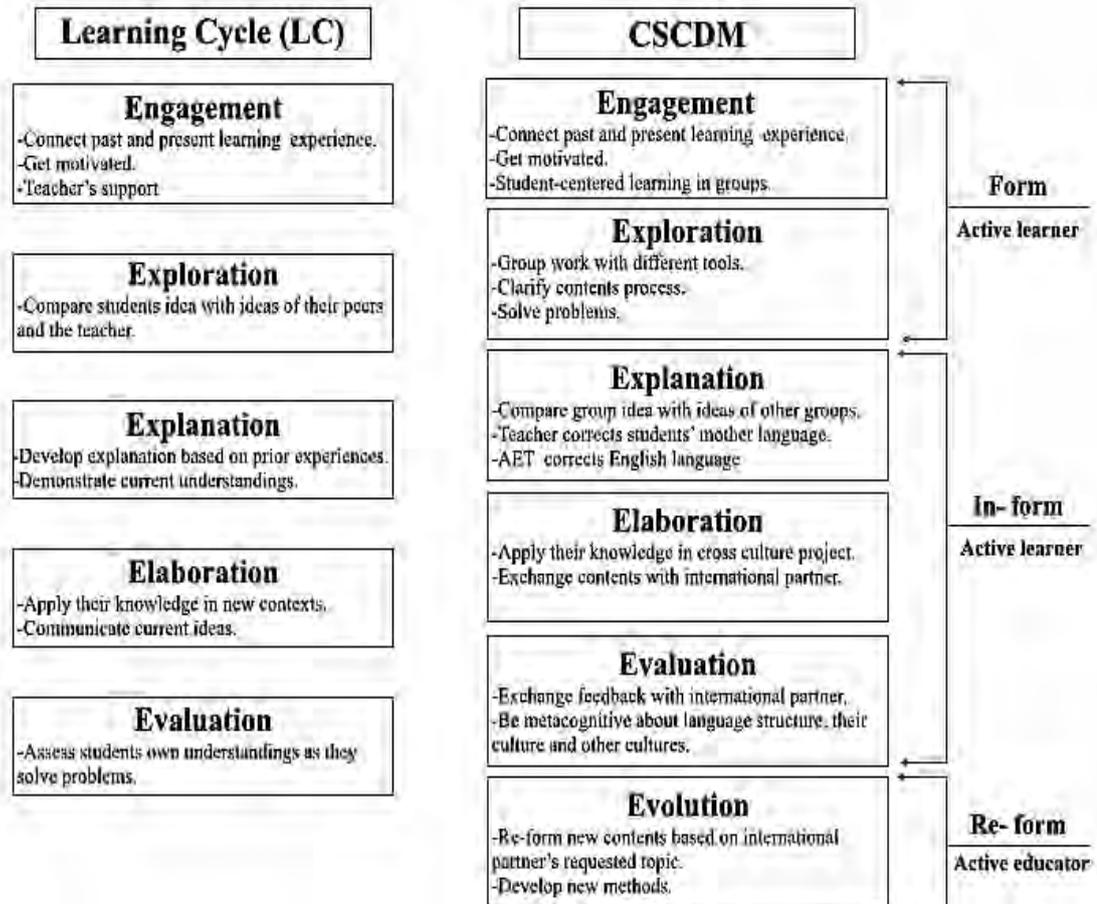


Figure 1. LC and CSCDM Approaches

### 3. FIR Instructional Implementation and its evaluation

The CSCDM and its FIR phases of 6E model experiment were utilized compared to the conventional teacher-centered teaching. The main participants in this study were 30 fifth-grade Japanese elementary students with the collaboration of two elementary teachers and the authors, the assistant language teacher (ALT) at the same school, in a rural area of Kitami city of Hokkaido prefecture, Japan. The same students explored two learning style as control group who explored conventional constructional style, and as experimental group divided into 6 groups with the FIR method. The students ranged in age from 10 to 11 years of age. There were 20(67%) males and 10 (33%) females in the class. The both (proposed and conventional) CSCDM study were conducted over a three-month period, twice a month according to the school curriculum in the year of 2013-2014. The implementation of the study designed in 6 classes in 45 minutes each in project work. Students engaged in creating digital materials on their culture and school life based on the CSCDM instructions. Students produced digital learning materials

to be displayed at the school library and engaged in additional activities in which they apply their formed experiences to new learning form. The new learning form used in new cycle learning approach. From student questionnaire result, we note that, respondents said that the FIR process is effective to be implemented at school (66.6% respondents). In term of motivation, respondents of (53.3%) agree that the FIR motivated them to achieve their learning goal. See figure 8. Almost (70%) respondents agree that they could work in their pace with FIR than traditional class. In term of multimedia tools, (53.4%) agree that FIR provided variety of learning tools in order to develop their content. In term of engagement, (66.8%) respondents agree that they engaged full time in process. Also (66.7%) respondents agree that they enjoyed the FIR class. In order to confirm the former result, (73.4%) respondents disagree on the statement of “*I did not enjoy FIR class*”. Another two statements were investigated on which style do students admire. The first statement of “*I like traditional class better than FIR class*” (30%) respondents agree, (43%) disagree and (26.7%) respondents said “I don know”. The second statement of “*I prefer FIR style more than traditional class*” (36.8%) agree, (30%) disagree and (33.4%) said “*I don know*”.

#### 4. Conclusion

CSCDM and its FIR phases of 6E model manage and guide several learning activities, such as: developing approaches, strategy-maker, monitoring process, community educator.

Among the advantages that the student also gets the followings:

- Gradual achievement of the contents subject and progressive development of the individual and group learning approach.
- Gradual progress in learning approaches and the significant transformation from knowledge-receiver to educator.
- Gradual progress in learning skills such as strategy-maker and active-distributed learner.
- Gradual progress in interactive learning style through communicative activity, self-engagement activity and innovative activity
- Gradual progress in conceptual and cognitive learning outcomes through positive learning environment and developing learning concepts for better learning assessment.

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# Ubiquitous Learning Logs Analytics

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**Abstract:** This paper describes a system that can be used to visualize and analyze some ubiquitous learning logs to discover several learning patterns and trends. Visualization and analysis of the system are based on vast amount of learning data in ubiquitous learning environment. Ubiquitous Learning Log (ULL) is defined as a digital record of what learners have learned in the daily life using ubiquitous technologies. It allows learners to log their learning experiences with photos, audios, videos, location, RFID tag and sensor data, and to share and to reuse ULL with others. This paper will reveal about the relationship between the ubiquitous learning logs and learners by using network graph.

**Keywords:** ubiquitous learning, network graph, time-map, information visualization

## 1. Introduction

Recently, researchers in the educational engineering area have been studying focusing on ubiquitous themes. For example, CSUL (Computer Supported Ubiquitous Learning) or context aware ubiquitous learning (u-Learning) have been constructed using computing technologies such as mobile devices, QR-code, RFID tag and wireless sensor networks (Hwang et al., 2008; Ogata & Yano, 2004). These learnings take place in a variety of learning space such as classroom, home and museum.

Also, these learning dataset include spatiotemporal data. Spatiotemporal data usually contain the states of an object, an event or a position in space over a period of time. These datasets might be collected at different locations, various time points in different formats. It poses many challenges in representing, processing, analysis and mining of dataset due to complex structure of spatiotemporal objects and the relationships among them in both spatial and temporal dimensions (K.Venkateswara Rao et al., 2011, 2012).

Similarly, it poses many issues about relationship between the learners and the ubiquitous learning logs due to complex structure of the ubiquitous learning logs in SCROLL. In addition, it is important for learners to recognize what and how they have learned by analyzing and visualizing the past ULLs, so that they can improve what and how to learn in future (Ogata et al., 2011). To tackle these issues, it is necessary to reveal relationships between the learners and the ubiquitous learning logs.

Therefore, this paper proposes a method to visualize and analyze relationships between the learners and the ubiquitous learning logs using Time-map and network graph.

## 2. Related Works

### 2.1 Learning Analytics and Knowledge

In recent years, Learning Analytics and Knowledge (LAK) has been drawing an attention from researchers of such fields as educational engineering, information science and network science. To date, Course Management System (CMS) and Learning Management System (LMS) enabled us to record learners' access logs onto server. The Learning Analytics (LA) aims for practical use based on learning mechanisms revealed by visualizing, mining and analyzing vast amount of learning data (Ferguson 2012). This paper focuses on the Social Learning Analytics (SLA), a subset of the LAK (Buckingham 2012). The SLA puts forward presenting appropriate information to learners at the appropriate timing

through the Dashboard in real time. As a new challenge, this paper aims to reveal about relationships between learners and learning logs on spatiotemporal fields.

## 2.2 Time-map

Time-map is a library of javascript, which collaborated with Google maps and SIMILE (Semantic Interoperability of Metadata and Information in unLike Environments) TimeLine (SIMILE project). SIMILE focuses on developing robust, open source tools that empower users to access, manage, visualize and reuse digital assets. The time-map function means that the user can scroll the timeline and then the Google maps will display the learning logs recorded during learners' selected period. It is designed to help learners to reflect what they have learned. For example, if a learner clicks his learning logs on timeline, Google maps will display their positions as shown in Figure 1.

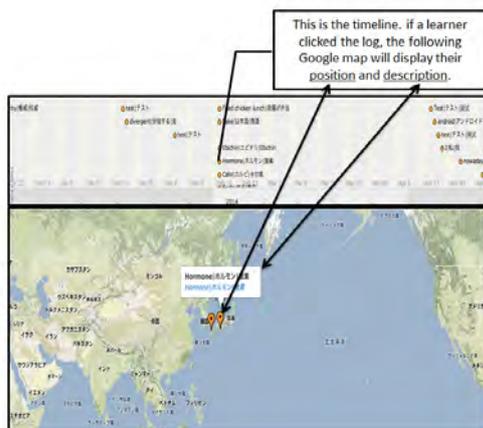


Figure 1. Time-map

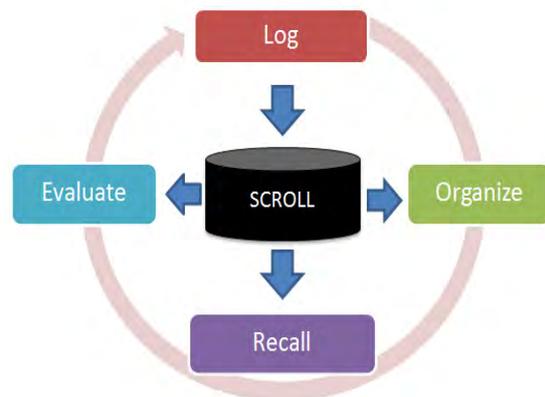


Figure 2. LORE model in SCROLL

## 3. Design of the system

### 3.1 SCROLL

One of the objectives of SCROLL is to support international students in Japan to learn Japanese language from what they have learned formal and informal setting. It adopts an approach of sharing user created contents among users and is constructed based on a LORE (Log-Organize-Recall-Evaluate) model which is shown in Figure 2 (Ogata et al., 2011).

### 3.2 Collecting a ubiquitous learning log on SCROLL

The learners can record some learning language such as English, Japanese and Chinese with a photo using android device and SCROLL as shown in Figure 3.



Figure 3. An example of adding a ULLO

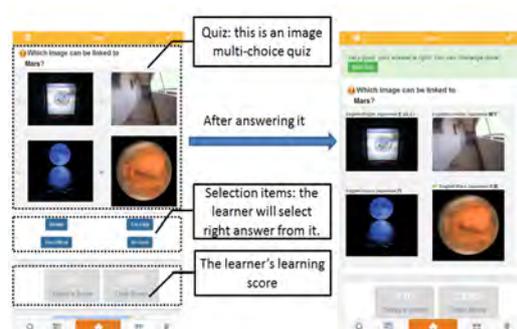


Figure 4. Quiz function

The learning log includes meta-data such as author, language, created time, location (latitude and longitude) and tag. The learners will record or review a learning log using these functions on

android device. Such iterative learning is supported by our quiz function on SCROLL. There are three types of quizzes generated automatically by the system, which are yes/no quiz, text multiple-choice quiz and image multiple-choice quiz. Figure 4 shows an image multiple-choice quiz interface generated automatically based on the meta-data of ULLs.

### 3.3 Structure based on network graph in SCROLL

To reveal several relationships between the learners and knowledge or knowledge and location, we have uniquely defined them as three-layers structures as shown in Figure 5.

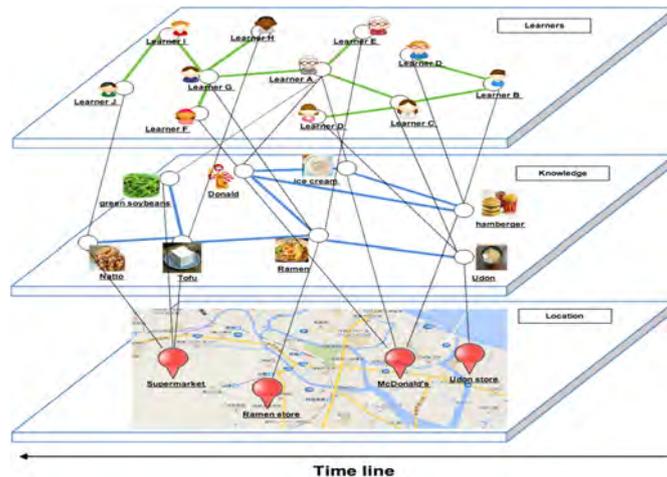


Figure 5. Three-layer structure in SCROLL

The upper layer contains each author in order to confirm position of own or other learners.

The intermediate layer contains the knowledge that learners learned. Also, some fields of learning tasks can be included in this layer. For example, some task-based learning in ubiquitous learning environment can be carried out using knowledge and event. The scalability of the layers can be enhanced and the field of visualization can be widened by linking one's own learning logs to the knowledge learned by doing tasks.

The lowest layer contains data such as location and time. In order to realize spatiotemporal visualization of our learning logs, nodes on the intermediate layer are linked to the nodes on the lowest layer using Time-map.

## 4. Implementation

This section describes ways of the implementation of the system for visualizing the three-layer structure using network graph using Time-map.

### 4.1 System for visualizing network graph in SCROLL

The interface of the network graph on web browser is shown as Figure 6. The learners can recognize relationships between own/others author and knowledge by using the network graph interface. The learners' node (green or blue node) on the network graph is connected to many knowledge (yellow node) in accordance with node color.

Recommendation objects in Figure 6 are shown rankings in the learning trends in order to expand a field of their view from visualized ubiquitous learning logs on the network graph. By arranging the in-degree centrality in the high order from the ubiquitous learning logs that they might study in the next learning session, the learners are able to recognize famous or representative learners and important knowledge.

Time-map function in Figure 6 consists of the timeline and Google maps. It represents the shift of learning history in accordance with lapse of time. The learners might forget the learning logs when and where they have learned before. Therefore, the system can remind the learners of them by combining timeline with map. The system will remind them of their learning logs recorded during the specified period of time by showing them on the timeline (default: two month before and after the

setting time). Besides, the system will lead them to be aware of knowledge recorded right before or after the knowledge of their interest which was recorded by other learners. Therefore, it will give them a hint on what to learn in the next learning session.



Figure 6. System interface

## 5. Conclusion and Future work

This paper described the system for visualizing relationships between the learners and the learning logs. International students can add their knowledge as the learning log in SCROLL, and then SCROLL can provide learning contents to recall what they learned based on their learning contexts.

In the future, we will develop a new function so that the system can analyze various situations focusing learning analytics such as network analysis, decision tree and association rule.

## Acknowledgements

Part of this research work was supported by PRESTO from Japan Science and Technology Agency, and the Grant-in-Aid for Scientific Research No.26350319 from the Ministry of Education, Culture, Sports, Science and Technology (MEXT) in Japan.

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# Location Based Context-Aware Support for Second Language Learning Using Ubiquitous Learning Lots

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**Abstract:** It is always difficult to solve the problem that how to help international students finding out suitable learning contents and learners when they want to study in a new environment. This paper considers using social network method with learners' location information to accelerate second language (L2) cold-start acquisition in context and judge the relationship among learners to find more suitable learning contents and learners. This approach is based on the Ubiquitous learning log system called SCROLL. In proposal approach, first of all, when learners go to a new environment and do not know what they should learn there, they check in the location information. Secondly, proposal approach will recommend learning logs for them using social network analysis method based on learners' learning behavior and language background.

**Keywords:** context learning, location based, ubiquitous learning

## 1. Introduction

When international students begin living in new countries or environments, it is essential for them to use their language skills in context. Additionally, mobile devices can influence how information is gathered and used in education (Johnson, L et al 2010). SCROLL, is developed to let learners to use mobile devices to learn second language in context. When learners study, SCROLL will record not only the learning contents, but also the learning environment data, like GPS information, temperature, speed, photos, audios, and even battery information.

But if learner has no learning log or not enough in the environment, SCROLL will not recommend any learning log for him, and even they do not know whether the learning contents and learners are suitable for them.

This paper aims to accelerate international students' L2 acquisition and application in context using social network analysis with learners' environment information, and judge the relationship between learners using social network analysis. In proposal approach, when learners go to a new environment and check in the location information with the name of the location, proposal approach will generate a relationship network with the point of location to find related learners, words, locations. At then, judge whether the learning contents are suitable for learners.

## 2. Previous Work and Issues

### 2.1 SCROLL

SCROLL allows the learners to log their learning experiences with photos, audios, videos, location, QR-code, RFID tag, and sensor data, and to share and to reuse ULLOs with others everywhere and anytime (Hiroaki Ogata† et al. 2010). By this, language learner can record their learning experience whenever and whatever as the Ubiquitous Learning Log Object of SCROLL.

The LLO notification processes to help recalling learning contents. When learn add a learning log to SCROLL, SCROLL will record the environment data. If the learners enter the same environment again, SCROLL will reminder learner that what they have learned there. Like this, SCROLL can help learners learning from their experiences.

## 2.2 Problems in SCROLL and Proposal solution

There are some deficiencies in recommendation function of SCROLL.

- The recommendation function in SCROLL is based on what learner has learned and where the learner has learned. If the learner hasn't learned any learning content in a place, SCROLL will not recommend any learning content for the learner.
- When learners study with SCROLL, they do not know whether the learning contents or learners are suitable for them.

The other hands, there are two parts in proposal method.

- Firstly, building social network that is linked by learners' location information to find learning contents and learners shown like.
- Secondly, Judging whether learning contents and learners are suitable for learners.

With proposal function, the learning style in SCROLL will be changed from passive learning to personal active learning. Because, when learners want to study, they can use check-in function to get some learning contents to learn and some learners to follow, even more function will recommend more suitable learning contents for learners.

## 3. Related Works

In 1973, Grnovetter and Mark had proved that social learning network analysis is the key point to support learning. In this decade, lots of researchers have developed a lot of learning system to improve learning problem with social network analysis. (Granovetter, Mark., 1973)

Social network analysis investigates ties, relations, roles and network formations, and a social learning network analysis is concerned with how these are developed and maintained to support learning (Granovetter, Mark., 1973). Therefore, a lot of researchers began to focus on using social network analysis to find the relationship between learning contents, learners, learning environment and so on.

Additionally, Martinez, A. has developed a system called Computer Supported Collaborative Learning (CSCL) system for the study of classroom social interactions (Martinez, A., et al. 2003).

In this paper, location information is used as the point of the learning network with social network analysis method to find relations between learners and learning log contents. What's more, proposal approach uses learning behavior, learning experience and Japanese background in SCROLL to understand learners' learning favorite frequency and finds similar learners for the new learners.

## 4. Method

### 4.1 General

In proposal function, when learner want to study at a place, he checks in his location information, proposal function will generate a social network for him to find learning contents and learners. After finding out some learning contents and learners, proposal function will filter out more suitable learning contents for learner with C4.5 decision tree. The flow chart is shown as Figure 5.

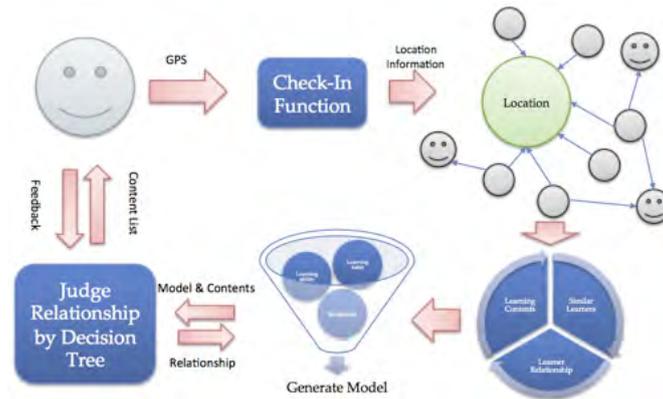


Figure 5. Flow chart of proposal function

#### 4.2 Check-In Function

First part of proposal function is generating social network using location information.

- When learner goes to a place and want to study, he click the button on the interface to check-in his location information.
- Proposal function will get his GPS data and find place names in database and Google Place API.
- After learner selects his place name, proposal function will find out related learning contents there and related learners.

With check-in function, proposal will know where learners exactly at. It is more beneficial than get place name automatically for proposal function to find related contents.

#### 4.3 Relationship Judgment

Nick C. Ellis has said, “Humans are sensitive to the frequencies of events in their experience. Ask them to make explicit judgments from memory about the relative frequency with which things happen and they are typically pretty good at it.” (Nick C. Ellis. 2002) and proved frequency is a key determinant of L2 language acquisition. (Nick C. Ellis. 2002) Therefore, this paper chooses learning frequency as starting point to find similar L2 learners for learners.

There are four kind of learning behavior data in database. They are learning contents, location, quiz, and time. With these data, each weekly learning frequency can be calculated out.

id	nickname	wordcount	locationcount	quizcount
1	shin-chan	33.5	15.5	103.5
2	jslee	14.111111	4.111111	25.444445
3	juice	23.833334	4.333335	210.5
4	coco	74	13	475.33334
5	Mr.Mias	5.428571	1.3571428	15.357142

Figure 6. Data process of learning frequency

After get learning frequency data, this paper used WEKA to do the model clustering. At last, all learners had been divided into 8 kinds of models. The result is shown as Figure 7.

Additionally, proposal function considered using language background to support prediction with C4.5 decision tree. To SCROLL database, accuracy of C4.5 algorithm is better than Bayesian Network and Multilayer Perceptron (Hiroaki Ogata† et al. 2014).

- Firstly, combining learners’ model NO and language background in SCROLL.
- Secondly, predict out meaningful attributes to find similar learners using C4.5 decision tree classification algorithm.
- Thirdly, find out learning contents of similar learners and learning contents.

Like this, this paper can get suitable learning contents and learners. Then, learning contents and learners in check-in function can be filtered. After filtering, suitable contents and learners will be put at the front of recommend list. Result is shown like figure 8.

#### 4.4 Relationship Management

This paper considers the relationship between each learner not only with model but also the operation in SCROLL. It means when learner selects item in recommend list, the relationship between learners will be updated in database. The next learner uses proposal function, recommend list will be sorted by relationship parameter.

### 5. Conclusion and Future Work

This paper considers solving this problem, which is how to help international students finding out suitable learning contents and learners when they want to study in a new environment. Firstly, this paper used social network method to generate social network that is linked by location information to find learning contents and learners. Secondly, judging the relationship between learners with C4.5 decision tree by learning frequency to find more suitable learning contents.

In the future, this paper will consider doing the evaluation experiment with international students. In experiment, two questions will be evaluated.

- Does this proposal function is helpful for students' L2 learning in context?
- Is the number of logs added by proposal function more than current function?

### Acknowledgements

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# Designing Interactive Comics to Affect Time Perception

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**Abstract:** This research aims to explore how to design interactive comics to affect time perception. Time perception plays a crucial role in many aspects such as consciousness, memory of the past and future. These aspects are related to self-directed learning. Therefore, designing a visual storytelling system to express time using interactivity to affect reader's time perception could be valuable for educational purposes.

**Keywords:** Time perception, interactive comics

## 1. Introduction

Comics as a visual information and communication medium has been used in education and training related fields (Gordon, 2006; Mallia, 2007; Tatalovic, 2009). It is convenient for translating information into visual language at a relatively low cost. The most important attribute of comic medium is sequentiality (Eisner, 1985; McCloud, 1994), which means it contains "time".

Along with the growing popularity of electronic devices, comics reading behavior migrates from paper-based to digital forms. Several existing interactive comics also contain voice, animation and playful interactions. However, research shows that people still prefer paper as a medium for reading, especially in-depth reading (Liu, 2005). In our opinion, in order to create clear expression methods and a natural reading experience that can enhance comprehension with digital comics, time could be the key.

Timing and time perception are crucial in digital learning and interactive storytelling. The way we read may have different effects on learning. Toplak et al carried their study on the connection between time perception and reading difficulties and found problems with time perception can cause reading difficulties (Toplak, Rucklidge, Hetherington, John, & Tannock, 2003). According to Angrilli et al (Angrilli, Cherubini, Pavese, & Mantredini, 1997), there are three particularly relevant factors that have been shown to affect perceived durations: 1) attention and amount of information processing; 2) arousal; and 3) affective valence.

We consider that there are at least four kinds of "time" in the context of interactive comics: 1) Real time in reality; 2) Perception of the time in reality; 3) Time in a story; and 4) Perception of the time in the story.

We intend to explore how interactive comics as a carrier can affect the time perception of the readers, and as a further step, their learning. The current hypothesis is: Interactive Comics can Affect Time Perception. This hypothesis breaks into research questions below:

- 1, How interactive comic elements affect time perception?
- 2, How to detect reader's time perception through interactive comic reading?
- 3, How to combine comic elements and interactivity for certain time perception?
- 4, How to measure and evaluate effects of comic elements and interactivity on time perception?

## 2. Research Framework

### 2.1 Time concepts

In a broad sense, time is considered as "a number of changes (Coope, 2005)" which has directions (McTaggart, 1908) and the sense of direction helps us define past, present and future.

In the context of reading digital comics, perception of the time in reality would be how long reader estimates his/ her time spent on reading. Since a story contains narrative line which also fits the definition of a number of changes, time also exists in story. And because of the time in story should not necessarily match real time in reality, we could have our own understanding with narrative time.

This study will discuss about the perception of time based on the understanding of time with directions. There are three basic forms: linear, circulatory and no time. Time perception can be linear, circulatory, unordered, speed-up or slow-down and out-synced.

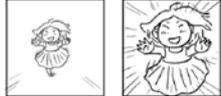
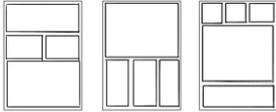
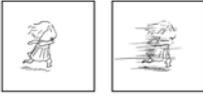
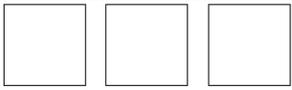
## 2.2 Two different types of motion as input for interaction design

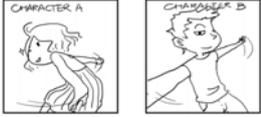
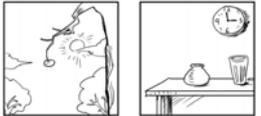
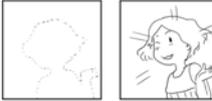
Motion has intrinsic element of time. To study time perception in relation to interactive comics, it is a plausible starting point to look into motion as expressed in comics, as well as possible user actions taken in motion for interaction with comics.

### 2.2.1 Motion as expressed in comics

Bakhtin pointed out that in the literary artistic chronotope (literally, “time space”), spatial and temporal indicators are fused into one carefully thought-out, concrete whole. “Time, as it were, thickens, takes on flash, becomes artistically visible; likewise, space becomes charged and responsive to the movements of time, plot, and history.”(Bakhtin, 2002) There are many examples of mapping different types of motion into static visual forms (Tufte, 1991). As Scott McCloud claims, Comics is an artist’s map of time itself (McCloud, 2000). In the context of virtual storytelling, space (image size and layout) is also important. In table 1, selected comic elements can help us see how comics as a static medium expresses motion.

Table 1:Comic elements that contain “motion”.

Comic element	Schematic image	Motion	Comic element	Schematic image	Motion
Perspectives		Perspective switch can cause narrative changing and attention changing.	Movement: Small->Big		Change between small and big.
Serialize		Narrative goes on through serialization.	Movement: Far->Close		Change between far and close.
Pages		Narrative and reader's reading path go through pages.	Movement: Slow->Fast		Change between slow and fast.
Panels		Narrative and reader's reading path go through panels.	Movement: Gentle->Strong		Change between gentle and strong.

Character(s)		Character's movement.	Movement: Black & white->Color		Change between black & white and color.
Word		The change of amount of information, font.	Movement: Abstract->Concrete		Change between abstract and concrete.
Object		The time change of object. (e.g. sun rises, clock clicks)	Movement: Invisible->Visible		Change between invisible and visible.
Line (drawing style)		The change of drawing style can cause attentional motion.			

### 2.2.2 Motion in reading and interacting with comics

Traditional reading activity can be considered with three parts: 1) Eyes (moving in a range, gazing with scale); 2) Hands (holding reading material, flipping leaves, supporting reading); and 3) Static reading material.

Digital reading activity however, contains more opportunities such as eye-tracking, voice control, facial expression recognition, gesture recognition, keyboard control, touch screen control and handle control. Various examples in this area emerge. For example, de Lima et al. presented a storytelling system that allows users to interact with virtual characters by sketching objects on the paper (De Lima et al., 2014).

Also, the reading process with digital context can be dynamic. The "motion" can be occurring either in visual expression in the comics or reading activity of the reader. For example, either the panels are stable while eyes moving through panels, or, eyes can be more or less stable in a certain range while panels are moving.

### 2.3 Mapping time perception on to motion

As we explained in 2.2, there are two types of motions in the context of reading interactive comics: one is expression motion and the other is reading motion. The relation between these two motions themselves and with time perception remains unclear. We plan to conduct several experiments to test this by mapping time perception on to motion. For example, to test how different interactivity can influence time perception, we can define several reading control methods: mouse goes forwards means go forward in narrative time while mouse goes backwards means go backwards in narrative time. The different mapping way we choose will bring different reading experience, and we assume it will also have different effect on time perception.

### 2.4 Combine time perception, motion and narrative structure

Actually, we are also curious about whether different time perception will lead to different understanding of the same story. This idea came from generally western culture tends to see time linearly while eastern culture sees it circularly. We believe by separating time, comic expression elements and interactivity, we will be able to express different understanding of time in on comics.

### 3. Current Status

This research follows a research through design approach and can be seen as an iterate process.

It would require several iterations to complete this research. In order to find the proper way to affect time perception, several experiments to test combinations between comic elements and interactivity are required, and usability might also need to be improved. We will collect data through designed experiments. Each experiment can be seen as part of the general iteration process and contains its own process: goal, methods and expected result.

We are currently finished creating an interactive comics prototype—*The Dreaming Wine* and conducted to the first visual expression experiment based on our framework. We believe the results we are analyzing can provide us a deeper understanding of the research question and enlighten approaches for further research.

### Acknowledgements

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# Connecting Aesthetics and Critical Thinking In Game Based Learning

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**Abstract:** This paper presents a brief account of my dissertation proposal on establishing connections between the aesthetics of game based learning environments and the critical thinking abilities of learners. It commences with an introduction of my personal interest in the subject followed by a detailed review of literature on digital game based learning, learning theories on aesthetics and critical thinking establishing the research gap. Based on a theoretical framework of visualization and using an ethnographic research program the proposal is further explained concluding with the significance and contribution in the field of educational technology.

**Keywords:** Aesthetics, game based learning environments, critical thinking, engagement

## 1. Introduction

My doctoral research seeks to investigate the role of aesthetics in game based learning environments and in particular to what extent specific aesthetic designs can help foster critical thinking and problem solving skills in learners. My interest in the subject emerged primarily on account of my students, when I was a teacher, prior to joining the program. My students were into gaming and wanted games to be a part of the curriculum based study that is followed in the classrooms. I was also intrigued to find that whenever my students played educational games (Boggle for example) they were motivated and made a concerted effort to think through their solutions by increasing their vocabulary. The value of aesthetics in game based learning environments has been a subject of great interest for me simply because of the evolution of designs of games, both educational (*Cuckoo Time, Supercharged, Bioshock*) and commercial (*Civilization, Assassin's Creed, Full Spectrum Warrior, Okami*) and the recent trend towards acknowledging the importance of aesthetics in educational games (Squire, 2011). Besides my passion towards learning various dance forms and choreography made me wonder about the aesthetic process of designing games.

## 2. Rationale and Review of Literature

The present definitions of game based learning environments (NMC Horizon Report, 2014, 2012) state how games have emerged as systematic data driven pedagogies that enforce critical thinking and problem solving skills. The history of development (Malone, 1980; Bowman, 1982; Heinich, Molenda, Russell & Smoldino, 1996; Cordova & Lepper, 1996; Squire, 2003, 2011, 2012) of game based learning environments reveal the evolution from simple interactive environments to rich digital worlds and designed cultures with performative dimensions. Beyond the complex learning that occurs with commercial games in classrooms, this decade has witnessed the emergence of game spaces that are designed to specifically support academic content as valued in schools (Barab, 2012). Recent research also shows that there have been efforts to review cognitive processing, transfer from computer games to external tasks, use of games for evaluation as well as game design to determine how video games can be effectively used in classrooms (Tobias, Fletcher & Wind, 2014). In addition, there has been a broader shift towards aesthetic considerations or audiovisual representations of the gaming worlds. The importance of games as forms of play that motivate and engage students through rich visual and spatial aesthetics (Poole, 2000) has since been considered for design of educational games but getting the ideal mix of academic and gaming content has sometimes been difficult for game designers (Kim, Park & Baek, 2009). The value of entertainment through aesthetics surfaces again in research (Barab, Pettyjohn, Gresalfi & Solomou, 2012; Kafai & Peppler, 2012) which emphasize how game designs have to be unique in order to engage youth in transformative learning experiences. Squire (2011) in fact argues that it is the moral imperative of educators to study games as aesthetically enlivening

experiences because in a digital participatory age such learning experiences awaken the intellectual curiosity of the children and empower them to pursue a basic education.

Although there has been considerable research with games as motivational tools (Gee, 2005; Hoffman & Nadelson, 2010; Petkov & Rogers, 2011), empowering tools (Hernandez, 2009; Pitaru, 2008), new literacies (Steinkuehler, 2010; Black & Steinkuehler, 2009; Ching, 2012), possibilities for impacting the world (Barab, Gresalfi & Ingram-Noble, 2010; Barab, Pettyjohn, Gresalfi & Solomou, 2012) and for problem solving (Gee, 2008; McGonigal, 2008, 2011), there seem to be a research gap from the angle of mobilization of cognitive powers brought about by aesthetic experiences, as understood through the Kantian notion and Dewey's pragmatist approach towards aesthetics (Jay, 2005). Gadamer's definition of aesthetic understanding is the notion of play derived through the participation in moments of opening and venture, crucial for individuals in deciphering ways of the world (Jardine, 2006). Egenfeldt-Nielsen, Smith & Tosca (2013) from a purely technical point of view, define aesthetics in games as not how a game sounds or looks but how its characteristics such as audiovisuals, rules, geography, temporal features, and number of players work in unison to show case the experience of "how it plays" (p.117). Researchers (Squire, 2011) have also claimed that art in games or aspects of aesthetics can be utilized to communicate educational concepts because aesthetics motivates players to see patterns in the process. Further aesthetic qualities of a learning environment promote higher levels of comprehension by clarifying the subject matter through patterns, motifs or routines as well as through sources of aesthetic tension and consummation arising from the content or subject matter (Parish, 2009). Within this vein, my study will bring about a connection among these perspectives by exploring aesthetics in game based learning environments and the effect on critical thinking (Scriven & Paul, 2007; Snyder & Snyder, 2008; Stanton, Wong, Gore, Sevdalis & Strub, 2011) and problem solving abilities (Scriven & Paul, 2007; Snyder & Snyder, 2008) of learners.

### **3. Research Plan**

My proposed research plan is driven by the following questions: How do gamers interpret and interact with aesthetics in games? How do aesthetic interactions within a game promote critical thinking and problem solving?

My research uses the theoretical framework of visualization (Brodie et al., 2005), "a process that extracts meaningful information from the data and constructs a visual representation of the information" (p. 219) for cognitive processing. Connecting the notion of emotions to game based learning environments (Kim & Kim, 2010) my research will utilize a macro-cognitive model of sense making (Klein, Moon and Hoffman, 2006) as a data frame symbiosis to assess critical thinking (Scriven & Paul, 2007; Snyder & Snyder, 2008). Using the above theoretical constructs my research will establish how aesthetics of games can evoke emotions and motivation to generate understanding of the underlying theme of the game.

I will use an ethnographic research program (Madden, 2010; Williams, 2005) which will commence with data collection at two schools in Calgary (Canada) and these schools will be chosen based on the use of game based learning at the senior high level. Games with different aesthetic qualities as used in two specific classes by the teacher and a set of recommended games (such as *Civilization*, *On the Ground Reporter*, *Darfur* and other games from [www.gamesforchange.org/play](http://www.gamesforchange.org/play), *Modern Prometheus* etc) will be used to address the learning of language and humanities. I will observe the proceedings and gather information through field notes. I will also conduct audio and video recordings of purposefully selected students in groups while at play. Artifacts produced by learners or recorded discussions with teachers on the subject will be used to help reaffirm the line of thought of the students. The video recordings are meant to capture the emotions displayed through facial expressions, movements of mouse and touch pads. Information will also be gathered through data mining for a comparative analysis with the video recordings. Data mining will serve towards classification and clustering of the data through a qualitative analysis of the codes to determine the observations towards problem solving in the game. Screen captures along with captured screen content and input will be utilized and assessed to match information from data mining and audio and video recordings for triangulation. I will finally conduct semi-structured interviews with teachers and purposefully selected students based on their performance to determine the role of aesthetics in their interactivity towards the problem presented. The interviews will help understand students' experiences as players and their ideas on the aesthetics of the games, which will further help to determine their level of engagement. In

analyzing the data based on the classified themes I will use an interpretive lens to answer how aesthetics stimulates critical thinking skills leading to deeper engagement.

#### **4. Significance**

The expected outcomes of the research include an in-depth understanding of aesthetics in games and to what extent it can facilitate learning. One of the significant contributions of the study will be towards providing design and assessment principles for supporting critical thinking. It will further establish that aesthetics of digital games can indicate core learning concepts and enable deeper engagement with the content. These criteria can be used by teachers for evaluating games for classroom use. Educational games are often deemed uninteresting by youngsters. Rethinking educational game design through aesthetic qualities will lend a new perspective on engaging learners.

#### **5. Presentation of Preliminary Ideas (Co-written with Dr B Kim)**

##### *5.1 Ideas 2014 Rising to the Challenge Conference, Calgary, Canada*

Concurrent Sessions Proposal on Connecting Engagement and Aesthetics in Game Based Learning: IDEAS 2014 Rising to the Challenge Conference, Calgary, Canada (May, 2014) and subsequent contribution to the Proceedings.

##### *5.2 AECT International Convention on Learning, Design and Technology, 2014, Jacksonville, U.S.A*

Acceptance towards Concurrent Proposal on Interpreting Aesthetics of Games and Evaluating its Effect on Problem Solving using Visualization Theory and subsequent contribution to the Proceedings at the 2014 AECT International Convention on Learning, Design & Technology, Jacksonville, U.S.A.

##### *5.3 ICCE 2014: The 22<sup>nd</sup> International Conference on Computers in Education*

Acceptance towards Short Paper Presentation and contribution towards Proceedings on Aesthetic Design for Learning with Games at The 22<sup>nd</sup> International Conference on Computers in Education (ICCE 2014) at Nara, Japan.

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# The Above-average Effect and Its Implications on Feedback Design for Educational Game Systems

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**Abstract:** This study proposes a data-driven feedback mechanism for an educational game system to address the discrepancy arising from the cognitive dissonance between perceived and actual performance on cognitive tasks during learning. By making the dissonance visible, the feedback mechanism enables the students to stay informed of their ongoing performance in comparison with that of their peers, thus motivated to respond with actions correspondingly and constructively.

**Keywords:** above-average effect, feedback, motivation, peer comparison, behavioral change, game design

## 1. Introduction

The above-average effect is a widely recognized cognitive bias that describes a tendency in which one overestimates his/her positive qualities or abilities while underestimating the negative ones (Alicke & Olesya, 2005; Aronson, Wilson, Akert 2010; Carlson, 2013). This cognitive bias is omnipresent in cognitive scenarios across all age groups. An elementary student, for instance, may have a fairly accurate evaluation about his/her pecking order in the classroom with respect to academic performance, as he/she may have gained this knowledge through various channels such as academic leaderboards, or teachers' evaluative comments. However, the same student is unlikely to assess his/her other qualities not explicitly quantifiable with equal accuracy. In these self-evaluative situations, the absence of an explicit frame of reference contributes to the tendency of holding a more favorable comparative view on themselves, resulting in a falsely inflated self-image, hence a dissonance between ones' perceived capability and actual performance.

This study aims to design a feedback mechanism for an educational game system that provides the student with a constant feed of information about their ongoing performance, as well as that of the peers, so that the student stays informed of his/her performance in comparison with the peers. It also aims at fostering the students' informed decision-making and guiding their subsequent behaviors based on the cognitive dissonance uncovered by the feedback message. Based on real-time analysis of performance data of the entire class, the feedback mechanism generates messages of player's status on-the-fly. Upon completion of any given task, a message pops up, briefly summarizing the student's performance on that particular task, as well as the average performance of the entire class. In this way, the student's dissonance between their perceived capability and actual performance is made visible. It is hypothesized that when the students are informed of their performance in relation to that of the peers, they are more

likely to respond correspondingly to narrow the dissonance between perceived capability and actual performance in comparison with the class average.

## 2. Theoretical framework

### 2.1 Cognitive dissonance

Cognitive dissonance describes a situation when one is confronted by new information that conflicts with existing beliefs, ideas, or values (Harmon-Jones, 2002). Numerous studies exist in the literature pertinent to cognitive dissonance, and strategies addressing the issue are widely mixed in the literature. Some studies have highlighted the cause of its occurrence, attributing it to factors associated with flaws in human reasoning (Dunning, Heath, & Suls, 2004). Other research emphasizes the role of dissonance on behavioral changes induced by social comparison (Buunk et al., 1990). A more recent study (Bounoua et al., 2011) used two well-established social comparison paradigms to integrate and extend prior research from the achievement goal and social comparison literatures. Carlson (2013) suggests that the construct of mindfulness, defined as paying attention to one's current experience in a non-evaluative way, may serve as a path to self-knowledge.

In contrast to research that stresses on the negative effects, other psychologists have incorporated cognitive dissonance into learning models, notably constructivist models. Along this line of study, educational interventions have been designed to foster dissonance (as opposed to suppress it) in students by increasing their awareness of conflicts between prior beliefs and new information and then providing or guiding students to new, correct explanations that will resolve the conflicts (Guzzetti, Snyder, Glass, & Gamas, 1993).

Combining the strategies introduced above, this study seeks to leverage the constructive power of cognitive dissonance by incorporating it to surface the conflicts of cognition from under one's consciousness, and make the dissonance visible, thus manageable.

### 2.2 Feedback

Feedback mechanisms are incorporated in game design to promote human-computer interaction, as well as users' participation and sustain continued interests in learning activities (Prensky, 1996; Shute, 2011). Kulhavy and Wager (1993) introduced the concept of a "feedback triad," arguing that, by providing information for learners to validate or change a previous response, feedback may motivate users' to increase response rate, and reinforce a message that would automatically connect responses to prior stimuli. Because of its motivational properties, feedback is therefore employed in game systems to regulate player's behaviors (Kulhavy & Wager, 1993; Ávila, Chiviawsky, Wulf, & Lewthwaite, 2012).



Figure 1. Feedback triad

While feedback provided by game systems can be impactful in shaping students' perception and guiding their behavior, how the students react to feedback may also shed light on the design of game systems. This study exams both ends of the spectrum, i.e., how feedback is perceived and accepted by students, and how students respond to feedback upon reception.

### 3. Implications on game design

In conventional stand-alone learning systems, learners' performance data are typically isolated, static, and socially decontextualized, making comparisons of actual performance on a given task against perceived performance technically infeasible. In contrast, online game-based learning systems are characterized of its connectivity and real-time data streams with respect to learners' performance, enabling easy comparisons between perceived and actual performance, or between one's individual performances against those of the peers. Such comparative information may be particularly helpful for those under-prepared learners, i.e., those who over-estimate their capability, but fall below the average. Therefore, for the learners to stay informed of their performance in relation to the peers, a feedback mechanism should be implemented to make such comparisons explicitly visible.

In addition, to guide the learners' subsequent actions following comparison, options for action should be provided to the students to alter the amount of effort investment in respond to the result of the comparison, e.g., to invest more efforts on the given task, or to give up trying,

### 4. Stereotype of system implementation

In implementation, the proposed feedback mechanism generates a message upon completion of any given task, summarizing the student's performance in relation to the others', and the average performance of the class. In this way, the dissonance which exists subconsciously becomes visible and tangible. The message in Fig. 2 shows a snapshot of a feedback message captured at the end of a task completion. Based on real-time data analysis of the overall performance of the entire class, the feedback mechanism provides a constant feed of information about the average performance of the class, enabling the students to stay informed of their performances in relation to their peers. In addition, options for actions are offered to guide the student to respond with subsequent actions (e.g., to continue collecting more stars, or to give up trying and do something else).

The screenshot displays a feedback interface with a leaderboard, class average, and a character. The leaderboard is as follows:

Rank	Name	Star
24	Benson	19
25	Jerry	17.5
26	Kevin	17.5
27	mox	16.5
28	Ally	15

Below the leaderboard, the class average is shown as **Class Average: 20.5**. Two buttons are present: "Collect more stars" and "Do something else". To the right is a character with two yellow stars above its head and a yellow star on its chest. The text "You are great!" is displayed above the character. At the bottom, a blue bar contains the text: "You gained 3 stars less than the class average" and "You will be one position up the leader board if you gain 1/2 more stars".

Figure 2. A stereotype of a feedback message showing the discrepancy between the actual performance and the class average (highlighted in red) with options for responsive actions

## 5. Expected contribution

The study identifies the existence of the above-average effect in learning contexts, a cognitive bias that is extensively prevalent in cognitive psychology. In addressing the cognitive dissonance arising from the discrepancy between perceived and actual performance on a wide range of cognitive tasks and affective states during learning, this study proposes a data-driven feedback mechanism that is based on real-time analysis on students' performance to guide decisions. The proposed mechanism can be incorporated into the design of educational game systems at large. By making the dissonance visible, the feedback mechanism enables the students to stay informed of their ongoing performance in comparison with that of their peers, and thus respond to the dissonance correspondingly and constructively.

This study expects to contribute to the existing literature by taking a design approach to unleash the power of cognitive dissonance to induce greater effort investment from, and to the benefit of, the students, as opposed to suppressing dissonance from occurring, as has been the emphasis of numerous previous studies.

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# Framework to Refashion Existing Drill Materials to Support Japanese Language Learners: Enhancement of Meaningful Practice with Motivation, Inputting, and Outputting

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**Abstract:** We are planning to develop a framework to refashion existing Japanese grammar drill materials because most existing materials lack strategies to make learning meaningful. Our new framework, called “injapa!+”, allows learners to engage in meaningful learning, meaning that they can imagine the situation in which the grammar is used before doing a drill, and have an opportunity to produce a phrase using the grammar with self-monitoring. This paper presents an overview of “injapa!+”.

**Keywords:** Self-directed Japanese Learning, Meaningful Practice, Motivation, Output

## 1. Introduction

### 1.1 Research Background

According to the 2012 Survey of Overseas Organizations Involved in Japanese-Language Education, there are about 4 million Japanese language learners in the world (The Japan Foundation 2013). With the development of advanced communications technology, those learners can easily gain access to a lot of learning resources without leaving their country. However, in the field of asynchronous, self-led e-learning, there are still not many learning environments that enable beginning students of Japanese to systematically learn about Japanese grammar.

In many beginners' courses, a structural syllabus is used as the basis for designing a complete language course. The structural syllabus consists of a list of grammatical items, usually arranged in the order in which they are to be taught (Ellis 1993). Many well-known Japanese textbooks have adopted the structural syllabus. In the beginners' classes, teachers first make an effort to pique learners' interest by laying out some situations in which the target grammatical structures can be used. After that, teachers present the target grammatical items, explain its meaning and usage, offer pattern practice to establish the memory of learners, and make learners do the communicative tasks.

Kai (2011) has surveyed current existing e-learning materials for beginning students of Japanese (31 sites found in the database "NIHONGO e-NA" (<http://nihongo-e-na.com/>)). Most of them seemed to have been developed as offline classroom supplements. The sites are largely limited to providing grammatical explanations and drills only. There are 18 sites with drill materials and 20 sites that have grammatical explanations. Eight sites use different situations or topics to illuminate grammar, but no site offers situations that each learner might find interesting (lack of personalizing). In addition to that, no sites were found that gave learners the opportunity to speak or write phrases using the grammar taught (lack of language output). This means that most existing drill materials are not designed to motivate students, and don't offer any opportunity to speak or write because teachers have instructed those activities normally.

## 1.2 *The Purpose of This Study*

In this paper, we propose a framework we call “injapa!+” to refashion existing drill materials so that learners can practice more meaningfully. For the purposes of this paper, the term “refashion” is used to refer to changing the structure of learning from grammar-based mechanical drills into interest-based, contextualized learning.

This framework has two main functions: a personal attention-getter and speaking/writing opportunities. The goal of this research is to develop the framework and clarify its effect on learners.

## 2. *Related Research*

### 2.1 *Literature Review of SLA*

As already mentioned in chapter 1.1, most existing drill materials are not designed to motivate students, and don't offer any opportunity to speak or write. Is it the ideal learning environment for language acquisition? In this chapter, we consider the appropriateness of existing drill materials.

The effect of adopting output activity and showing relevancy has been widely studied in the field of second language acquisition (SLA). Swain (1985) states that language acquisition and/or learning may occur through producing language, either spoken or written. Swain pointed the three major functions of output in SLA, which are 1) the noticing function (getting learners to recognize their linguistic weaknesses), 2) the hypothesis-testing function (allowing learners to test their own language skills), and 3) the metalinguistic function (helping learners think more deeply about language). Many language teachers and researchers now back up Swain's idea; however, few free, self-led e-learning sites offer output activities such as writing and conversation, because in the Japanese language there is still no reliable auto-correcting system.

As regards motivation, Krashen (1982) proposes that certain emotions, such as low motivation, anxiety, self-doubt, and boredom, interfere with the process of acquiring a second language (the affective filter hypothesis). Dorney (2001) also recommends that teachers try to promote students' awareness of the instrumental values associated with the knowledge of a learner in order to make the curriculum and the teaching materials relevant to students and increase motivation. But the existing drill-centered materials hardly make learners recall the situations in which they might use the new grammatical structures they are acquiring. Attention must be directed toward determining which topics or situations are relevant to each learner.

These arguments suggest that learning with relevancy and output activities will enhance language acquisition, however, since there are no tools that support relevancy and output activities in an asynchronous self-led e-learning environment, how relevancy and output activities enhance language acquisition is not cleared. It is worth investigating how to make learners perceive the value of the learning material.

### 2.2 *Idea and Related Studies*

#### 2.2.1 *Idea*

Developing materials that include motivation, input, and output takes a lot of time. However, we thought it would be possible to do this relatively quickly if we utilized existing input materials and added short functions only. With the new framework, a simple drill can be refashioned into a series of meaningful practice exercises. As far as we know, no frameworks like this currently exist; therefore, they might be worth developing.

#### 2.2.2 *Related Studies (“injapa!” and “Output!”)*

We have developed two language-learning tools: a tool to motivate learners (named “injapa!”) and a tool for outputting practice (named “Output!”).

“injapa!” helps guide learners to existing drills. It allows learners to choose a learning target from authentic situations, not from grammatical items (Kai et al., 2012). This tool is expected to give learners a sense of purpose that helps them understand the reason for learning Japanese grammar. Our preliminary results show that all participants (n=6) preferred learning Japanese using this tool rather than doing drills only. In interviews, users gave affirmative feedback such as, “It is fun, like playing a game” and “I can imagine the situation easily”. “Output!” aims to give learners an opportunity to engage in output (speaking or writing) and self/peer-monitoring (Kai, et al. 2014).

These two tools are developed independently, therefore do not support a series of learning. If we can develop a framework that includes these two functions together as “injapa!+”, learners can acquire grammar after understanding its relevance and having an opportunity to use it. We believe this will lead to more “meaningful practice” in language learning.

### 3. Research Plan

#### 3.1 Research Question

The research questions of this study are: 1) Does the “injapa!+” framework increase learners’ motivation and Japanese proficiency? 2) Does learning using this framework make learners feel that their learning is more meaningful? 3) What type of learners prefer this kind of learning style? and 4) What are the optimum control parameters?

#### 3.2 System Design of “injapa!+”

In this section, the system design of “injapa!+” is described. “injapa!+” is a framework to refashion existing drill materials so that learners can practice grammar more meaningfully. This system allows learners to choose a learning target from authentic, real-life situation rather than from grammatical items. It also gives learners an opportunity to self-monitor their learning. Table 1 shows the learning flow using “injapa!+”. For example, a learner will receive three topics relevant to his/her interest first (1). When he/she chooses a topic like “asking telephone number”, then grammatical learning materials connected to the topic are shown. After learning these materials (2), he/she is asked to answer the question about the topic (3). He/she can self-check the correctness of the answer with grammatical checklist shown, and share what he/she said with other learners to know variations in usage (4).

Table 1: The Learning Flow Using “injapa!+”

Learning Phase	Displayed Content	Learner’s Activities
1. Goal Setting	<ul style="list-style-type: none"> <li>(interest survey)</li> <li>Three endorsers of situation-based tasks.</li> </ul>	<ul style="list-style-type: none"> <li>Determine a goal</li> <li>Imagine Japanese speaking situation</li> <li>Notice gaps between L2 and learner’s Interlanguage</li> <li>Raise consciousness about grammar</li> </ul>
2. Input Activity	<ul style="list-style-type: none"> <li>Pattern drill practice (third-party site)</li> </ul>	<ul style="list-style-type: none"> <li>Develop an explicit understanding of how a grammatical structure works</li> </ul>
3. Output Activity	<ul style="list-style-type: none"> <li>A question and answer form (both oral / written answers acceptable)</li> </ul>	<ul style="list-style-type: none"> <li>Answer the question using learned grammar</li> <li>Have an opportunity to use grammar</li> </ul>
4. Self-Monitoring	<ul style="list-style-type: none"> <li>Checklist of usage</li> <li>Answers made by other learners</li> </ul>	<ul style="list-style-type: none"> <li>Adopt self-monitoring and self-correction strategy</li> <li>Know variations in usage</li> </ul>

“injapa!+” is a member-only website and is only available in Google Chrome (<https://www.google.com/chrome/>). “injapa!+” has two main functions that encompass the existing drill materials. We briefly describe each function.

##### 3.2.1 Situation Recommend System as Personal Attention Getter

The situation recommend system is used before users start learning input materials. The system lets learners choose a learning target not from grammatical items, but from authentic situations. The administrator of “injapa!+” first registers each URL of existing grammar drills to “injapa!+”. Then, the

administrator picks some grammar items up, makes a sentence, sets a situation in which the sentence seems to be needed, prepares an endorser, and registers all the information to “injapa!” as a “Quest” in advance. The learner is first directed to reply a questionnaire about his or her field of interest. Then, from registered quests, three quests are chosen automatically as order adapting to the interest and learning stage, and the endorser of the quests are shown. When a learner chooses a quest from the possible options, s/he is guided to the drill site after the situation and the task are explained.

### 3.2.2 Speaking/ Writing Practice System to Offer Outputting Opportunity

The output practice system will be used after learners finish each drill. The system gives learners an opportunity of outputting and self-monitoring.

After learners finish a drill, a question is displayed. Learners answer the question using the grammar they learned by talking through a microphone or typing. When clicking the “submit” button, a checklist is shown that reviews what the learner said or wrote (Self-monitoring 1). After self-reviewing, the learners’ answer will be posted. Then answers given by past learners will be listed. Learners are to review again if the sentence they produced was correct (Self-monitoring 2).

### 3.3 Features

Two key features of “injapa!+” are its easiness to set up and its versatility. Learning support staff can set up a learning course through a browser. All they have to prepare are the lists of URLs of drills, and ideas for outputting situations. Knowledge of computer programming is not necessary. Staff can set any type and any size of learning materials (even a PDF can be used). They can also control the learning order by setting prerequisites for each drill.

## 4. Expected Contributions of this Research

With the “injapa!+” framework, learners are expected to be able to follow the process of what we call “meaningful learning” by themselves, meaning that they can imagine the situation in which the grammar is used before doing a drill, produce a phrase using the grammar with self-monitoring after the drill, and share it with other learners. We are planning to complete the development of “injapa!+” by the winter of 2014, and conduct a survey on learners’ experience with it in the spring of 2015. A detailed data of the effectiveness of “injapa!+” will be gathered and presented in a future paper.

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# Predictors of E-Learning Satisfaction among the Malaysian Secondary School Teachers

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**Abstract:** This study will explore key drivers of teachers' e-learning satisfaction. 400 respondents will complete a survey questionnaire measuring their self-reported responses to twelve constructs [perceived usefulness (PU), perceived ease of use (PEOU), flexibility (FLEX), interaction (INT), attitude (ATT), anxiety (ANX), self-efficacy (SE), training (TRN), management support (MS), technical support (TS), usage (U), and satisfaction (S)]. The quantitative descriptive research data will be analysed using structural equation modeling. This study hopes to provide a predictive framework, whereby scholars and practitioners could examine the explanatory power of the framework to further explain teachers' satisfaction towards the e-learning use. Past studies have concluded that teachers who are satisfied with their e-learning system will continue to use the system extensively. So by having a model that can help us assess teachers' satisfaction, stakeholders are in a better position to understand and develop appropriate policies to both sustain and increase satisfaction.

**Keywords:** Satisfaction, e-learning, secondary school teachers

## 1. Introduction

Malaysian Education Blueprint is a detailed plan of action that maps out the education landscape for the next 13 years (2013-2025). It emphasizes efforts to leverage ICT in order to improve the quality of learning across the country. One of the many initiatives identified under the first wave of the Malaysian Education Blueprint (2013-2015) includes providing 1BestariNet and softwares for schools. 1BestariNet is a project led by the Ministry of Education (MOE), to provide access to cloud-based virtual learning platform known as the FROG VLE and a high-speed connectivity by June 2014 to all its 10,000 schools. Its implementation is expected to run over 13 years and is hoped to transform education in the country by seeing more technology use in the classrooms. E-learning in the Malaysian context will only be used as a supplement to the face-to-face approach. This is often defined as blended learning (BL), which is a thoughtful integration of classroom face-to-face with online learning experiences (Garrison & Kanuka, 2004).

Local assessment is needed to assess the effectiveness of the learning management system (LMS); the FROG VLE which is adopted from the United Kingdom. Inconsistent and improper introduction of technology into a system may result in failure to successfully use and integrate technology into the teaching and learning environment. As a large amount of funding and resources have been allocated and given to educational and corporate organisations to increase access to technology, there is a mounting pressure placed on educators to transform schools. However, studies have shown that even with well-developed and widely available technology systems, many countries are still experiencing challenges related to technology integration in their teaching and learning process (World Bank, 2008). There is still gap between technology's presence and its effective integration in academic institutions regardless of location (Eteokleous, 2008; Keengwe, Onchwari & Wachira, 2008). As such among the many ways of assessing an Information System's effectiveness and success, end-users' satisfaction is one of the most widely used measures (Delone & McLean, 1992). This is partly because this method is empirically easy to validate and it has a high degree of face validity (Doll & Torkzadeh, 1995). As teachers are the link between the Ministry of Education and the general student population, teachers' satisfaction will naturally link to better performance at work, hence increased implementation of any innovation in education. A large amount of research have been done in the past on the measurement of end-user IS satisfaction (Bailey & Pearson, 1983; Ives et al, 1983; Doll & Torkzadeh, 1988, Chin & Lee, 2000). These results provide practical value for organisations to evaluate whether a particular aspect of an Information System (IS) needs to be improved. There are limited studies that clearly identify educators' satisfaction for e-learning system (Yengin, Karahoca & Karahoca, 2011). Most studies

focused on students instead of the instructors (Devetak & Vogrinc, 2010). Hence, we need a study on user satisfaction that focuses on social aspects of interaction with the system. This study will explore three key dimensions (i.e. user quality, LMS quality and organisation quality) that predict satisfaction towards e-learning among teachers and usage as the mediating variable. This study provides a predictive framework, whereby scholars and practitioners could examine the explanatory power of the framework to further explain teachers and their satisfaction towards the FROG VLE.

## 2. Review of the Literature

### 2.1 Theoretical Framework

A number of empirical studies have shown that Technology Acceptance Model (TAM) by Davis (1989) to be an essential predictor of user satisfaction (Yeh & Li, 2009). TAM postulates two main variables as antecedents to individual technology acceptance; perceived usefulness (PU) and perceived ease of use (PEOU). These variables are the independent variables (IV) whereas the dependent variable in this model is system use. These two IVs determine the attitude toward using the system. Attitude and behavioural intention to use the technology act as the mediating variables of TAM. The use of technology will be high if users believe that by using the system, it will improve their job performance and if they think the system is easy to use. Constructs of behavioural intention and attitude as the mediating variables will not be included in this study, instead system use will be the mediating variable and attitude studied as an independent variable. In this study, besides the three independent variables taken from TAM which are the PU, PEOU and attitude, eight other external variables are added to the study in examining predictors of satisfaction among the teachers. The second theory adapted in this study is the Information System (IS) Success Model by DeLone and McLean (1992) which is one of the most widely cited models in examining various IS contexts including knowledge management (Kulkarni, Ravindran & Freeze, 2006). It is also one of the most established and frequently used theories that facilitate the examination of success and user satisfaction (DeLone & McLean, 1992, 2002, 2003, 2004). DeLone & McLean Information Success model posits that Use of a system will bring benefit to both individuals and organisations. The benefit in this study is defined as the satisfaction.

This study proposed that the ten IV mediated by usage of the LMS system will affect satisfaction among the secondary school teachers. It posits that beliefs formed through the eleven variables will have a direct impact on satisfaction towards the LMS and that the ten variables also have an indirect impact on satisfaction through the mediation of the LMS usage as shown in Figure 1.0. This study proposed that users will use a system and then evaluate it on the basis of being satisfied or dissatisfied. The positive relationship between user satisfaction and usage has been validated in empirical studies (Torkzadeh & Doll, 1999; Gelderman, 1998; Baroudi, Olson & Ives, 1986). Zhang (2010) found in his study that user satisfaction predicted continued usage and satisfaction was identified as the variable with the most prominent influence on usage. Thus, it makes sense to assume that the more satisfied the teachers are with the system; the more likely they are going to use the system more frequently. With increased use of LMS among teachers, this would hopefully then lead to reduced drop-out rates, improved exam passing rates and raised students' grades (Lopez-Perez, Perez-Lopez & Rodriguez-Ariza, 2011; Vaughan, 2010).

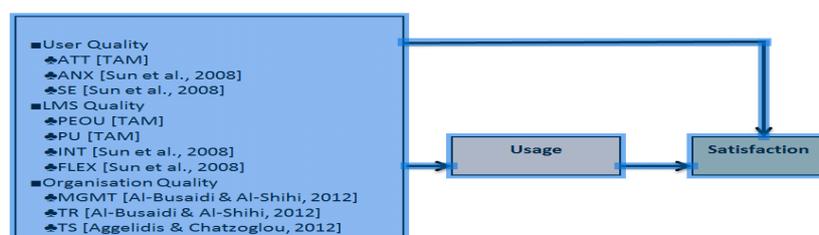


Figure 1.0: Proposed Conceptual Framework of Study

## 2.2 Satisfaction among Teachers as End-Users

Literature has shown that satisfaction can be affected by various factors. This study will be studying satisfaction from teachers' perceptions of themselves as users, how supportive is their environment in preparing and supporting them, and their perceptions towards the LMS which they are required to adopt in their classrooms. It hopes to develop and empirically tests a new model of End-User Information System Satisfaction (EUISS) that is based on DeLone and McLean IS Success Model and TAM Davis. Though EUISS assessment is one of the most widely used measures of IS effectiveness due to its high degree of face validity and easy to validate, previous measures have not captured the underlying reasons for the satisfaction or dissatisfaction among the teachers in schools. Besides, there has been limited empirical research done to determine the antecedents of website satisfaction beyond e-commerce settings and the classical contexts (Schaupp, 2010). Previous available measures may not be relevant to the Malaysian context, thus can hardly provide practical insights and value as to the current situation success rate. Satisfaction has been modified and applied from the customers' satisfaction concept. User satisfaction is defined as an attitudinal construct. According to Torkzadeh & Doll (1999), satisfaction is defined as an affective attitude one has toward a computer system after interacting with the system directly. It is a result of many external variables which can be viewed as an individual's emotional consideration based on experiences and beliefs. Satisfaction is studied as a dependent variable in this study as it informs how the LMS is received, accepted, and valued and a reflection of the learning experience quality. The collected and measured information on teachers' satisfaction towards the LMS can be used to have a better understanding as to what our teachers need, what can and should be done to increase satisfaction, thus use of the system.

## 3. Methodology

### 3.1 Research Design

This study will be based on a quantitative approach as the researcher aims to test the hypotheses of the proposed research model. Descriptive survey method was deemed most appropriate and suitable for this study with two rationales that support and strengthen its selection. Firstly, past studies had utilized survey design as the research methodology to determine factors that influenced end-user satisfaction (Sun, Tsai, Finger, Chen & Yeh, 2008; Deng, Doll, Al-Gahtani, Larsen, Pearson, & Raghunathan, 2008; Ong & Lai, 2007; Arbaugh, 2000; Ives, Olson, & Baroudi, 1983). Secondly, the survey design is appropriate as it allows the researcher to gather information from a larger sample quickly and cheaply. This permits generalization to a larger population (Creswell, 2008). According to Fraenkel, Wallen, & Hyun (2012), a descriptive survey's sample if taken from a large population, permits findings to be generalized. It aims to gather information on secondary school teachers' satisfaction towards the LMS implementation. Thus, quantitative descriptive survey design to be used in this investigation is fully justified.

The following hypotheses were formulated based on the objectives of the study and the literature review and will be tested in the study.

#### **Hypotheses: Objective 1**

- H1 Organisation Quality; technical, training and management have a significant influence on teachers' satisfaction towards the learning management system
- H2 User Quality; attitude, anxiety and self-efficacy has a significant influence on teachers' satisfaction towards the learning management system
- H3 Learning Management System Quality; perceived usefulness, ease of use, interaction and flexibility have a significant influence on teachers' satisfaction towards the learning management system

#### **Hypotheses: Objective 2**

- H4 Usage mediates teachers' satisfaction towards the learning management system

#### **Hypotheses: Objective 3**

- H5 Gender moderates teachers' satisfaction towards the learning management system

### 3.2 Procedures and Instruments

The instrument used in this research study is a set of questionnaire. According to Fraenkel, Wallen and Hyun (2012), advantages of questionnaires are they can be mailed and distributed to large numbers of people at the same time. However, the setback remains whereby unclear or ambiguous questions cannot be clarified and there will be no opportunity for the respondents to react verbally or expand their responses to the questions. A follow-up future study beyond the scope of this paper will be a possible solution. As the research model was developed by the researcher, no one existing instrument was found to be suitable. Items were adapted from previously validated instruments in numerous published studies, according to the constructs studied. They will be subjected to exploratory and confirmatory factor analyses to ensure that their psychometric properties are acceptable for measurement purposes (Teo & Wong, 2013). Participants will respond to the self-reported instrument using a five-point Likert-scale of strongly disagree (1), disagree (2), neutral (3), agree (4), and strongly agree (5). The scores from the items on each section will be aggregated to provide individual scores on each part. In this study, the negative items are reversed coded for meaningful analyses at the sub-scale level.

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# Exploring the Pedagogical Use of Social Learning Platforms in Tasks of Self-Editing and Peer-Assessment for Enhancing English Writing Competence among Elementary ESL Learners

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**Abstract:** This study aims to explore the pedagogical potential of social learning platforms for supporting English as Second Language (ESL) learners at the elementary school level in Hong Kong to enhance their English writing competence through the tasks of self-editing using Google Drive and peer-assessment using Edmodo in everyday English writing classes. An empirical research which combines qualitative and quantitative methods is planned to investigate the process and impact of the designed technology-supported pedagogy in the real classroom environment. Two classes of Grade 4 ESL learners will be invited for a two-month trial teaching period. One class will be randomly selected as the experimental class for the arrangement of drafting and self-editing their English writings using Google Drive on their own, and then working in pairs to peer-assess writing compositions with feedback provision through interaction on Edmodo; while the other class as the control class to undertake the same learning tasks without the use of social learning platforms. The empirical research will conduct attainment tests, content analysis of student artifacts, questionnaire surveys and semi-structured focus group discussions to investigate the impact of the designed technology-supported pedagogy on the achievements, processes and perceptions of learners in the development of English writing competence through self-editing and peer-assessing the writing products. This study will contribute to pedagogical innovations in the use of social learning technology for the effective development of high-level linguistic knowledge among elementary ESL learners.

**Keywords:** English, writing, self-editing, peer-assessment, social learning platforms

## 1. Research Motivation

School education in the twenty-first century puts a growing emphasis on learner-centered learning through the meaningful integration of Information and Communication Technology (ICT), especially the free digital resources online, with practical pedagogies for classroom learning (Halse & Mallinson, 2009; Säljö, 2010). In language subject area, there is an advocacy of research into the process and impact of using ICT in language classrooms in elementary schools, especially for the development of high-level linguistic knowledge, as this learning stage is critical for young learners to build foundation for the long-term development of linguistic intelligence (Andrews et al., 2007; Richards, 2009).

Elementary schools in Hong Kong have put a decade-long effort on the pedagogical integration of ICT into the delivery of English as Second Language (ESL) curriculum, as English language is not the native language of the majority of student population. The use of ICT is considered helpful to provide young ESL learners with various types of affordances for the effective development of high-level linguistic knowledge such as writing competence (Hegelheimer & Fisher, 2006; Zhao & Lai, 2008). The ESL research community over the world has made continuous effort to research into the use of emerging technology of social learning platforms such as Goggle Drive and Edmodo in elementary schools (Andrews et al., 2007; Hegelheimer & Fisher, 2006). In view of the long advocacy that self-editing and peer-assessment are potential pedagogical approaches for ESL writing classrooms, the

research delineated in this paper is motivated to explore a technology-supported pedagogy which integrates the approaches of self-editing and peer-assessment with the technology of social learning platforms for the development of English writing competence in elementary ESL writing classrooms.

## **2. Research Issue**

This study aims to explore the pedagogical synergy of self-editing and peer-assessment with social learning platforms for supporting elementary ESL learners to develop English writing competence.

In ESL writing curriculum, self-editing by individual learners is an important step in student writing tasks. According to Jones (2008) and Woo, Chu, Ho, and Li (2011), there are in general four categories of writing revisions that learners can be made in self-editing tasks. The first type is meaning-preserving changes, which refer to primarily syntactical or lexical changes without altering the original concepts in the text, such as additions and deletions. The second type is formal changes, which refer to changes involving conventional copy-editing operations, such as those in spelling and grammar. The third type is macrostructure changes, which are changes premised on formal changes, altering the global meaning and summary interpretation of the text. The fourth type is microstructure changes, which are changes premised on meaning-preserving changes, slightly adjusting or elaborating existing text without affecting the overall interpretation of the text. According to Liu and Sadler (2003) and Woo et al. (2011), the writing revisions made by learners in the self-editing process are reciprocally related to the feedback that they gained from peer-assessment tasks.

Peer-assessment, which is premised on the social learning theory, refers to the process that learners timely interact with peers to exchange ideas and collect feedback on their learning products, and so as to actively construct target domain knowledge and manage their learning progress (Roberts, 2006; Topping, 2005). In the field of ESL education, the pedagogy of peer-assessment is often implemented in writing lessons across different grades with a great flexibility for classroom implementation, in terms of group size, member ability, etc. Learners in peer-assessment activities are usually asked to review and comment different aspects of the writings produced by group members, such as the language use and content scope (Shih, 2011; Xiao & Lucking, 2008).

Social learning platforms are emerging web-based tools specific for educational use. They are websites with interface layouts and communication functions similar to those in social networking sites, but with user groups and interaction contexts limited for designated communities within schools for pedagogical purposes (Ghamrawi & Shal, 2012; Solomon & Schrum, 2007). These platforms provide affordances that support learners across different grades to conveniently share and store multimedia resources, and easily exchange and track discussion ideas within restricted groups of teachers and learners for learning purposes anytime, anywhere. They are therefore considered potential to help learners to achieve active, constructive and interactive learning when appropriate subject topics and pedagogical designs are selected in classroom teaching (Halse & Mallinson, 2009; Säljö, 2010).

## **3. Research Plan**

Based on the literature review on the pedagogy of self-editing and peer-assessment as well as the technology of social learning platforms for educational purposes, a technology-supported pedagogy is conceptualized with a goal of forwarding the use of ICT for fostering elementary ESL learners to develop English writing competence. The social learning platforms Google Drive and Edmodo will be used in this study, as they allow teachers to conveniently manage the logistic arrangement of grouping learners for compositions allocation without the constraint of classroom seating plan. The designed technology-supported pedagogy arranges learners to draft and self-edit their English writings using Google Drive on their own; and then work in pairs to peer-assess writing compositions with feedback provision through interaction on Edmodo. This involves four types of learning and teaching activities in sequence: (i) individually working on short writing and self-editing under the selected theme; (ii) individually working on peer-assessment, with a tailor-made peer-assessment form on the social learning platform; (iii) collaboratively working with partners on explaining and reflecting on the peer-assessment results through the use of the social learning platform; and (iv) individually working on writing refinement based on the feedback collected.

The proposed research will be an empirical study which will adopt both quantitative and qualitative methods to investigate the process and effectiveness of the technology-supported pedagogy designed. An elementary school that has rich experience in ICT in education will be purposefully sampled in Hong Kong as the partner school. Two classes of Grade 4 students, each consisting of around 30 students with similar learning ability, will be selected from the partner school for a two-month trial teaching period. The two classes of learners will be randomly assigned to the experimental group and the control group. The two-month trial teaching period will consist of three theme-based writing units, of each will last for one week. This will amount around nine 35-minute lessons. With the need to embed the trial teaching into routine school curriculum, the English teachers of the sampled classes will take charge of the classroom teaching throughout the trial teaching period.

For the experimental group, learners will draft and self-edit their English writings using Google Drive on their own; and then work in pairs to peer-assess writing compositions with feedback provision through interaction on Edmodo. The learners will be exposed to four types of learning and teaching activities as designed for the target pedagogy under investigation. For the control group, learners will be exposed to the four types of learning and teaching activities as same as the ones in the experimental group, but without the use of social learning platforms.

Four research questions are made for the empirical research:

- (i) What are the achievements of elementary ESL learners in English writing tasks with the process of self-editing and peer-assessment using Google Drive and Edmodo?
- (ii) What are the characteristics of writings revisions among elementary ESL learners in the process of self-editing when using Google Drive in English writing tasks?
- (iii) What are the characteristics of feedback provision among elementary ESL learners in the process of peer-assessment when using Edmodo in English writing tasks?
- (iv) What are the perceptions of elementary ESL learners toward the use of Google Drive and Edmodo for supporting self-editing and peer-assessment in English writing tasks?

#### **4. Research Methods**

The proposed research will adopt four methods to investigate the effect of the designed technology-supported pedagogy. First, all students will sit for identical pre-test and post-test (Creswell, 2012) before and after each of the three writing units, respectively. The nature of pre-tests and post-tests will be English grammar tests for measuring learners' level of accuracy in English grammar usage. The test papers will be adapted from the instrument designed by Yin, Sims, and Cothran (2012) to include a series of questions that assesses learners' knowledge of English grammatical topics to be involved in the three targeted writing units. Second, a content analysis (Krippendorff, 2013) of student artifacts will be conducted with all learners at the end of each of the three writing units, respectively. The writing products (i.e., the 100-word English writing compositions) of all learners before and after each writing unit will be analyzed with two emphases: the accuracy in English grammar usage and the appropriateness of language expression. Each content analysis will focus on the overall quality, syntactic maturity and sentential complexity of writing compositions among the learners (Chan, Tsui, Chan, & Hong, 2002; Ortega, 2003; Tompkins, 2012). The differences in the test results and writing quality between the experimental and control classes will be statistically compared.

Third, a questionnaire survey (Creswell, 2012) will be conducted at the end of the whole trial teaching period. All learners from the experimental class will be asked to complete a self-administered questionnaire to indicate their perceptions of the implementation and impact of the designed technology-supported pedagogy in supporting the development of English writing competence. The survey questionnaire will be adapted from the established relevant instruments such as Xiao and Lucking (2008). Fourth, five students in the experimental class will be randomly selected for the semi-structured focus group discussion (Creswell, 2012) to further investigate their perceptions of the designed technology-supported pedagogy. The selected students will be asked to describe the changes in their process, motivation and achievement in the development of English writing competence through the lessons that implement the designed technology-supported pedagogy. The student feedback in the survey and focus group discussion will be systematically analyzed.

## 5. Research Contribution

In response to the growing need of ESL teachers to make pedagogical innovations in the use of ICT for fostering learners' development of English writing competence in everyday curriculum, this study sets to contribute to the empirical research in the real classroom environment for obtaining evidence that helps to inform the establishment of a pedagogically sound practice which exploits the potentials of self-editing and peer-assessment together with social learning platforms for maximizing the learning effectiveness among elementary ESL learners in English writing lessons. The research approach of this study will lead the evidence-based research outcomes, which not only give ESL teachers recommendations on the advancement of English writing competence in ESL writing classrooms; but also support ESL teachers to gain insights into further effort in the innovative design of technology-supported pedagogies for English writing lessons in elementary school education.

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