Reggie Kwan Fu Lee Wang (Eds.)

Hybrid Learning: The New Frontier

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Selected Papers

Volume Editors

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Preface

Welcome to Macau and the second International Conference on Hybrid Learning (ICHL2009). We hope you enjoy the August heat in this part of the world and this seems to add to the passion we have in hybrid learning.

Armed with the success of the inaugural conference held in Hong Kong last year, the Organizing Committee (OC) is thrilled to take the Conference to another world city. On behalf of the OC, we would like to thank last year's organizers, Professor Frances Yao of City University of Hong Kong, Professor Reggie Kwan of Caritas Bianchi College of Careers, and Caritas Francis Hsu College and this year's organizers, Professor Wen-Jing Shan of University of Macau and Professor Victor Lee of the School of Continuing and Professional Studies of The Chinese University of Hong Kong.

With the advances of the internet and other technologies, access to different learning resources is almost always at our fingertips. Hybrid Learning has become mainstream. We can now pick the activities to fit our level, needs, pace, learning style, and so on. Time and place are no longer obstacles. ICHL will hopefully continue to be an annual event in which researchers and practitioners can share what we have been doing lately. We are happy to report that there have been over 160 submissions. The range of papers goes from the very technology oriented tools and systems to the pedagogical side of blending the latest face2face learning model with the most appropriate technology. The Program Committee is in debt to the army of tireless reviewers who made sure we have quality papers published in the proceedings.

Finally, the Program Committee would like to thank the International Hybrid Learning Society for supporting this conference. We would also like to extend this gratitude to all our sponsors and they are Pei Hua Education Foundation Limited, City University of Hong Kong, Hong Kong Computer Society, and ACM Hong Kong Section.

August 2009
Reggie Kwan and Fu Lee Wang
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Deriving a Learning Path from the Concept Map According to Different Criteria

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Abstract. During the last decade, the interest for e-learning systems has grown rapidly thanks to the great development of bandwidth and computational power. In an e-learning system, a course can be modeled as a concept map which is a graph consisted of learning objects and the relation between them. We define a learning path as a sequence of learning objects which strictly conform to the constraint of the prerequisite relation in the concept map. There are many possible learning paths which can be inferred from a concept map, thus it is necessary to define additional criteria in identifying the advantages of various learning paths. In this paper, we propose three ways of defining the learning paths according to three different criteria: difficulty, frequency and similarity. We also present a method for validating the effectiveness of these learning paths. As an application, we illustrate how our method can be adopted in the Chinese character handwriting education.

Keywords: e-learning, concept map, learning path

1 Introduction

With the increasing usage of the Internet technology, web-based e-learning system has been widely used. E-learning [1] is a revolution in the field of education, since it changes the learning process of many people. However, it can be a difficult process for learners to acquire the desired knowledge because of the huge amount of course information that may not be well organized. Learners may need to decide what they need to learn in which sequence. Concept map [2] is a graphical tool for organizing and visualizing knowledge by exploring the relation between concepts. In an e-learning system, a course can be modeled as a concept map which is a graph representation. Within this graph, each node represents a learning object (LO) and two learning objects are connected by an edge only if one of them is a prerequisite of the other. For example, if learning object **A** is a prerequisite of learning object **B**, then **A** must be learned before **B** and there will be an arrow pointing from the node **A** to the node **B** in the concept map. We define a course as a set of learning objects in a specific field. A valid learning path is a sequence of learning objects which strictly conform to the constraint of prerequisite relation in the concept map. Figure 1(a)

shows an example concept map of a course S, where S={a, b, c, d, e}. The learning path in Figure 1(b) is valid because it conforms to the constraint of prerequisite relation meaning that the directions among the learning objects in the learning path do not violate the directions among the learning objects in the concept map. The learning path in Figure 1(c) is invalid because it suggests to learn **b** before **a**. However, **a** is a prerequisite of **b** thus **a** should be learned before **b** instead. Consider another concrete example: when someone learns arithmetic, he/she should learn addition (+), subtraction (–), multiplication (×) and division (÷) operations. The course arithmetic can be considered to be composed of learning objects {+,–,×,÷}. We know that before one learns subtraction (division), he/she should have mastered addition (multiplication), because subtraction (division) is the inverse operation of addition (multiplication). A valid learning path in this case is thus <+,–,×,÷>.

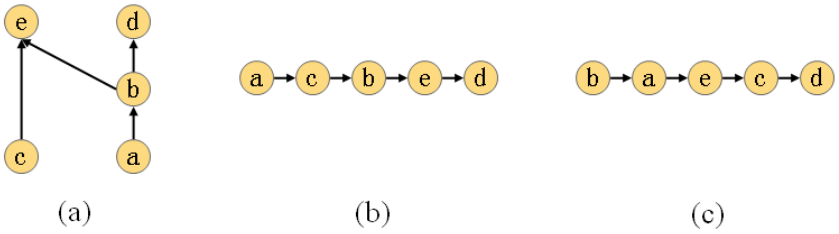


Fig. 1. (a). An example concept map. (b). A valid learning path. (c). An invalid learning path.

In this paper, we aim at deriving a learning path given a concept map. The learning path should be structured in a reasonable way so that it facilitates users to learn the learning objects. We present three criteria for deriving three learning paths, each of which has its unique advantage. These criteria are defined based on the difficulty, frequency and similarity among learning objects.
This paper is organized as follows. In Section 2, we will describe the related work. In Section 3, we illustrate our approach for deriving the learning paths from a concept map according to three different criteria. A case study specifying how our work can be applied in Chinese character handwriting education is presented in Section 4. The conclusion and future work are described in Section 5.

2 Related work

Finding a suitable learning path is one of the problems in course planning. In recent years, many researchers have focused on this problem by considering personalized or adaptive course planning. In [3], the similarity between the teacher's and the learner's concept maps is considered for measuring the misconceptions. The closeness of each learning object is then calculated by considering how much the student could be improved if the student re-learns the learning object. Afterwards the system constructs the learning path according to the learning gain and distance traveled among the learning objects. In [4], students are offered with navigational support according to

their knowledge level, where the overlay model is used to model the knowledge level of the students. In [8], personalized learning is provided according to the learner's goals and previous knowledge, and the course is dynamically adapted according to the learner's success in acquiring knowledge. The researchers in [9] explore how to implement personalized and adaptive learning by the use of concept map. In [5], the selection of learning style models which are appropriate for adaptation is discussed. The work in [6] incorporates learning style into mobile learning environment, where the Dunn and Dunn learning style model is considered appropriate in such environments. In [7], a web-based educational system is developed which includes information about student learning style to optimally adapt instructional materials to the student. The identification of the learner's learning style is done by asking students to complete evaluation questionnaires.

Compared with the above personalized or adaptive course planning, fewer works have been dedicated to the problem of finding a learning path from the learners' current knowledge background to the learning goal. The work in [10][11] try to find a best learning path from an initial to a desired knowledge. The course is first modeled as a graph. Each edge is then associated with a weight which denotes the difficulty to access a topic coming from a previous one. The initial values of the weights are established by teachers, and they are further refined with the system help. In [10], the best learning path is modeled as the path with the minimum weights, i.e., the shortest learning path. In [11], students are provided with all formative paths from an initial to a desired knowledge. The paths are adapted according to student needs and capabilities, and they are dynamically modified when such needs change.

3 Proposed method in deriving learning paths

A good learning path can facilitate learners to acquire the knowledge present in the learning objects. In this section, we will propose three criteria for deriving the learning paths such that each learning path has its unique advantage. The three criteria are difficulty, frequency and similarity among learning objects.

In a real learning environment, people feel more comfortable when they learn things in an easy-to-difficult way. It is the traditional way of teaching things and it is easy to keep track of the progress. As a result, the first criterion in deriving a learning path is based on the difficulty of the learning objects. We will present our method in generating the learning path by optimizing the progress in terms of difficulty such that the path strictly follows an easy-to-difficult manner.

When the frequency criterion is considered, the learning path is derived according to the descending order of the frequency of each learning object, i.e., it requires learning objects that appear more frequently to be learnt first. The main idea behind this kind of learning path is that people tend to learn the commonest thing first. With this learning path, people can get a quick overview of the knowledge. The algorithm to generate such learning path by optimizing the progress in terms of frequency is similar to the one with the difficulty criterion.

Another criterion for deriving a learning path is based on the similarity among learning objects. Learning may be more effective when similar things are learnt

together. It is easier for people to learn something if it is similar to what they have already learnt. We model the problem of finding such learning path as a traveling salesman problem. A dynamic programming approach can be used to obtain the solution.

3.1 Difficulty criterion

Most people feel more comfortable when they learn things in an easy-to-difficult manner. The difficulty criterion is thus proposed to derive a learning path which strictly follows an easy-to-difficult way. Recall that the learning objects are related in a concept map in which a directed edge denotes a prerequisite relation. In considering the difficulty criterion, we need to define a difficulty measure for each learning object. Such difficulty measure depends on the domain knowledge. However, the relationship between difficulty values of learning objects should be closely related to their prerequisite relations in the concept map. This is formally stated in Proposition 1:

Proposition 1. If A is a prerequisite of B, then A can not be more difficult than B, i.e., difficulty(A)$\leqq$difficulty(B).

The learning path derived by considering the difficulty criterion must conform to two constraints: 1) the prerequisite relation, i.e., a learning object should not appear before its prerequisite learning object in the learning path; 2) the easy-to-difficult manner, i.e., a more difficult learning object should not appear before an easier one in the learning path. In fact based on Proposition 1, if a learning path satisfies constraint 2, then it must also satisfy constraint 1. In other words, if a learning path follows the easy-to-difficult manner, it also conforms to the constraint of prerequisite relation. Assume that there is a learning path $<a_1, a_2,\ldots,a_n>$ which follows the easy-to-difficult manner, i.e., difficulty(a_1)$\leqq$difficulty(a_2)$\leqq\ldots\leqq$ difficulty(a_n). From Proposition 1, a learning object a_i can only be prerequisite of another learning object a_j if and only if $i<j$. As a result, this learning path also conforms to the constraint 1 about the prerequisite relation.

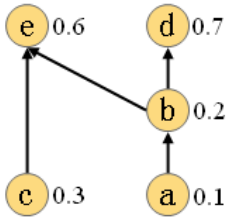


Fig. 2. The difficulty of learning objects in the concept map shown in Figure 1.

Given the above observation, it is easy to generate a learning path according to the difficulty criterion. It can be achieved by sorting the learning objects according to their difficulty in ascending order. For example, in Figure 2, the difficulty values of a,

b, c, d, e are 0.1, 0.2, 0.3, 0.7, 0.6 respectively, then the corresponding learning path obtained by sorting these difficulty values is <a, b, c, e, d>.

3.2 Frequency criterion

It is reasonable for people to learn common things first which helps people get familiar with the desired course quickly. The frequency criterion sets the learning path with learning objects from high-to-low frequency. We define the frequency of a learning object as how many times it appears in the course, i.e., how common a learning object is. In fact, in the concept map, the out-degree of a learning object is closely related to the frequency of that learning object. Notice that when counting how many times a learning object appears, there may be multiple edges between two learning objects, because a prerequisite of learning object A could appear several times in A. Moreover, in considering the frequency of learning object B that is a prerequisite of learning object A, we should multiply the out-degree of B by the out-degree of A. Figure 3 illustrates how to count the frequency. The frequency of c is 1 because the out-degree of c is 1 (from c to e). The frequencies of e and d are both 0 because their out-degree is 0. The frequency of b is 2 because its out-degree is 2 (from b to d and from b to e). The out-degree of a is 1, and the out-degree of its successor b is 2, so the frequency of a is equal to 1×2 = 2.

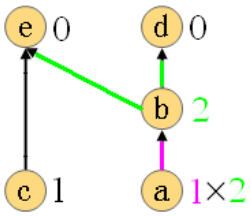


Fig. 3. Illustration of counting the frequency.

Proposition 2. If A is a prerequisite of B, then B can not be more frequent than A, i.e., frequency(A)≧frequency(B).

The learning path derived by considering the frequency criterion must conform to two constraints: 1) the prerequisite relation, i.e., a learning object should not appear before its prerequisite learning object in the learning path; 2) the high-to-low frequency manner, i.e., a less frequent learning object should not appear before a more frequent one in the learning path. In fact based on Proposition 2, if a learning path satisfies constraint 2, then it must also satisfy constraint 1. In other words, if a learning path follows the high-to-low frequency manner, it also conforms to the constraint of prerequisite relation. Assume that there is a learning path $<a_1, a_2,\ldots,a_n>$ which follows the high-to-low frequency manner, i.e., frequency(a_1) ≧frequency(a_2) ≧… ≧frequency(a_n). From Proposition 2, a learning object a_i can only be prerequisite of

another learning object a_j if and only if $i<j$. As a result, this learning path also conforms to the constraint 1 about the prerequisite relation.
Given the above observation, it is easy to generate a learning path according to the frequency criterion. This process is similar to the difficulty criterion. It can be achieved by sorting the learning objects according to their frequency in descending order. For example, in Figure 3, the frequencies of a, b, c, d, e are 2, 2, 1, 0, 0 respectively, then the corresponding learning path obtained by sorting these frequencies is <a, b, c, d, e>.

3.3 Similarity criterion

It is beneficial to group similar learning objects to be learnt in an immediate sequence because it is more appealing for people to learn things that are similar to what they have just learnt. The concept map is a directed acyclic graph, and we can further associate weights to each directed edge to indicate the similarity between two adjacent nodes (learning objects). According to the similarity criterion, the learning path is derived with the minimum sum of weights after visiting each node exactly once. This is equivalent to the traveling salesman problem. The following procedure illustrates the algorithm Trasal that transforms the problem of deriving the learning path based on the similarity criterion to the traveling salesman problem:

```
Procedure Trasal {input: concept map (V, E);
                        output: traveling salesman model}
     for each x∈V do
       for each y∈V do
         if x is not a prerequisite of y and y is not a
         prerequisite of x then
         begin
           create directed edges (x, y) and (y, x) if
           these two edges do not exist;
           calculate the similarity between x and y,
then
           associate it as weight to edges (x, y) & (y,
x);
         end
         else if (x, y)∈E or (y, x)∈E
         begin
         calculate the similarity between x and y, then
         associate it as weight to edge (x, y) or (y,
x);
         end
       end
     end
end Trasal
```

Figure 4 shows the traveling salesman model transformed from the concept map shown in Figure 1. The edges in pink are newly created edges in addition to the edges originally present in the concept map.
The traveling salesman problem (TSP) could be mainly divided into two categories, symmetric TSP and asymmetric TSP. In the symmetric TSP, the distance between

two cities is the same in each direction, thus the underlying structure is an undirected graph with which each tour has the same length in both directions. This symmetry halves the number of feasible solutions. In the asymmetric TSP, the distance from one city to another is not necessary equal to the distance in the opposite direction. In general, there may not even be a connection in the other direction, thus the underlying structure is a directed graph as in the example with one-way streets.

Solving an asymmetric TSP can be somewhat complex. One option is to turn an asymmetric TSP into a symmetric TSP, but the complexity will be doubled. A graph can be represented by an adjacency matrix. For example, Figure 5(a) shows an example graph and Figure 5(b) provides its adjacency matrix. In order to turn an asymmetric TSP into a symmetric TSP, the size of the adjacency matrix needs to be doubled. Each node in the graph is duplicated, creating a second ghost node. The weight between a node and its ghost node is very low such as 0. This can provide a cheap route linking back to the real node and allowing symmetric evaluation to continue. The original 3×3 matrix is visible in the bottom left and its transpose in the top-right. Both copies of the matrix have their diagonals replaced by the low-cost 0. Table 1 shows the double sized matrix of the original matrix shown in Figure 5(b).

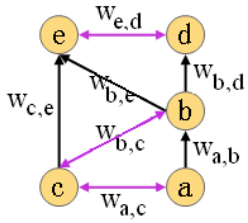
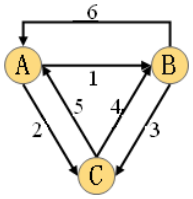


Fig. 4. Traveling salesman model transformed from the concept map shown in Figure 1.



(a)

	A	B	C
A		1	2
B	6		3
C	5	4	

(b)

Fig. 5. (a) An example directed graph and (b) its corresponding adjacency matrix.

The sum of weights for the original path A-B-C-A is equal to 1+3+5=9 as shown in Figure 5. It can be observed that the path becomes A-A'-B-B'-C-C'-A and the sum of its weights is still 0+1+0+3+0+5=9 which is unchanged as shown in Table 1.

Table 1. Double sized matrix

	A	B	C	A’	B’	C’
A				0	6	5

B				1	0	4
C				2	3	0
A'	0	1	2			
B'	6	0	3			
C'	5	4	0			

There are many ways to solve the traveling salesman problem which can be divided into two main kinds of algorithms: exact algorithm and approximation algorithms. In our settings, since the number of learning objects is not too large, we can choose the exact algorithms. The simplest exact algorithm is to try all permutations and see which path is the cheapest (using brute force search). The running time for this approach lies within a polynomial factor of $O(n!)$, where n is the number of nodes (learning objects). This solution becomes impractical even for a concept map consisted of only 20 learning objects. Instead, we choose the dynamic programming technique proposed in [12] to solve the problem whose running time is equal to $O(n^2 2^n)$.

3.4 Evaluating the effectiveness of the learning paths

The effectiveness of the learning paths should be evaluated from user studies. We propose to divide subjects into six groups randomly. They will be asked to learn a set of learning objects that are randomly divided into 3 groups A, B, C. Each group of subjects will learn groups A, B, C with different combinations of learning paths derived from difficulty, frequency and similarity criteria as shown in Table 2. The learning time for the subjects required to learn under each kind of learning path derived from each criterion will be recorded. The effectiveness of each criterion can be assessed by comparing the average learning time required to learn the concept maps using the learning path derived with that particular criterion.

Table 2. Settings of user studies to evaluate the effectiveness of each criterion in deriving the learning path.

Learning path / Subjects	Difficulty criterion	Frequency criterion	Similarity criterion
1st group	A	B	C
2nd group	A	C	B
3rd group	B	A	C
4th group	B	C	A
5th group	C	A	B
6th group	C	B	A

4 Case study in Chinese character handwriting education

As a case study, we examine in this section how our proposed approach can be applied in the application in Chinese character handwriting education. We will describe how to define difficulty, frequency and similarity measures in this domain.

4.1 Difficulty criterion

A Chinese character is composed of strokes thus learning to write a Chinese character can be mapped to a concept map with strokes as learning objects as shown in Figure 6. We define the difficulty of learning objects (strokes) according to the number of transitions in direction when writing the strokes. Different types of Chinese strokes are shown in Table 3. For example, the stroke "一" does not have any turning point so the difficulty value of this stroke is defined to be 1. The stroke "乙" has 2 turning points when writing this stroke thus the difficulty value of this stroke is defined to be 3. A parent node in such concept map is referred to a set of strokes. The difficulty value of such a parent node can be assigned as the sum of difficulty values of its children nodes. Such definition of the difficulty would conform to Proposition 1. The learning path derived based on the difficulty criterion for the case in Figure 6 is <"丨", "一", "丿", "乀", "丶", "乛", "大", "口", "犬", "哭">.

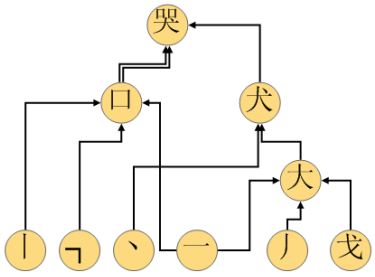


Fig. 6. The concept map of the character "哭".

Table 3. Difficulty of all the Chinese handwriting character strokes

strokes	Name	Difficulty	strokes	name	Difficulty
丶	点	1	𠂉	横　钩	2
一	横	1		横 折 钩	3
丨	竖	1	乙	横折弯钩	4
丿	撇	1	𠃌	横撇弯钩	4
乀	捺	1	𠃍	横折折折钩	5
㇀	提	1	𠃋	竖折折钩	4
㇇	撇 点	2	亅	竖　弯	2
㇉	竖 提	2	𠃎	横 折 弯	3
㇁	横折提	3	乛	横　折	2

𠃌	弯 钩	2	𠃍	竖 折	2
亅	竖 钩	2	𠂉	撇 折	2
乚	竖弯钩	3	𠂆	横 撇	2
乀	斜 钩	2	𠃋	横折折撇	4
乛	卧 钩	2	𠃎	竖折撇	3

4.2 Frequency criterion

The frequency in this domain is defined in the same way as described in Section 3.2. For example, for the example shown in Figure 6, the frequency of "一" is equal to 1×2+1=3 and the frequency of "丨" is equal to 1×2=2. A learning path derived by the frequency criterion for the case in Figure 6 is <"一", "丨", "𠃌", "口", "亅", "乀", "大", "丶", "犬", "哭">.

4.3 Similarity criterion

To apply the similarity criterion in deriving the learning path, the similarity between learning objects needs to be defined. For Chinese character handwriting education, a learning object is a set of strokes. The similarity between learning objects in this domain is thus the similarity between two sets of strokes. We will first define the similarity between two single strokes and then describe how it can be extended to measure the similarity between two sets of strokes. A stroke i is represented by N sample points $\{(x_1^i, y_1^i),(x_2^i, y_2^i),...,(x_N^i, y_N^i)\}$. To compare two strokes **A** and **B**, the sum of cosine similarity between the directions along the strokes will be used as illustrated in Figure 7. The similarity between two single strokes **A** and **B** is formally defined in Equation (1).

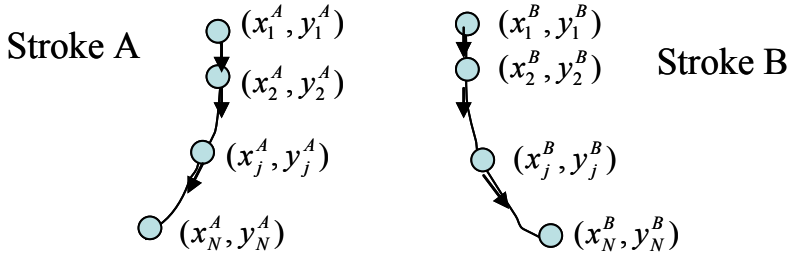


Fig. 7. Two strokes **A** and **B** represented as sequences of sample points

$$distance(A,B) = \sum_{j=2}^{N} \cos\left(\arcsin\left(\frac{y_j^A - y_{j-1}^A}{x_j^A - x_{j-1}^A} \right) - \arcsin\left(\frac{y_j^B - y_{j-1}^B}{x_j^B - x_{j-1}^B} \right) \right) \quad (1)$$

Now we need to consider the similarity between two sets of strokes $\mathbf{C}_1$ and $\mathbf{C}_2$. Denote $\mathbf{C}_1=\{c_1s_1, c_1s_2,\ldots,c_1s_m\}$, $\mathbf{C}_2=\{c_2s_1, c_2s_2,\ldots,c_2s_n\}$, where $m \leqq n$ (if $m>n$, then $\mathbf{C}_1$ and $\mathbf{C}_2$ should be swapped). The symbol c_is_j denotes the j-th stroke in the stroke set $\mathbf{C}_i$. For each stroke in $\mathbf{C}_1$, we should find a corresponding stroke in $\mathbf{C}_2$ which is denoted as $\text{map}(c_1s_i)=c_2s_j$, where $0<i<m$ and $0<j<n$. The mapping should be the one that minimizes the overall distance between the two stroke sets $\mathbf{C}_1$ and $\mathbf{C}_2$ as defined in Equation (2). In fact, this mapping can be found by using the Hungarian method with the similarity matrix obtained by computing the similarity between every pair of strokes using Equation (1). Since $m \leqq n$, there is a one-to-one mapping between the m strokes in $\mathbf{C}_1$ and there are n-m unmatched strokes with a fixed unmatched cost K.

$$distance(C_1, C_2) = \min_{map(\bullet)} \sum_{i=1}^{m} distance\left(c_1s_i, map(c_1s_i)\right) + (n-m)K \quad (2)$$

After defining the similarity between learning objects (set of strokes), we can associate the similarity between two nodes to the edge which is used to connect them. Afterwards we can transform the resulting graph into the traveling salesman problem and use the dynamic programming to solve it.

4.4 User study

The user study can be conducted with the web-based Chinese handwriting education system developed at City University of Hong Kong (http://vache.cs.cityu.edu.hk/ccls). The settings of the user study described in Section 3.4 can be followed in this specific application.

5 Conclusion and future work

In this paper, we proposed three criteria in deriving the learning paths from a concept map: difficulty, frequency and similarity. The advantage of each learning path has been discussed. Explicit solutions have been provided for constructing these learning paths. A case study about how the proposed approach can be applied in Chinese character handwriting education has been reported.

In the near future, we will conduct the user studies by asking people to following different learning paths for the application of Chinese character handwriting education. Moreover, we will also study the possibility of merging multiple criteria in deriving the learning path and examine its effectiveness.

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Impact of Computer Games on Players' Cognitive Processing and Learning

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Abstract: As video game become more and more popular in our life, working and learning. Researchers begin to focus their attention on its social and cognitive effect on human. Some researchers have done much works about its effect on social and personal development. The present paper is intended to give a brief introduction of video game play on cognitive development, and what we can learn from video game play. Finally, suggestions of positive effect and video game study in the future were discussed.

Keywords: Video Game Play, Cognitive processing, Learning

1. Introduction

Since the first video game was released in 1970s By MIT computer engineers, the percentage of people who play video games has grown in surprising speed. And the development of video game has been spurred on by the advancements in hardware and software technology. Take the leader of the video-game industry, Nintendo, as an example: they sold out about one billion games in all in just 12 years from 1983 to 1995, meaning one game for each teenager in the world. Now, another 12 years have passed and many more games were sold. Furthermore, at present years, online video games have gained great popularity. Such popularity enables players to play with from several to hundreds of others from all over the world. Video game play has become a more social than individual activity. The total sales of computer game in 2008 were 409.9 millions, this number was 15% increasing than 2007 which were 366.7 millions. By the end of 2008, more than 50% of Chinese internet users (that was about 2.44 million) played at least one online game. There are 49.36 millions frequent game players, and 40.17 millions of them are adolescents. This increasing speed is surprising in every year. Many adolescents spend a lot of time playing video

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games on the computer and even become addicted to them. Parents and school teachers started to worry about the negative influences of the video game playing. For example, people believe that playing too much video games may cause depression and violence in the adolescents, and that students who play video games are not interested in their school study any more.

Since video game is becoming more and more popular, it is impossible to treat it as some kind of evil things and get rid of it from our life. The right thing to do is to change the way we think of it from negative to positive. Some work (e.g., Wu and Li; 2008) had been done to find out the value of video game, such as the learning factors involved in it. Actually, the computer video games were described by Klabbers (1999) as actions involved many skills and knowledge. Playing video games provides the possibility to improve the cognitive abilities of players, because game-playing is the process of solving one or more problems by using some clues and following specific rules. The computer video games are specified as two categories: knowledge-directed games and non-knowledge-directed games. The knowledge-directed games are designed based on some professional knowledge in a certain field, whereas the non-knowledge-directed games do not require specific knowledge to play. Most of action video games are non-knowledge-directed games, in which the problem space is created by setting up plenty of plots. Therefore, video games can teach you how to learn new knowledge and help you with your thinking and development of creativity. That why many researchers devote themselves to finding out the educational values of video games.

The ecological cognitive psychologists argued that video games created an imaginary world for the players. People know it is not real and they do not need to take it very seriously. But, they can really get into it when playing. The players are active participants in the games. Players must be an observer with particular purpose and search for useful information, but not just accept the stimulus passively. Learning in the games is not stimulus-centered, but player-centered. The players do not need to form the hypothesis of what they see or hear before they are aware of their perception. The researchers of game-playing can study the players' behaviors by observation without assumption about the internal mental structures and abilities. You might notice that, the latest technique makes the imaginary world become more real. People can experience "real" learning environment in the internet.

Given these great work, the present paper is to give a brief introduction of the cognitive and learning effects of video games on players from the different aspects.

2. The cognitive consequences of video game experience

There are some studies on video games focused on the causes and therapy of game-play addiction (Zhang and Lei, 2007), and on how to apply the video games into school teaching (Yan, 2006). But, most of the research done in the US is related to some positive influences of video games. They found that playing video games could help people gain the experience of interaction, develop the skill of hands-eyes cooperation, encourage the students to look for fun during the boring class study, and help people to develop the sense of achievement. Furthermore, video games were

found to improve children's cognitive abilities (e.g., spatial representation and mental rotation) (Forsyth & Lancy, 1987; Gagnon, 1985; Gauvain, 1993; Green, & Bavelier, 2003; 2006a; 2006b; Greenfield, Brannon, & Lohr, 1994; Subrahmanyam, & Greenfield, 1996), problem-solving and inductive reasoning (Gauvain, 1993; Greenfield, Brannon, & Lohr, 1994; Greenfield, 1985; Greenfield et al, 1994; Rosas et al 2003), and visual attention (Green, & Bavelier, 2003; 2006a; 2006b; Castel, Pratt, & Drummond, 2005).

Among all kinds of video games, many have exceptionally high perceptual or cognitive requirements for players, for example, discriminating one color or shape from others, controlling the aircraft to elude the coming bullets or respond very quickly to an "enemy" that pops up from behind a wall. Therefore, many researchers (e.g., Griffith et al., 1983; McClurg & Chaille, 1987; Orosy-Feldes & Allan, 1989) suggested and made progress in that video game play could result in some modifications in players' visual-motor skill and cognitive skills.

2.1 Effects on reaction time and eye-hand coordination

As what was said, many games required players responding very quickly to almost any "new objects" in the screen or controlling the role of the game (a soldier or an aircraft) to finish series of tasks (e.g. moving forward or backward, shooting enemies, eluding bullets, or beating with opponent) with even more than ten key buttons when playing, and failure to do so could result in very serious consequences (lost life or dead). It was suggested, therefore, that video game play could improve players' eye-hand coordination and enhance their reaction speed.

To support such hypothesis, Griffith and colleagues (1983) required their subjects to track a moving stimulus with a pursuit rotor in their research and found that video-game players could finish the task at higher speed than non-video-game players. In another experiment, Orosy-Fildes and Allan (1989) applied pre-post paradigm where all subjects were first given a reaction time pretest (press a button as quickly as they could when a light turned on) and then half of them received a 15-minute video game training before the post-test. They found that the subjects who received the 15-minute training responded faster in the post-test than in the pretest while those who did not get the training did not show such benefits. The results indicated that video game play, even though just for 15 minutes, improved the eye-hand coordination of the players.

In these studies, the games were not popular now or updated because of the 3D/VR and video game technology development. 3D/VR and online based interactive video game are different from all the computer games playing before 1990s. It is more complicated, interactive and real for the player. They should pay more cognitive resource when playing games. So, the new generation 3D/VR video game on player's reaction time and motor skill play more important role than previous games. This is a potential researching field for researchers.

2.2 Effects on visual attentional resource and allocation

Traditional attention theory suggested a limited capacity of attentional resource, meaning that, at a given time unit, people were just able to pay attention to a limited subset of rather than all information in the visual field. Therefore, one of the most important functions of our visual system was to search and select the relevant information to the task at hand while ignoring the interference from the irrelevant stimuli (e.g., Castel, Pratt & Drummond, 2005; Lavie, 2005).

Green and Bavelier(2003) used the flanker compatibility effect which was a standard experimental paradigm in attentional studies, measured the attentional resource of both action video-game players (VGPs) and non-video-game players (NVGPs). In this experiment, participants were required to finish a target task (search through the display to determine whether a square or diamond was presented) while ignoring to-be-ignored distractors (other shapes such as triangle). When the target task was made very difficult by increasing the number of to-be-ignored distractors, NVGPs had to devote all their available attentional resources to the target task and had no left-over resources to spill over to the distractors. However, at the same difficulty level, VGPs, successfully finishing the target task, still had left-over resources to process the distractors. The results indicated that VGPs than NVGPs had an enhanced attentional capacity and were able to process more visual information at a given time period.

Zhang and Yang (2009) based on the previous researches, explored the attention distribution of action video game players and non-players at different perceptual loads under focused attention condition. we found that, at low perceptual load, action video game players tried to focus their attention on the task at-hand whereas the non-players tried to explore the adjacent locations with the left-over resources from the research task; however, at high perceptual load, the players would process the visual information at the adjacent locations of the target with the left-over resources, if any, because they had a comparatively larger attentional capability, whereas the non-players focused their attention on the target locations to finish the search task. Furthermore, the training study of the present research indicated that the two video games applied (Counter-Strike as action video game & Tetris as control game) could both enhance the reaction speed of the participants and that limited training could not alter the way of the spatial attention distribution.

In addition to possess more attentional capacity, VGPs could allocate or divide their attention more efficiently. Research by Greenfield and colleagues (1994) measured the divided attention of expert and novice VGPs and the results indicated that the experts could divide and allocate their attention more efficiently than novices (experts could detect the presentation of the target at locations where targets were presented at a very low probability with no increment of reaction time compared with at locations where targets were presented at 50% probability; while novices showed reaction time increment). Furthermore, studies by Green and Bavelier (2006a) and Castel and Pratt and Drummond (2005) suggested that, with a larger attentional capacity, action-video-game players, able to divide their attention more efficiently, could search and select targets from distracting stimuli more efficiently.

Therefore, based on these experiments discussed above, it could be suggested that video game play could play an important role in enhancing the attentional resource and its allocation efficiency or visual search efficiency.

2.3 Effects on the ability to track moving objects

As what was discussed above, that video game play could influence people's perceptual and basic cognitive ability such as eye-hand coordination, attentional resource and attention allocation. However, in our reality life, people always need to track moving objects (paying attention to a running child while driving, for instance), sometimes tracking several moving objects simultaneously. Moreover, many games also required players tracking one to several moving "targets" (two enemies might pop out simultaneously in the game counter-strike for instance).

To examine people's ability of tracking moving objects, Pylyshyn and Storm (1988) introduced the multiple-object tracking (MOT) paradigm where subjects were required to track several independently and unpredictably moving items (white cross) on the screen display. They found that subjects were able to successfully track up to 3-5 moving targets in a field consisting of ten identical independently and unpredictably moving items.

Another MOT study by Green and Bavelier (2006b) found, however, VGPs were able to successfully track approximately 5-7 items, which were 2 more than NVGPs. This indicated that video game play could improve people's ability to track simultaneously moving objects.

2.4 Effects on perceptual learning

It is well known that practice or training on one visual task often results in improvements of performance on the task; however, although many researches have indicated that subjects improve with practice or training on a number of tasks, one of the enduring findings concerning perceptual learning, especially visual learning, is that training on one task rarely improves subjects' performance on other tasks; that is subtle changes in the experimental paradigm between training and testing will lead to significant differences on the performance (e.g., Shiu & Pashler, 1992; Sagi & Tanne, 1994; Sireteanu & Rettenbach, 2000; Schoups, Vogels, Qian & Orban, 2001; Saffell & Matthews, 2003). For example, if subjects are trained to discriminate one shape from another (square from diamond, for instance), they will definitely show improvements on such task, but hardly improve to discriminate one size from another (2° square from 2.1° square, for instance).

We know that video game play could lead to a number of modifications to vision and cognition such as eye-hand coordination or reaction time, attentional resource and its allocation efficiency, and the ability of visual search and to track moving visual information. However, arguments concerning the effects of video game play on vision and cognition may be raised whether any kind of video game could result in such modifications or improvements as the capacity or the allocation of visual attention. This will be discussed in the following section.

Because of 3D/VR video game seems much more like real situation, and involves player more cognitive processed and skills as if in our life. So learning from video game is also complicated. In some way, these skills could transfer to the similar situations in our life. So, finding more transfer rules or principles will help us get trained in some special skill, such as training by 3D driving games or simulator.

3. Video game on cognitive skill and problem-solving

James Gee (2003) concluded in *What Video Games Have to Teach Us about Learning and Literacy* that video games provided an inherently motivating context for learning, given their complex rules and demands. Learning was found largely facilitated through the resolutions of impasses encountered during the processing of problem-solving (Glaser, Lesgold, & Lajoie, 1985; VanLehn, & Jones,1994; VanLehn, Siler, & Murray, 2003). The impasse, in this context, is characterized as a gap in prior experience or a lack of knowledge necessary to complete a given task (Blumberg et al., 2008). Impasse negotiation relies on the reacquisition of the missing information through the outside resources, such as teachers or reference materials, or through planning and strategy manipulations (Blumberg & Sokol, 2004), and reminding some important cues from memory by themselves. This information will help the players to solve the impasse successfully. The players will learn new knowledge and problem-solving strategies in this way. Impasse-driven learning is clearly inherent to the structure of video games given that video games are designed to sustain player interest by presenting increasingly challenging problems or obstacles to overcome (Driskell & Dwyer, 1984).

Zhang and Luo et al (2008) studied the problem-solving skills used by frequent and infrequent Chinese video game players to negotiate impasses encountered while playing a novel video game. All participants were instructed to think aloud while playing a video game for 20 consecutive minutes. Comments made were then used to make inferences about the problem-solving skills that participants used to resolve impasses encountered during the game. Findings showed that frequent players made significantly greater reference to insight and game strategies than infrequent players. After reaching an impasse, all players also were most likely to comment on their game progress and potential game strategies to use. Over the course of game play, there are some cross cultural differences were founded. Zhang and Shen et al (2009) studied the influence of video game experience on problem representation, efficiency of strategies, meta cognition, and quality of mental models during solving the problems that encounter in a new game. This experiment asked all the participants to keep thinking aloud during the 20-minite process of playing, and their verbal report was analyzed to study the problem solving. The results indicate a significant influence of computer games on game players' performance in an unfamiliar game. The most frequently referred comment is direct strategy, next are game rules and cues, monitoring and game progress. Expert players performed better than novice players on problem representation, efficiency of strategies, and meta cognition.

The nature of the relationship between impasse and learning was defined as "encountered during video game play presents a new venue for examining the specific

problem solving strategies that facilitate 'expert' performance during game play" in Blumberg's study (2008). Experts here refer to the frequent players who have more background knowledge and experience with video games than novices or infrequent players. Hong and Liu (2003) found that experts demonstrated greater analogical thinking than novices who demonstrated more trial and error when playing the game. Unfortunately, they did not use a real video game in their study. It is still unclear how video game players think when they are actually playing the games.

Complicated cognitive skills are the basis of expertise and the professional abilities to solve complex problems in a particular field. Glaser, Lesgold, and Lajoie (1985) proposed 6 dimensions to appraise the development of cognitive skills. Those dimensions include (1) the structure and organization of knowledge; (2) the depth of problem representation; (3) the quality of mental models; (4) the efficiency of procedures or methods; (5) the automaticity of cognitive performance; and (6) the meta-cognitive skills. Compared to novices, the experts form some complicated connections between the knowledge and skills, so that they represent the problems in deeper levels and they apply more accurate, more direct, and more efficient methods in the process of problem-solving. The experts also have the ability to construct high-quality mental models to guide the problem solving, and they are better in planning, monitoring, and self adjustment. 3D/VR based video game will help to improve these cognitive aspects in our complicated cognitive skills.

4. Consequences of different kind of video games

Early in 1980s', the work of many researchers (e.g., Cooper & Mackie, 1986; Irwin & Gross, 1995; Schutte et al., 1988; Silvern & Williamson, 1987) suggested that aggressive video games would result in increment of aggressive behaviors of players, demonstrating that the content of video game determined, to some extent, its consequences, at least from the aspects of its social effects. Then it's time for us to answer the question whether different kinds of video games have different perceptual and cognitive consequences.

In the experiment by Orosy-Fildes and Allan (1989), subjects who got trained on an Atari 2600 video game system for just 15 minutes could respond as many as 50 milliseconds faster in the post-test than in the pretest, indicating that video game play could lead to reduction in reaction time or increase in eye-hand coordination. However, it should be noticed that the video game selected for training (Atari 2600 system), although very simple and the level of its cognitive complexity being very low, had requirements for players to respond fast and cooperate the movements of the roles he controlled with his attention in great harmony. Therefore, it's reasonable to suggest the hypothesis that the practice or training effects of video games on the visual attention or cognition was also dependent on their content or what was called in this part requirement. Given such hypothesis, some games without requirements of eye-hand coordination or reaction speed, chess-play or card-play for instance, might not result in such benefits found in the experiment of Orosy-Fildes & Allan.

The work by Green and Bavelier (2003, 2006a, 2006b) explored the effects of action video game play on the visual spatial attention including its capacity,

distribution and temporal resolution and meanwhile the difference of the effects between action video game and non-action video game. They got several main findings: a) action video game players possessed an enhanced attention capacity which enabled them to process more visual information simultaneously; b) action video game players could distribute their spatial attention with a higher efficiency over the visual field even at the untrained spatial locations; c) action video game players had improved temporal resolution of visual attention; that is they were better able to process a rapid stream of visual information.

However, it should be paid enough attention that, in their studies, action video games meant those that "have fast motion, require vigilant monitoring of the visual periphery, and often require the simultaneous tracking of multiple targets". Therefore, taken these requirements and their findings together, their work also demonstrated that video games could have different perceptual and cognitive effects because of their serious perceptual and cognitive requirements.

Furthermore, the training study in their work also supported this demonstration. In the training study, all subjects (non-video-game players) were first given the same pretests. Then half of them got from 10 to 30 hours' training on an action video game (Medal of Honor or Unreal Tournament) while the others on a control game (Tetirs was chosen for this part because of its high requirement for eye-hand coordination than those of action video games). After the training, all subjects were post-tested on the same tests as the pre-ones. Results indicated that those who underwent the training on the action video game showed the similar benefits as the habitual players while those on the control game did not.

Therefore, video game play could result in various consequences as increase of aggressive behaviors and improvements of problem-solving abilities from the social aspects, or enhancements of eye-hand coordination and attentional capacity from the cognitive aspects; and their effects were dependent on their requirements or contents. Since one video game has a number of perceptual and cognitive requirements, it can lead to a number of modifications on the perception and cognition, which does not contradict with what was discussed in the above part "Effects on perceptual learning".

5. Practical implications of video games study

It has been well demonstrated that video game play can lead to a number of improvements on one's perception and cognition. So what's the practical meaning to study video game from the aspects of cognition? Or what are the practical implications of video game training? In this section, we will discuss it mainly from the following four aspects.

5.1 Cognitive training for children

For human being, it usually takes about 15 years for one's perceptual and cognitive skills to develop to reach adult level (Green & Bavelier, 2004). However, research by McClurg and Chaille (1987) found that children improved their performance on the Mental Rotations test after they got trained on a video game. And the 5th grade

children in their research who got the video game training performed better than those 9th graders who did not. Moreover, research by Hasdai and colleagues (1998) found that children who got trained on a joystick-controlled video game performed better when learning to operate a motorized wheelchair, demonstrating that corresponding video game play could improve the children's abilities to operate or their eye-hand coordination. Research by Dye and Bavelier (2004) also found that video game play could lead to similar improvements for children as adults on visual attention tasks including the Useful Field of View (UFOV) and the attentional blink. Therefore, despite the lack of correlative research concerning the effects of video game play on children's perceptual and cognitive development, Green and Bavelier (2004) suggested that children who played video games might obtain the same significant rewards from the video game experience as those of adults, which might answer the question they raised whether video game play could augment the natural development of the perceptual and cognitive systems in children.

5.2 Training for the cognitive aging and the disabled

Usually, because of the natural growth of aging, the elderly always suffered from the declines of a number of perceptual and cognitive abilities. For example, some researchers pointed out that the elderly always suffered from declines of such abilities including short-term, reasoning, manual dexterity, eye-hand coordination and response selection (Drew & Waters, 1986; Whitcomb, 1990). The same situation often happened to the disabled who suffered from some accidents. Therefore, it would be of great significance to find a way to help them to retain such abilities to live a more normal life.

Research by Drew and Waters (1986) explored the effects of video game play on the elderly. They found that, after a 2-month video game training (one hour per week), the elderly subjects (61-78 years old) in their experiment showed improvements both in the Purdue PegBoard and in the Rotary Pursuit tasks, demonstrating that the 2-month video game experience led to enhancements of the abilities in both manual dexterity and eye-hand coordination. Research by Clark and colleagues (1987) on the same field found that the elderly subjects (with a mean age of 65 years) responded faster after than before given a 7-week video game training (at least two hours per week) in a reaction time test while those without the training experience did not show such improvements. Moreover, they found that the reduction of reaction time for those given the video game experience was even bigger on incompatible response condition (to press the button below the light that did not turn on) than on compatible response condition (to press the button below the light that turned on). Therefore, they suggested that since the reduction of reaction time was bigger on the incompatible response condition, the video game experience led to enhancements in the reaction speed but, more importantly, the ability of response selection.

The results of these experiments indicated that video game experience could be very helpful for the elderly to retain some perceptual and cognitive abilities which declined with the natural age growth. However, although the situation might be similar for the disabled as the elderly, the lack of research for the former concerning video game play impeded our arguments about whether they could enjoy the similar

rewards from video game experience as those observed in the elderly. Therefore, more work is still needed on this field.

5.3 Training for those with special profession

It has been well demonstrated that video game play can lead to measurable enhancements in some perceptual and cognitive skills including eye-hand coordination, reaction speed, response selection, attentional capacity, visual search efficiency and the ability to track moving targets. Therefore, it comes very naturally the idea that these enhancements must be of great benefits to those whose professions have high requirements for these skills. For example, when driving, drivers must be aware of the boys playing basketball on the roadside or a pedestrian who might be talking on a mobile phone while focusing their attention to the road ahead. Therefore, a high efficiency to divide attention, an enhancement in eye-hand coordination and a reduction, even just tens of milliseconds, in reaction time would mean a lot to them when a boy rushes to the middle of the road chasing a ball.

Furthermore, many studies examined the effects of video game play on the military personnel and some found that video game play was a covariate for carrier landing research and suggested that video game might be beneficial to some military tasks (Jones, Kennedy & Bittner Jr., 1981; Lowery & Knirk, 1982; Lintern & Kennedy, 1984). Particularly, Gopher and colleagues (1994) examined the effects of video game training on flight tasks with Israeli Air Force and found that the personnel trained on a video game performed better than those who were not given the training.

In addition to drivers, military personnel and pilots, video game play might be beneficial to those operating complicated machines which have requirements for a high level of eye-hand coordination.

5.4 Other implications of video game study on learning

Video game has gained great popularity all over the world and been making great profits for video game industry. Therefore, it should be of significance and interest to study video games and find out how to make them capture players' attention much more. The suggestion of Green and Bavelier (2004, 2007) for video game training might be helpful for this, which was to make the difficulty level of the video game just higher than where the players were so that they could attain their goals before losing their patience. Advanced cognitive skills also could be trained by special designed video game or soft ware simulator. When we find more learning rules and principles from video game, it will help to make our skill learning and training more efficiently. In our recent studies, we did find VGPs outperformed NVGPs on these advanced cognitive skills. So, when we change our viewpoint, video game can be used not only as entertainment, but also better tools for learning skills.

6. Theoretical and practical value of video game studies

We have reviewed form video game studies, some focused on basic cognitive process and found positive effect of video game on cognition, other focused on training in special population and profession. We also did both of these work in our studies. Generally, all these studies have found some important results on cognitive effect of video game. There are also training application of video game for improving special skill (such as driving, flight, motor skill, and so on). As a result from these finding, these studies was mostly based on computer games before 2000 which 3D/VR video game was not developed and popular used well. However, from these studies, we could find the theoretical contribution on cognitive theory. That is, some basic cognitive ability also could be train and improved by playing video and other train program. Actually, not all basic cognitive process was studied in the previous literatures. So the further studies need to be done in the future. It is also remained unclear whether video game play would change the neural mechanisms. Although research by Koepp and colleagues (1998) found an increase in the amount of dopamine released in the brain when participants played an action video game, it is still very hard to fully understand the effects of video game play on the structure of neural system. Therefore, with the help of technologies as Event-Related Potentials (ERP) and functional Magnetic Resonance Imaging (fMRI), work in this respect is still in need in the future.

Secondly, many studies have been well demonstrated that video game play can lead to a number of modifications to one's cognition and skills. Researcher found the results in lab, not in daily life. Even some researchers trained some skills as video game application. However, there is still a long road ahead to make it to be a common learning and training way in life. To examine whether video game play is a causal factor of its consequences, a training study is always needed. However, the progress of the training is not easy to be controlled strictly, which is of great importance for the training efficiency (Linkenhoker & Knudsen, 2002). For example, the subjects might play on their own computer games or other training program out of lab. Anyway, the training effect is clear, video game could improve some advanced cognitive skill as some studies done in lab. In fact, video game and simulator have been used in driving and flight simulated training. Further work should to be done in other training program, and make cognitive ability and skill gained from video game transfer to working, life and learning process.

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Cognitive Learning Styles and Academic Performance in the Online Learning Environment

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Abstract. Individual differences are of concern to both academics and practitioners in the education field. On the one hand, we would like to better understand each individual learner to be able to determine the most effective teaching and learning processes. On the other hand, the recent developments in information technology make if more possible than ever to provide personalized learning modes to individual learners, thus allowing the best match between individual learning styles and appropriate instructional means. Even though it is unnecessary to find an individual instruction method for every individual learner, a mismatch of learning styles and instructional methods can create conflicts that affect cognition, affect, and behavior during the learning process. In this paper, the author reviews the cognitive learning style scales that have been adopted in previous research and presents the results of a four-year long analytical study of the cognitive learning styles of undergraduate freshman at a local university in Hong Kong, as well as the distribution in these styles over the four-year period. A pilot study that identified significant differences between cognitive styles and academic performance (in terms of cumulative GPA) ($p < 0.01$) is also discussed. A pilot review of courses on an online Interactive Learning Network (ILN) with a high/medium/low degree of usage shows significant differences between cognitive styles and course grades, but no significant relationship between usage of this online learning platform and academic performance. The implications of and possible reasons for these findings are addressed, and plans for a future full-scale study are discussed.

Keywords: Cognitive style index, learning style, learning outcomes, academic performance, online learning, hybrid learning.

1 Introduction

Prior studies of traditional classroom teaching and learning have identified individual differences to be an important factor in explaining the cognitive process and found that emotion may affect learning motives and learning behavior, as well as decisions about whether to engage in learning activities. For example, Mayer's models for understanding suggest that learning materials, instructional method and learner

characteristics are the three main predictive components of learning performance in the teaching and learning processes [1].

An investigation of the impact of individual differences in learning has two primary aims: (1) to provide a better understanding of how individual learners develop their own learning strategies in the learning process and (2) to provide guidance for better matched instructional methods for more effective teaching and learning.

Understanding these differences has long been considered important, but implementing that understanding in practice presents difficulties. This is because, in the traditional classroom, the instructor has little opportunity to implement different instructional methods for individual students. However, recent developments in information technology afford the possibility of much more flexible learning, such as through course management systems/learning management systems (CMS/LMS). These software developments have made more personalized or customized instructional modes possible. Agreed with the fact that there are few empirical studies examined the relationships between cognitive and learning styles and web-based learning, further studies in the area are very much in need [2].

The importance of empirical investigations of the relationship between individual learner differences and academic performance in the online learning context is therefore clear. However, a review of recent studies found that few of them adopt validated scales of learning styles or use such scales consistently in large-scale sample sets. Instead, the research in this area tends to be ad hoc, using various non-validated scales and considering individual courses. In the review of literature on 13 most influential models on cognitive learning styles, most of the scales are either not reliable or not valid [3].

This paper therefore represents an attempt to fill the gap in this research area by exploring how cognitive learning style interacts with the online learning environment. Such an investigation is important, as it may allow us to predict academic performance in such a context. The remainder of the paper is organized as follows. After a brief review of the cognitive learning style scales used in prior studies, it focuses on a cognitive style index instrument. Following a review of empirical studies on the online learning environment, two hypotheses about the relationship between cognitive style and academic performance are posited. The paper then turns to a discussion of two studies: a four-year analysis of the cognitive learning styles of all freshmen in a Hong Kong university and a pilot study carried out using a sample of students in the university's Department of Communication and Journalism to test the two hypotheses. The paper concludes with a discussion of the implications of these two studies and plans for a future large-scale, longitudinal investigation of the cognitive learning styles and academic performance of undergraduate students in the online teaching and learning-support environment.

2 Literature Review

2.1 Cognitive Style Index (CSI) and Pedagogical Implications

Over the past decade, there has been increased interest in cognitive styles among academic researchers and practitioners. Learning effectiveness depends on the contingent fit of cognitive styles with instructional methods, and an acknowledgement of different cognitive styles allows individuals to search for the best learning mode to suit their individual needs. The objective of the first study discussed herein was to measure the cognitive styles of all new students to provide the university with an overall picture. A better understanding of these learning styles will allow the university administration to devise development plans, teaching faculties to devise specific teaching strategies for different courses and students to select the best learning mode. As Coffield et al. note, the study of cognitive styles and its implications for teaching and learning are serious and should be of concern to learners, teachers and trainers, managers, researchers, and inspectors [3].

Cognitive style has been defined as "consistent individual differences in preferred ways of organizing and processing information and experience" [4]. Researchers suggest that cognitive styles actually converge around two poles, which are commonly labeled 'analytical' and 'intuitive' and are often associated with the specialist functions performed by each hemisphere of the human brain.

Analytical. Rational information processing has been linked with the left hemisphere of the brain, which is held to be primarily responsible for logical thought, particularly in verbal and mathematical functions. In the work context, an analytical person tends to be compliant, to prefer a structured approach to decision making, to apply systematic methods of investigation and to be especially comfortable handling problems that require a step-by-step solution.

Intuitive. Nonlinear thinking has been identified with the right hemisphere of the brain, which specializes in synthesis and the simultaneous integration of inputs, with an emphasis on spatial orientation and the comprehension of visual images. An intuitive individual tends to be relatively nonconformist, to prefer a rapid, open-ended approach to decision making, to rely on random methods of exploration and to work best on problems that favor a holistic approach [5].

These two primary types have several implications for pedagogy. For example, it has been suggested that matched cognitive styles are often effective in mentoring relationships, and analytical qualities have been found to be desirable in university dissertation supervisors [6, 7]. If it were to be shown that placing a higher value on intuitive performance by university students led to more successful career and business outcomes, then changes in pedagogy and assessment would be in order.

Prior studies have examined the association between cognitive style and the nature of interpersonal relationships [8]. Similarities in cognitive style have been found to lead to smoother interaction and positive mutual feelings between individuals, owing to shared interests, common personality attributes and equivalent modes of communication. Mismatched cognitive style, in contrast, is more likely to result in conflict [9-14], as such differences also yield differences in interests, values and problem-solving techniques, which may handicap working relationships [15]. It has been observed that people who are highly adaptive in their cognitive style do not readily combine with those who are highly innovative [16]. Adaptors appear to see innovators as abrasive and insensitive, whereas innovators seem to regard the more extreme adaptors as more likely to reject them and their ideas than to collaborate with them. One empirical study shows differences in weblog adoption rates among different cognitive style groups [17].

2.2 Online Learning Features and Pedagogical Implications

It has been suggested that the distinct feature of online communication is deindividuation. That is, written communication is characterized by anonymity and a lack of physicality. Such deindividuation may be a barrier to online learning because learners experience isolation, loneliness and feelings of alienation, and have little sense of community [18-26]. However, recent research has found that the deindividuation inherent in online learning may have positive outcomes for socially excluded individuals and may help them to form and maintain interpersonal relationships [27-30].

Online learning provides support for teaching and learning in various ways. (1) It is suitable for announcements and calendars, thus serving as an advanced organizer. It tells learners well in advance which subjects are to be taught and which learning activities are to be organized. This helps learners who need more self-discipline and direction in the organization of their learning. (2) Online learning serves as a forum, providing a public and social platform for individual learners. According to Vygotsky [31, 32], the public, social plane is an important place for more experienced and knowledgeable individuals to share knowledge with less knowledgeable individuals who then internalize what they have learnt for private and individual use. After practicing the knowledge and skills obtained in their own learning contexts, these individual learners are then ready to share them in the public and social plane with new learners. Online forums provide such a shared learning place for individual learners to meet and interact. (3) Finally, online learning platforms facilitate community building. Individual learners can make use of the online learning environment to express themselves, to make friends and to maintain relationships. As prior studies have suggested that one of the greatest problems with online learning is that it may result in loneliness and emotional distress [19], the capability to form and maintain relationships is important in helping individual learners to feel positive and to engage in socially interactive learning activities. Differences in cognitive style may also affect interpersonal relationships, and the online learning environment makes it more possible for individual learners to identify cognitively similar others. This may lead to smoother interactions and positive feelings that facilitate the learning process.

3 Conceptual Model and Hypotheses Development

With reference to the conceptual model of the online learning context presented in Figure 1, it is suggested that cognitive learning styles affect the way individuals learn, and in turn affect their academic performance. Therefore, the following hypothesis is posited.

H1: There are significant differences in academic performance among different cognitive learning styles.

In the online learning context, however, there are various possible ways for individual learners to develop more effective learning strategies. Therefore, an appropriate match of teaching and learning support in this environment should lessen the significance of cognitive learning style differences for academic performance, which leads to our second hypothesis.

H2: In the online learning environment, there are no significant differences in academic performance among individuals with different cognitive learning styles.

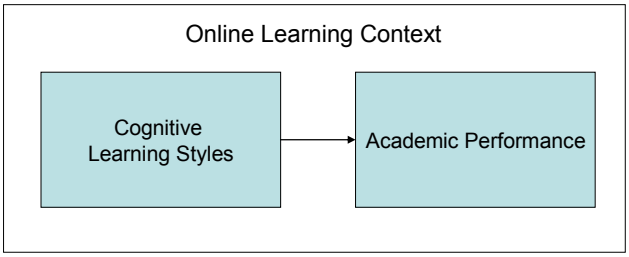

Fig. 1. Conceptual Model of Cognitive Learning Styles and Academic Performance in the Online Learning Context

4 Method and Findings of the Two Studies

4.1 Study 1

Sample. The Study 1 sample comprised all year-one students in all academic disciplines in a local university in Hong Kong. Over a four-year period, at the beginning of the academic year in September, all new students were given a questionnaire, which they were asked to complete and return to the Office of Student Affairs (OSA). In September 2008, questionnaires were distributed to all 1275 year-

one students, of which 1239 were returned, 1203 of them with all 38 question items completed, for a response rate of 94.35 percent (compared with 97.72, 97.6 and 93.4 percent in 2007, 2006 and 2005, respectively).

Measures. Based on the review of 13 most influential models on cognitive learning styles [3], Cognitive Style Index (CSI)[1], developed by Allinson & Hayes [33], is found to be the only instrument which passes through all the criteria: internal consistency, test-retest reliability, construct validity, and predictive validity. In this study, therefore, Cognitive Style Index, a self-report questionnaire, was administered to all year-one students to assess the generic, intuitive-analytical dimensions of the aforementioned cognitive styles. Each of the 38 items on this questionnaire has a true-uncertain-false response mode, with scores of 2, 1 or 0 assigned to each response. The direction of the scoring depends upon the polarity of the item (17 items are reversed to control for acquiescence response bias). The nearer the total score to the theoretical maximum of 76, the more analytical the respondent is judged to be, and the nearer to the theoretical minimum of zero, the more intuitive. The internal consistency of the 38-item CSI in 2008, as measured by Cronbach's alpha reliability coefficient, α, is 0.7349, which exceeds the minimum threshold ($\alpha = 0.7$) suggested in the literature [34] (the respective figures for previous years were $\alpha = 0.743$, 0.702 and 0.722 in 2007, 2006 and 2005).

Descriptive Statistics. The overall mean for the 38 question items was 46.33 (compared with 46.05, 45.78 and 44.36 in 2007, 2006 and 2005, respectively), with a standard deviation of 8.310 (compared with 8.408, 7.936 and 8.064 in 2007, 2006 and 2005, respectively). The minimum and maximum scores were 15 and 68, compared with 14 and 71 in 2007, 17 and 70 in 2006, and 12 and 68 in 2005. The figures are summarized in Table 1.

Table 1. Descriptive Analysis of Cognitive Style Scores in the 2005-2008 Period

CSI scores ($N = 38$)	Mean	Min	Max	Variance	Standard Deviation	Cronbach's Alpha	N
2008	46.33	15	68	69.052	8.310	0.735	1203
2007	46.05	14	71	70.688	8.408	0.743	1245
2006	45.78	17	70	62.980	7.936	0.702	1180
2005	44.36	12	68	65.023	8.064	0.722	816

Median Splits. Distinguishing high (analytical) and low (intuitive) scores by splitting the groups according to their CSI median would have been arbitrary and without theoretical justification. It was therefore decided that a more valid criterion for the notional boundary between analytical and intuitive thinking would be the median score (mdn = 43) previously obtained using a relatively large sample [35] of the working population. Thus, the CSI scores were designated as low (intuitive) if they

[1] The CSI instrument can be obtained directly from the authors [33].

were < 43 and high (analytical) if they were ≥ 43. The result in 2008 was two groups: an intuitive group with 367 students and an analytical group with 836 students. The results for the four years are presented in Table 2.

Table 2. Cognitive Style Groupings from 2005 to 2008

Cognitive Styles	2008 (N = 1203)	2007 (N = 1245)	2006 (N = 1180)	2005 (N = 816)
Intuitive	367 (30.5%)	390 (31.3%)	392 (33.2%)	316 (38.7%)
Analytical	836 (69.5%)	855 (68.7%)	788 (66.8%)	500 (61.3%)

Discriminating between Groups. The CSI is capable of discriminating between groups that are presumed to differ in their cognitive style. Areas for comparison may be gender [16, 36], age and academic discipline, among others. The cross tabulation analysis presented in Table 3 shows the distribution of cognitive styles by gender.

Table 3. Gender Differences in the CSI:Group Cross Tabulation (2005-2008)

		CSI Group											
		Intuitive (08/07/06/05)				Analytical (08/07/06/05)				Total (08/07/06/05)			
Gender	M	10.64	10.36	13.7	16.5	22.03	22.09	27.4	26.0	32.67	32.45	41.1	42.5
	F	19.87	20.96	19.5	22.2	47.46	46.59	39.4	35.3	67.33	67.55	58.9	57.5
Total		30.51	31.32	33.2	38.7	69.49	69.68	66.8	61.3	100%			

4.2 Study: Pilot

Sample. As a pilot sample, all year-two students in the university's Department of Journalism and Communications were selected from the larger pool. The final pilot sample includes 149 completed student subject records, out of a total of 172 students.

Measures and data analysis. First, the CSI [33] scores of each student were collected from the complete sample set in Study 1. Second, these students' transcripts were reviewed to see what courses they were taking. Only compulsory courses were considered in the pilot study, to allow all student subjects to be examined. At the same time, a review of the usage by each course of an online learning platform called the Interactive Learning Network (ILN), which had been implemented in the university to support teaching and learning, was carried out. The courses were then divided into three usage categories (see Table 4): high usage (regular and frequent use by the instructor and the students), medium usage (some usage, but not regular or frequent), and low or nil usage (very rare use or no such course online). Finally, information on the overall grade point average (GPA) for each course and the cumulative GPA of each student was collected.

Table 4. ILN Usage Categories of for Different Courses

ILN Usage	Courses
High	BUS110, HIST100 (sessions 1, 4, 6), JOUR100*
Medium	CH101, ENG111,* HIST100 (sessions 2, 3), JOUR110, SOC204, PSY100
Low	CH132* (no usage)

**Compulsory courses selected for analysis.*

Descriptive Statistics. The means of the overall GPA for each course and of the cumulative GPA of the students are given in Table 5.

Table 5. Descriptive Analysis of the Courses Selected for Analysis

Courses	Mean	Min	Max	Standard Deviation
JOUR100	2.816	0	4.0	0.6460
ENG111	3.157	0	4.0	0.5345
CHI132	2.559	0	4.0	0.8820
Cumulative GPA	2.854	1.771	3.803	0.4270

One way ANOVA. Using one way ANOVA, it was found that there were significant mean differences between the two cognitive styles in terms of cumulative GPA, thus supporting H1. The analytical group outperformed the intuitive group. The mean GPA for each course and the cumulative GPA among this group were 2.936 and 2.747, respectively. There were also significant GPA differences between the two cognitive groups in courses with different usage rates of the ILN, specifically in the high-usage course JOUR100 and the low-usage course CHI132. In both of these courses, the analytical group was found to outperform the intuitive group. The former had GPAs of 2.925 and 2.701 for JOUR100 and CHI132, respectively, compared to scores of 2.675 and 2.375 for the latter. There were no significant differences between the cognitive groups in ENG111.

Table 6. GPA Means among Selected Courses and One-way ANOVA between Cognitive Style Groups

Courses	Cognitive Style	Mean	Std. Dev.	ANOVA F-values (sig.)
JOUR100	Intuitive ($N = 65$)	2.675	0.5777	5.643* (0.019)
(High usage)	Analytic ($N = 84$)	2.925	0.6777	
ENG111	Intuitive ($N = 65$)	3.109	0.6358	0.922^{ns} (0.338)
(Medium usage)	Analytic ($N = 84$)	3.194	0.4411	
CHI132	Intuitive ($N = 65$)	2.375	0.9097	5.141* (0.025)
(No usage)	Analytic ($N = 84$)	2.701	0.8379	
Cumulative GPA	Intuitive ($N = 65$)	2.747	0.4461	7.503** (0.007)
	Analytic ($N = 84$)	2.936	0.3949	

**p < 0.05, **p < 0.01, ***p < 0.001, ^{ns}non-significant*

5 Discussion and Future Research

5.1 Cognitive Learning Style has a Significant Impact on Academic Performance

The results of the pilot study indicate that cognitive learning style has a significant impact on academic performance. Evidence for this is provided both by the students' cumulative GPAs and by the mean GPAs for the individual subjects. The pilot study adopted a validated and reliable instrument to measure individual differences in cognitive learning styles and to categorize learners into either the intuitive or analytical group. Different ways of thinking, i.e., different cognitive processes, do have an effect on performance in specific subjects and on overall academic performance. The findings of this initial study serve as a basis for future research into these two cognitive groups and ways to develop instructional methods that will improve learning among them. Such research would be especially relevant today, as recent developments in information technology make possible the implementation of personalized and individualized means of instruction.

5.2 Inconclusive Results on Interaction Effects of the Online Learning Environment

Although the pilot study provides evidence of the importance of individual differences in learning styles, particularly the learning styles of intuitive and analytical individuals, it was unable to demonstrate the interactive effects of the online learning platform on academic performance. Two areas require further in-depth investigation. First, prior knowledge of the subject domain may have a significant effect on academic performance. To examine the effects of the online learning platform, a direct comparison of the same subject domain over a number of years is required. Second, the specific functionality of the online learning platform requires investigation, as this study considered only its general usage.

5.3 Plans for Future Full-scale Study

Analysis of the data gleaned in the pilot study provides us with useful information on which to base a future, large-scale, longitudinal investigation of the cognitive learning styles and academic performance of undergraduate students in the online teaching and learning-support environment, particularly with regard to the following areas.

Online context categories. The pilot study provides a way of classifying an online learning platform into high-, medium- and low-usage categories. Future categorization may also include specific functionalities, for example, (1) the existence

of a discussion forum that provides a common shared platform for social interaction and learning, and (2) the existence of regular announcements or a calendar, features that allow the platform to serve as an advanced organizer and individual learners to better organize their study time.

Instructor effects. In the selection of courses for analysis, there may be ways to control for instructor effects. For example, group comparison could be made among courses taught by the same instructors over a number of years, thus allowing instructor-specific effects to be eliminated.

Subject domain knowledge effects. Because of differences in cognitive learning styles, each cognitive group may have strengths and weaknesses in a particular subject domain. Identification of these strengths and weaknesses would make visible the interaction effects, if any, of the online learning platform.

Control factors. There may be other control factors, such as gender, prior knowledge, experience with online learning platforms and individual usage habits, that could be included in the data analysis to determine their interaction effects, if any.

6 Conclusion

The two studies discussed herein represent important steps toward a better understanding of individual differences in the online learning environment. Their empirical findings show that there is a significant difference between the two cognitive learning style groups, intuitive and analytical, with regard to academic performance. Thus, future research may consider the development of appropriate instructional methods to strengthen specific cognitive learning groups in the learning process. Such research would be timely, as recent developments in information technology provide a clear direction for online learning system design and university-wide implementation strategies.

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Education Panopticon Structure and its Functions -- Citing STEE in China as an Example

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Abstract. Panopticon structure exists in education and education could effectively achieve its sociological functions through this structure. Basing on Bentham's Panopticon prison structure as a theoretical lens, the article aims to interpret the structure of STEE (Self-taught Tertiary Education Examinations) in China, and analyses how its two sociological functions – socialization and selection could be effective in practice through such a panopticon structure in current Chinese society.

Keywords: Self-taught Tertiary Education Examinations (STEE) in China, Panopticon Structure, Socialization, Selection

1 Introduction

1.1 Panopticon Structure

Michel Foucault introduced Jeremy Bentham's eighteenth century Panopticon as perfect way of power and observation in *Discipline and Punishment*. There is no need any more of the iron bars, fetters, or locks, but the seclusion and proper arrangement of doors and windows in this structure. The real conquer hence is produced automatically out of the fabrication. Take a look at the structure by Bentham as is also shown in Fig 1, and we will find that the building is circular with secluded cells in the circumference. The inspector's lodge locates in the centre of the building with glasses around. Each of the cells extends the whole width of the building. The cells have two windows: one on the inside, corresponding to the windows of the tower; the other, on the outside, allows the light to cross the cell from one end to the other. Then you put the inspector in the centre tower and a madman, or a patient, or a criminal, or a worker or a student into each of the cells. The inspector then could inspect the activities in the circumferential cells through the effect of the light. These cells are like the cages and platform in which every actor can have their own activities but are all in observation [1].

Bentham pointed out, "to say all in one word, it will be found applicable, I think, without exception, to all establishments whatsoever, in which, within a space not too large to be covered or commanded by buildings, a number of persons are meant to be

kept under inspection. No matter how different, or even opposite the purpose: whether it be that of punishing the incorrigible, guarding the insane, reforming the vicious, confining the suspected, employing the idle, maintaining the helpless, curing the sick, instructing the willing in any branch of industry, or training the rising race in the path of education: in a word, whether it be applied to the purposes of perpetual prisons in the room of death, or prisons for confinement before trial, or penitentiary-houses, or houses of correction, or work-houses, or manufactories, or mad-houses, or hospitals, or schools [2].

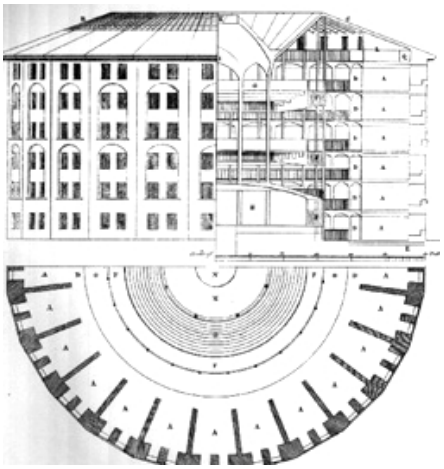

Fig. 1. Bentham's Panopticon Construction

1.2 Panopticon in Education and Hybrid Education

We could observe the practice of such mechanism in education. Sun Hanjue found that there exists power relationship of plotting and struggling between the teacher and students in an ordinary classroom of panopticon structure [3]. Moll holds that with all the evidence about the bias of control in the new technologies, the classroom, too, can become a panopticon [4].

Hybrid learning combines eLearning of using Internet computing with traditional classroom face-to-face personalized learning. Hybrid learning originated from North America in 2000 and is an ongoing trend. It is not merely a simple combination of direct teaching and eLearning, but comprises different learning strategies and important elements for teaching and learning. It focuses on student center learning and provides an environment for knowledge learning. Students are given more opportunities to be active learners and practice practical skills such as communication, collaboration, critical thinking, creativity, self-management, self-study, problem solving, analysis and numeracy [5]. Another term is blended learning, which is defined by Graham as an approach to blend different learning methods, techniques and resources and apply and deliver them in an interactive meaningful learning environment [6]. It involves technological side and puts forward challenges for the instructors and learners in the new era. The most significant point of hybrid learning

lies in that it provides realistic practical opportunities for learners and teacher to make learning independent, useful, sustainable and ever growing.

Self-taught Tertiary Education Examinations (STEE) in China is a national examination system in which face to face teaching and learning is not a must, hence could be counted as a form of hybrid learning. China established its STEE system in 1981. The examinations provide tertiary education examination opportunities for people who do not enter standard tertiary education institutions but self taught. It aims to encourage individual self learning and directed learning, promote part time and continuous education, prepare and select talents with both virtue and specialized capacity, hence to improve the national diathesis for the social modernization [7]. Currently Self-taught Tertiary Education Examinations has already become the most important form for open tertiary education. Students here enjoy the largest freedom to choose the best proper approach for themselves, no matter it is classroom teaching, self-learning with books, distance electronic delivery or any new ways of learning yet to appear. This article aims to argue that the panopticon mechanism can be witnessed in the STEE in China. It is through this panopticon power mechanism that the sociological functions of selection and socialization have been realized in STEE.

2 The Structure Analysis of STEE

In China, there are two choices for examinees to join STEE. One is that students teach themselves and take the STEE individually, and schooling doesn't exist in this case. The other is that students attend assisted self learning schools in the community. While we are observing the former form, we find it difficult or even impossible to analyze through school activities and teacher behaviors as we do in schooling situation.

Then, how are the functions of education implemented in terms of STEE when there is neither campus nor teachers? Bentham's Panopticon prison structure could be borrowed here to observe the STEE structure and hence to discuss the implementation of its socialization and selection.

Although there is no concrete school facilitation for STEE, there is comparatively rigorous framework and mechanism taking the shape of Panopticon. Its centre institution includes national STEE Directing Committee, STEE Office, Professional Committee (Research on Exams); at the provincial level (including the autonomous region and municipality directly under the Central Government) and the municipal level there are perspective STEE Committee and Administrative Body for STEE. The Provincial STEE Committee selects full time general tertiary education institute with strong faculty to be the Charging School. Related Committees under State Council authorize National STEE Directing Committee to decide the subjects of examination according to the perspective requirements of educated talents, and the STEE Directing Committee coordinates the local Administrative Body for STEE to carry out the examination. General Political Department of People's Liberation Army established the STEE Committee to coordinate the STEE in the army. Below in Fig 2 is the structure of STEE at different levels.

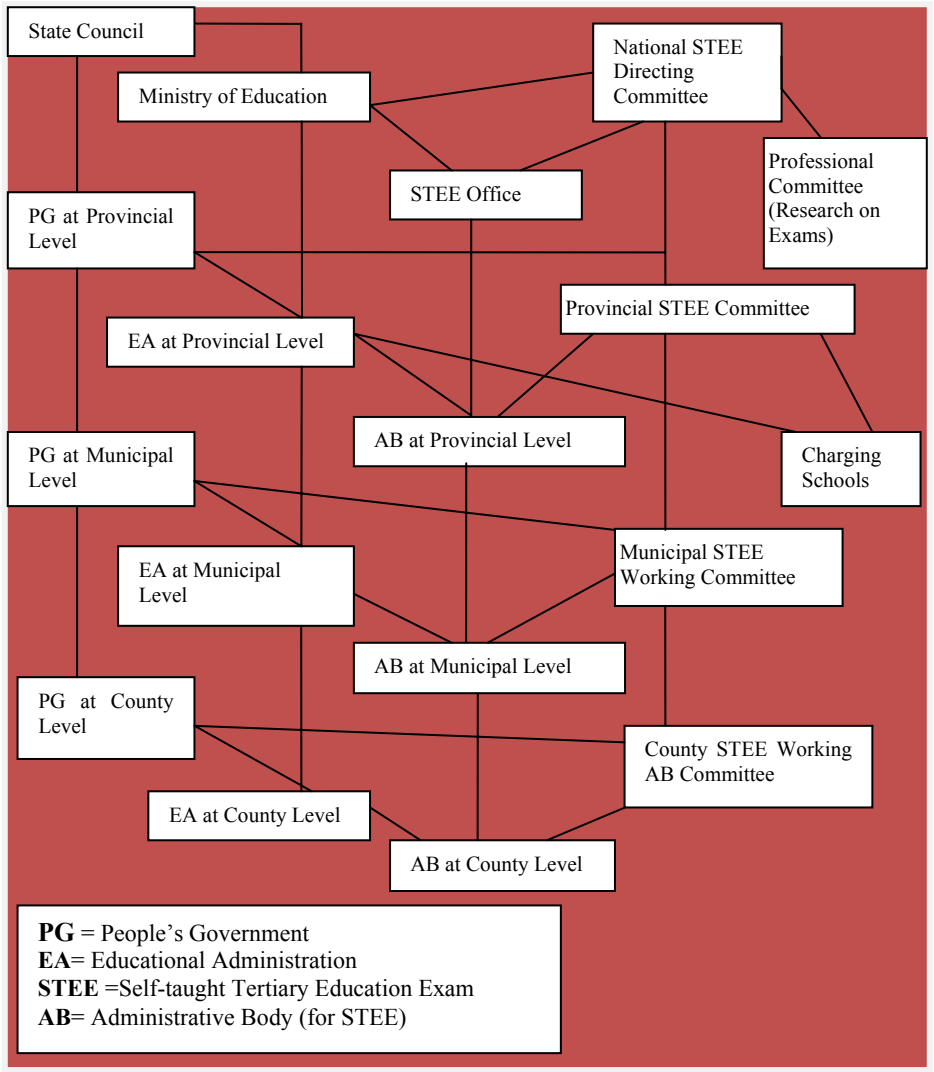

Fig. 2. The Structure of STEE

If we take a close look at the framework we will find that there are two layers, administrative and academic. The administrative framework includes National STEE Directing Committee, STEE Office under MOE, local STEE Committees and STEE Committee in army. This administrative framework is like Bentham's Panopticon prison structure. The central watch tower is the National STEE Directing Committee, while the STEE Committees at provincial and municipal levels and the ones in the army are like the surrounding structures which go as further into every geographic district and organizations. The penetrating surrounding structures sufficiently

guarantee that anybody could take the examinations anywhere under any circumstances.

The STEE is also structured academically. The academic essence is like the lamp light in Bentham's structure, going from the Professional Committee (Research on Exams) at National level through to the Charging Schools at Provincial level, until reaching into the brains of the individual who enters himself for the STEE. Also according to *Provisional Regulations on Self-taught Tertiary Education Examinations* in 1988, Chinese citizen could enter the STEE no matter what the gender, age, ethnic group, race and the previous education are. At the same time, the registration fee to STEE and the expense of text books and materials are very reasonable. These guarantee that the STEE framework could reach every person both theoretically and practically.

The mobility of students is taken into account in STEE as well. According to the *Regulations*, as long as one who had passed one subject examination, the Provincial STEE Committee should set up for him or her record file. When one is to move to another district because his or her registered permanent residence or employment district changes, or to change for another specialty within STEE, the record file also go through certain process.

3 Functions through Panopticon Structure in STEE

3.1 Socialization

Emile Durkheim holds that education conveys social ideal for human beings, including that of flesh, of moral and of knowledge. In his *Moral Education*, Durkheim points out that Education has never set the individual and his personal interests as its main target, yet it is first of all the way the society reproduces conditions of its own existence. Education is the systematic process of socialization for the young generation in certain aspect [8]. The function of education is to develop among the young people, the necessary physical and mental status for the general social members, and the physical and mental status for the particular social group members that the child belongs to. Although Durkheim sounds stale and cold by neglecting the interaction of society, the function of education does exist.

Talcott Parsons holds that socialization could be generalized as the development of individual responsibility and capacity which could be counted as the primary basis of their role in the future. And responsibility could then be divided into two aspects – the overall social responsibility and the responsibility of a certain position in the construction of the society. Capacity could also be categorized into two aspects – for the personal role and for meeting expectations of different social roles.

"Perhaps one way to discover the ideal that education attempts to transmit is to look at the sort of person who is rewarded by the educational system. If we adopt this line of approach, we will have to distinguish the type of person rewarded by individual teachers. In some cases the two may be the same, but not necessarily so. The teacher may reward hard work, or a cooperative pupil. The system may reward, with certificates, a 'clever' but lazy person, or one who thinks only of his own

success" [9]. Durkheim here provided a method to examine the practical function of the system through assessing people rewarded by the system. In this sense, when we study people who have been rewarded with the STEE certificate, we could find out the way STEE acts as the tool of socialization.

Let's look at the requirements to obtain the STEE certificate. According to the 25th item of the *Regulation*, the STEE taker could be awarded the graduation certificate if he or she: 1. have taken all the prescribed subject exams and have passed them; 2. have completed the required graduation thesis or design or other teaching experience tasks; 3. obtained the qualified virtues appraisal. Basing on Parsons' notion of responsibility and capacity, we could identify the following. Those who have passed the prescribed subject exams are STEE takers who meet capacity requirements for the personal role. Those who have completed the required graduation thesis or design or other teaching experience tasks are STEE takers who meet expectations of different social roles. While those who obtained the qualified virtues appraisal are STEE takers who are considered accountable and responsible.

People who satisfy all the three items will be awarded the diplomas, or the undergraduate certificates which are recognized by the government. Undergraduate STEE certificate holders who meet the degree requirements will be conferred the Bachelor's Degree in respective disciplines by the authorized Charging Schools according to the *Degree Regulations of People's Republic of China*. In addition to the degrees and certificates, STEE *Regulation* also requires that the STEE graduates be treated as the ordinary tertiary education institute graduates so far as employment and salaries are concerned.

We may easily agree that the first two conditions have already fully guaranteed the level of the STEE takers' knowledge and capacity with the specific course contents and requirements by STEE. But the third condition of virtue appraisal does not seem realistic. A virtue appraisal of a person can hardly be made in a simple way, as the local STEE Committees are facing thousands of examinees for every exam, and the contact between the examinees and the Committees are just registration and examination four times every year.

Hence we could say that the appraisal by the local STEE Committees is a mere formality. The real appraisal is happening in the process of accomplishing the first two conditions. The STEE examinees are often part time learners with full time work to do, which means they should teach themselves after their work. They are living in different walks in various cities or rural areas. After work they step into the cells or the stages described in Foucault's power mechanism. From their windows they could get access to the course books, syllabi, and tutorial materials displayed in the central tower. If there is light effect, we could found that every actor of figure is putting themselves on for the examinations. No matter in what way they study, they must share the same spirit or personality, which is persistence. Only with the spiritual and personality support could they complete their STEE journey of more than ten subjects. And it is this spirit and personality of persistence that qualify them to be capable of the overall social responsibility and the responsibility of a certain position in the Chinese society.

3.2 Selection

Another function of education is selection, in addition to socialization. Turner described two ideal types of upgrading mobility which are sponsored and contest mobility [10]. Hopper stated in his "A Typology for the Classification of Educational System" that the classification of sponsored and contest norms of UK and US education systems might be misleading. That is, people might take it for granted that education system is either UK type or US type. He hence developed Education System Typology. Hopper asked four basic questions: how and when does selection occur? Who and why are they selected? He believes that the study of education systems in these four aspects could help people better analyze the operation of this system and the relationship between the system and the society [9].

In China, there exists the competitive paradigm of mobility since the ancient dynasties with imperial examination system. The Confucian scholars were encouraged to study hard to excel in the final contest to be the social elite members by the pathway of "his name in the royal list of selected people after a student's long years of academic studies". After the restoration of *Gaokao*, National University Entrance Examination, the aim of all the students was restored. *Gaokao* papers are designed at the national or provincial level, the papers are scored in unison, the admission of students into universities is conducted by the government. This is considered the fairest way of selection in a big country with an enormous population. The winners in this final contest will be rewarded the membership of the social elite. Children of families in rural areas have to grab this only opportunity to leave their villages to become citizens in the city which, means they stepped into the upper class of the society.

How, then, is the selection happening in STEE? Bentham laid down the principle that power should be visible and unverifiable. Visible: the inmate will constantly have before his eyes the tall outline of the central tower from which he is spied upon. Unverifiable: the inmate must never know whether he is being looked at at any one moment; but he must be sure that he may always be so [10]. (Foucault) Such a combination of visible and unverifiable could be identified also in STEE. For the examinees, central tower is a grand image which is a synthesis of different levels of STEE Committees, professional committees, charging schools through the window of local STEE Committee. It is visible because the light from the central tower shades light on the individual in the cell through the window. Thus he knows that he is to check the list of all the subjects in a certain discipline if he wants to be selected to confer a certain diploma or certificate. If he does well and completed the list, he can make sure that the STEE selection mechanism will pick him out and give him the STEE diploma or certificate. It is unverifiable because the examinee has to grasp the knowledge with his or her own effort because of the lack of directions from the teachers in the school. The examinee actually does not know whether he has met the requirements set by the central tower when he takes the examination. The examinee then is with expectation in his mind but does not know if it will be realized under this mechanism. STEE then maintains its function of selection with the use of panopticon structure.

STEE is also a system that will allow the selection happen any time and anywhere, which puts Burenstein's suggestion of "a move from education in depth to

education in breadth" [9] in practice. As there is no restriction of gender, age, nationality, ethnic group and previous education level in STEE, and there is stated possibility to provide service of transfer the STEE file when they change resident areas, the STEE examinees have been offered the access to take part in the competition for knowledge and social position anytime and anywhere. The examination is no longer restricted to the young people, as the then 81 year old retired teacher LEI Huanzhang from Qidong, Hengyang in Hunan Province sat for the examination of *Foreign Literature History* and *Contemporary Literature Research* in the 46th STEE in 2006. The examination can even take place in the prison. Since April 2001, more than 400 prisoners in Fanyu, Guangdong Province have taken part in examinations in 127 subjects including Law, Finance, International Commerce and Stock Market[1]. STEE has provided access to all who are willing to take part in the competition to the largest extent, hence increasing the sense of competition in Chinese Education System.

As for whom and for what be selected, there is discussion in the second part of STEE Socialization of this article. Examinees who have taken all the prescribed subject exams and have passed them, completed the required graduation thesis or design or other teaching experience tasks, and obtained the qualified virtues appraisal, will be rewarded and selected. However the real reason of the selection is the capacity of certain social role and the particular personality required by the particular social and cultural background, which is persistence in the current Chinese social context. The STEE functions of socialization and selection are then realized.

Basing on the theoretical analysis of educational sociology, we could come out with such a solution: STEE as part of the education system was established at a particular historical period to cater for the social demand. It is providing equal education opportunities to the largest population in a panopticon structure, aiming to accomplish the two educational functions of socialization and selection in the largest scale. Empirical analysis in this area could indicate whether STEE realizes these functions in reality, whether its socialization and selection prove successful.

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[1] This might be one of the best examples to illustrate that prisoners in China has access to the right of education.

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Hybrid Learning and Challenges in Distance Education Practices in Nigeria

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Abstract. Nigeria is a vast country spanning Hundreds of kilometers with a population of 140,000,000 million people. The number of illiterate adults and youths who have dropped out of school is overwhelming. Majority of the people live in rural areas [1, 2]. This may require the construction of a new University every month for the next twenty years [3]. Hybrid learning sometimes called Blended Learning Provides the best opportunities for learning transition from classroom to e-learning. It fulfills e-learning's promise of anytime, anywhere, and any context [4]. But the case of Nigeria is different. This indicates serious challenges and has kept Distance Education Practices in Nigeria in a deplorable state that requires rejuvenation/modernization. The study seeks to find out possible challenges of Hybrid Learning in Distance Education Practices in Nigeria. Concepts, characteristics and brief history of Hybrid Learning and Distance Education were explored. Recommendations are made on possibilities of using Hybrid Learning (HL) to enhance the effectiveness of Distance Education Practices (DEP) in Nigeria. It is necessary for educators to consider how the Teaching and Learning process needs to be changed in order to take full advantage of Hybrid Learning Advances.

1. Introduction

With the significant effect of digital information, transfer, storage and Communication methods, Distance Education has undergone some metamorphosis in recent years. This development has allowed for access to Information Communication Technology (ICT) and the number of resources available to learning at all levels of schooling. Hybrid Learning (HL) provides the best opportunities for learning transaction from classroom to e-learning. It involves classroom [or face-to-face] [FTF] and online learning [9]. This method is very effective for increasing efficiency to classroom instruction and allowing increased discussion or information review outside classrooms [4, 5]. This gave birth to the constant transformations that were occurring in Distance Education [30].

The felt-need of this era demands a higher order thinking to functionally utilize the technological tools of this millemium. Distance Education emerged in felt-need to help create the needed skills, values, attitudes, knowledge among others, that are relevant to the development of people and the nation [6].

The practical justification of Hybrid Learning in Distance Education Practices is for effective implementation of Education for All (EFA) in Nigeria. It is an instrument for accelerating the pace of human transformation to shake-off inertia in a people, achieve mobilization and direct their productive forces in improving their living condition [7]. It is also time effective, cost effective and individually attractive. It provides for the socially and geographically isolated especially in Nigeria that needs to expand education rapidly and cheaply in this millennium [7].

2a. Concept of Hybrid Learning and the Relevance to DEP in Nigeria

Hybrid Learning, sometimes called 'Blended Learning', provides the best opportunities for learning transaction from classroom to e-learning. It refers to learning that require learners to meet for face-to-face classes while providing much of the learning content interaction online through content delivery software and learning tools. It provides learners with an option of taking some learning materials fully online and some in class [8]. [9] Highlighted that currently, the term Hybrid Learning has evolved to encompass a much richer set of learning strategy. A Blended Learning Programme (BLP) may combine one or more of the following dimensions with over-lapping features:

- Blending offline and online learning
- Blending self – paced and live, collaborative learning
- Blending structured and unstructured learning
- Blending custom content with off-the-shelf content.
- Blending work and learning [9].

The most common reason that an Instructor, a Learner or a Trainer might pick Hybrid Learning over other learning option is that it combines the best of both worlds. Based on this, hybrid learning provides various benefits over using any single learning delivery type alone, such as pedagogical richness, learning effectiveness, access to knowledge, cost effectiveness, ease of revision etc. In reality, Hybrid Learning brings a more natural way to learn and work. A blend is an integrated strategy that involves a planned combination of approaches, such as coaching by a supervisor; participation in an online class; reference to a manual and participation in seminars, workshops, and online communities, forums [11, 12]. Some possibilities of what can constitute a Blended Learning Strategies include as listed in Table 1.

Today, available research provides proof that Hybrid Learning can be more effective and efficient compared with the model of entire e-learning and with the model of traditional education.

The Learners participating in programmes of Hybrid Learning achieve the better learning results besides being more contented with combining process [13]. Rich Blended Learning (RBL) environments are giving learners greater control ever their learning journeys and making learning more effective. The concept of Hybrid learning is rooted in the idea that learning is not just a one-time event, but is a continuous process. Generally, the main features of H-Learning can be concluded as follows: [8].

Mixed Mode: Hybrid Learning combines the socialization group learning and hands-on opportunities of the classroom in FTF with the learning possibilities of the online environment.

Student-Centered: Learning Shifts from lecture to student – centered instruction. Faculty reconsiders – teaching strategies, becoming facilitators.

Communications Important: The key element underpinning a Hybrid learning environment is the scope and nature of the communication channels provided to support learners.

Access Flexibility: Blending is used to provide a balance between flexible learning options and knowledge access.

Cost-Effectiveness: Hybrid Learning provides an opportunity for reaching a large, globally dispersed audience in a short period of time with consistent, semi-personal content delivery.

Table 1. Possibilities of a Blended Learning Approach

Live face-to-face (formal)	Live face-to-face (informal)
• Instructor – led classroom • Work shops • Coaching/mentoring • On-the-Job (OTJ) learning	• Collegial connections • Work Terms • Mentoring • Role modeling • Counseling.
Virtual Collaboration/ Synchronous • Live e-learning class • E-Mentoring	Virtual Collaboration/ Asynchronous • E-mail • Online bulletin boards • Listservs • Online Communities
Self – faced Learning • Web learning modules • Online Resources links • Simulation • Scenarios • Video and Audio CD/DVD • Online self – Assessments • Workbooks	Performance Support • Help Systems • Print job Aids • Knowledge data basis • Documentation • Performance/ Decision support tools

2b. The Relevance of Hybrid Learning in DEP in Nigeria

Distance Education is not inherently learner friendly. Adults choose to study part-time through this learning environment because it is the most convenient or only educational option available. Adults choose Hybrid Learning because it offers a manageable way of combining study with family, work, friends, and everything else they have to do. In all other respects this is a demanding way to study, socially for University diploma or degree which takes several years to complete.

With Hybrid Learning, it is possible to bled ICT with existing distance media to create a more flexible and more personal experience. In Nigeria there are many adults leading busy lives, who want the benefit of a University without the requirement to

drag out to lectures. The Nigerian system of 'supported distance education' offers high quality teaching materials, backed by the personal support of a facilitator and advice and services delivered through a national and regional networking. Hybrid Learning can enhance this system in several ways:

= Learning Resources: the printed material tends to set fixed boundaries to a course, and can date quickly. Hybrid Learning supports a model of recourse based learning offering access to vast storehouse of information, data, and contacts.

+ Greater Individualization: Distance education has been likened in Nigeria to an 'industrial' model of teaching but from the learners perspective the experience can feel like being an anonymous number in the system taking a standard course. This is starting to change. Hybrid Learning facilitates self-directed study and opportunities for individual research and project. It also helps to breakdown the bureaucratic relationship between the individual and the institution: IMT Polyair students have access to and can amend aspects of their records, will have their own bulletin board, and will receive information tailored to their circumstances rather than general students' information.

+ Learning Community: IMT Polyair students welcome opportunities for other students and their tutors and there is a programme of face-to-face tutorial support. But on a typical course tutorials are neither frequent nor local. The use of e-mail and computer mediated conferencing has the potential to enable the students to become an active member of a learning community with easy access to fellow students in their group, their tutor, students on the course nationally and the course team.

+ Another relevance of Hybrid Learning to DEP in Nigeria is that the new learning technologies will be strengthening the sense of a learning community which is more accessible, personal, interactive and integrated, and as a result, to reduce the gap in Distance Education Practices.

One of the Hallmarks of Hybrid Learning in Nigeria is the innovative use of a variety of te3aching media ranging from print to television and video, radio, audio-cassettes and, increasingly, the new learning technologies. IMT Polyair has developed a multimedia approach to learner support and guidance including web based services. Even though, we are at the beginning of a very long journey.

3. Brief History of Distance Education Practice in Nigeria

The Practice of Distance Education in Nigeria started in 1840, through Isaac Pitman shorthand courses for distance Learners. In 1887, Nigerians embraced the London General Certificate in Education [14, 15]. In other words, Distance Education Programme that is treated as new fanged and pre-matured in this millennium is more than two centuries old in its modern term.

The first Higher Diploma Certificate Radio Programme in Nigeria was established by Institute of Management and Technology (IMT), Enugu in 1976 [16]. In 1983 the Nigeria Government set-up committee to work out the modalities of establishing National Open University of Nigeria. However, not long after its opening, the University was closed together with five other former University campuses which

later transformed into full fledged Universities. The five Universities were merged with their former 'foster' universities in 1984 but were demerged in 1988 into three Universities of Technology and two Universities of Agriculture [15]. The defunct National Open University of Nigeria, silently merged with the University of Abuja in 1985, yet it did not function until 1992 and still in 2002 [more than twenty years] is still working towards establishing a functional open and Distance Education for the people. However, the National Open University of Nigeria (NOUN) took-off again in 2004/2005 but still limited to Inservice Teachers Programme at different learning Centres [15]. It is dumbfounding that Distance Education Programme in Nigeria is still at its pre-mature and deplorable stage. Despite age and the good intention of the leaders that hatched out the idea [3, 17].

4. Concept of Distance Education (DE)

Distance Education has been described as the family of instructional methods in which the Teaching behaviours are executed apart from the learning behaviours. It also includes those educational activities that in a contiguous situation would be performed in the learners presence, so that communication between the facilitators and the learner must be facilitated by print, electronic, mechanical or other deices [18]. Rumble emphasized that the practice of Distance Education in Teaching and Learning needs: Library, video recording, Laboratory work for experimental kits, supplementary face-to-face (FTF) contacts between the learners and facilitators as well as learner-to-learner (LTL) contact; awarding scholarships and administering financial support to learner; administering examinations and award of certificates and conducting evaluations [19]. Distance Education Programme must invariably respond to a variety of local influences and come up with a pragmatic operational system matched optimally to its own context [20]. He added that the practical economic, social, management practices and political factors will dictate the use of a particular delivery system and thereby delimit choices among instructional media [20].

Garrison and Kanuka presented the characteristics of Distance Education as: Educational Communication between the Teacher and leaner that occurs non-contiguously; the involvement of two-way communication between the teacher and learner(s) for purpose of facilitating and supporting the educational Programmes, and the use of technology to mediate the necessary two-way communication [21, 22]. FGN defines DE as any form of learning in which the provider enables individual learners to exercise choice over any one or more of a number of aspects of learning. The concept is more of a number of aspects of learning. The concept of DE encourages learners to take responsibility for aspects of what they learn, how they learn, where the learning takes place, how quickly they learn, who to turn to for help and whether, when and where to have their learning assessed [23]. Wikipedia the free encyclopedia sees DE as a method in which the learners are not required to be physically present at a specific location during the term. Most often, regular mail is used to send written materials, videos, audio tapes and CD-ROMS to the learners and to turn in the exercises, nowadays e-mail, the web, and video conferencing over broad band network connections are used as well very often, students are required to come

to meetings at regional offices on specific weekends, for example to take examinations [24]. UNILAG (2003-2005) notes that Distance Education encompasses the provision of education by a mode other than the conventional face-to-face method but whose goal and objectives are similar to those of the on-campus full-time mode of learning [25]. DE primary aim is the delivery of educational services in a manner that would be more learners friendly and would motivate the learners towards the ultimate realization that learning is a life-long affair. The objective of distance Education includes the listed below:

- Provision of education for all and promotion of life-long learning.
- Filling the gap created by the closure of outreach/satellite campuses.
- Cost effectiveness
- Improved economics of scale
- Maximum utilization of academic personnel.
- On-the-job teacher training
- Flexibility of the delivery system
- Poverty eradication, vocational and life – long education.
- Provision of national Orientation and non-formal education.
- Reaching the unreached [23]

Distance Education share a single common feature: they involve an increase in focus on the needs of the individual learner and are thus more learner centred than traditional approach to learning [26, 27, 28].

5. Hybrid Learning and Challenges in Distance Education Practices in Nigeria.

Hybrid Learning has emerged and means different things to different institutes in practice. Hybrid Learning has been classified into skill driven model, attitude driven model and competence driven mode [29]. Graham divided the interaction in the environment into four critical dimensions: space; time, fidelity and Humannes. Nigeria has enjoyed military rule than that of the civilian since after independence in 1960. The practice of DE has enjoyed lip service than actual. Doubt has been expressed on the seriousness of African countries namely - Nigeria, Botswana, Tanzania, Kenya, Mauritius, Zimbabwe and Losotho. More over, they use DE for different purposes and innovations and changes in DE have not been accepted easily for fear of unknown consequences simply because of conservation in these countries. This could be as a result of lack of resources, management practices, media professionals [30]. Some other challenges of H.L in DEP practice in Nigeria include:

- Constant power failure in Nigeria has made it impossible for learning to read after day light and the cost of purchasing batteries hinders the smooth and effective learning.
- Expensive nature of mechanical and electronic deices in Nigeria, radio receivers and cassette, player; telephone and e-mail are often very expensive in relation to average wages and salaries. These problems may for a long time prevent the use of those media for oral presentations. [1].

- Official Corruption and mismanagement. Postal services are unreliable and irregular in Nigeria, hence a major draw backs in DE practices. This exposes the learners to the dangers and risk of traveling long distance to centers of distribution with the risk of accident and other economic implications.
- Ignorance and mismanagement of priorities. Most DE Institutions run down the programme by misplacing talents and expertise in place of mediocrity. Worse still is the issue of Quota position that sends such government laudable project/programmes to untimely death [7].
- Lack of political will and finance strictly limits the number of methods and media available for DE programme in Nigeria [7].
- Geographical remoteness which can result in learners lack of access to Institutions and other resources when needed most.
- Globalisation is survival of fittest. For any nation to engage in profitable productivity, the workforce must be ICT compliant. No wonder then that the Nigeria economy is slow in catching up with the rest the world. A greater percentage of the Nigeria workforce does not have computer based skills and this affected productivity and by extension profitability [31].
- Nigerian Information Technology Professionals Association (NITPA) affirm in their published report that of the current rate continues without any radical intervention, it would take Nigeria and other African countries 30 years to catch up with North American in household computers, 20 years with internet use, 150 years with information and Communication Technology (ICT) literacy, and close to 225 years in overall ICT economy [32].
- Inadequate financial grant to Facilitators to attend and participate effectively in International Conferences, Seminars, Workshops, Short-training etc.
- Commercialization of media in Nigeria against the rising cost of families for education their children at a time many families are not sure of any income at all.
- Most of the present Distance Educators can hardly be described as intellectually inclined either by training or in practice. Moreover, despite shortage of trained Distance Educators even the few experts available require constant retraining to keep abreast of the fast rate of technological changes.
- Other Hybrid Learning Challenges in Distance Education Practice is the down – turn in Nigerian economy, the gyration in energy cost, the policy summersaults, the lip service to training and retraining, the epileptic power supply, apathy, high interest rate, the widespread looting of public fund, etc [31].
- Nigeria is among the nine (9) populous countries which UNESCO identified as accounting for 75.20% of the world's illiterate and ranks 5th. One may not say that Nigeria citizens experience a measure of self –fulfillment and happiness in which they can realistically hope and work for a better tomorrow because of high rate of illiteracy (33). It is true that there is a lot of hustle and bustle on the economic and political fronts. It is true that budgets are dished out in billions and trillions of naira, figures unimaginable before. It is true also that there is grinding poverty as evidenced by the institutionalization of garbage picking by otherwise respectable persons who are no tramps (32). There is a lot of unhappiness among Nigeria masses, in spite of the nouveaux riches. There is still gross inequality of access to the nations resources. One is inclined to conclude that essentially Nigeria is still a

poor country in spite of the appearance to the contrary (34). All these are challenges of HL in DEP in Nigeria.

* *Nigerian Education is in Crises:*
- Institutions are not well managed…and operating as efficient service deliverer.
- Basic education is failing to provide many pupils adequate levels of literacy and Numeracy.
- The education sector suffers from and helps to create socio-cultural problems.
- Large numbers of teachers are unqualified or under-qualified.
- Outdated teaching methods employed by teachers in schools
+ Millions of Nigerian Children of School Going Age are not in Schools.: Many of our children are out-of-school or are dropping out of school at an alarming rate. The 2008 Global Monitoring Report [GMR] on EFA shows that Nigeria is not making much progress in reducing the number of out-of-school children. According to this report, in 2008, 8.1 million of school age children were not in school and by 2015, there will still be Nigerians 7.6 million children still out-of-school-compare this to countries such as India, Pakistan, and Ethiopia. Along with Nigeria in 2006, the four countries accounted for one-third of the 77 million children out-of-school school children in the world. However, between 2006 and 2008 when the reports were published, these other countries, particularly Ethiopia have significantly reduced the number of children who are out-of-school. Not so in Nigeria. Nigeria was listed in 200 EFA GMR as one of the countries which may not achieve the EFA goals by 2015. This is a big challenge to education practices and practitioners [FGN, 2006 & EFA-GMR, 2009].

6. Recommendations.

No right thinking nation can justifiably afford to leave the majority of its active population in an educational limbo and hope to achieve national development with about 30% of the population benefiting from education. It is for this reason, that Hybrid Learning emergence is heralded as a matter of necessity for any nation that wish to achieve high creativity for its citizens. Hybrid Learning sometimes called Blended Learning is the latest step in the history of learning from traditional learning to more and more enhanced technological based learning [34]. It provides new modes for the learners to learn, to collaborate, and to discuss while keeps the cultural effect of traditional learning, improved access and flexibility [35]. Distance Education practice has become necessary and has gained wide spread and growing interest in this millennium as a result of Hybrid Learning [36]. This would bring about effective telematic learning in Nigeria and thus the need for the under listed:

- Nigeria Government should save the masses from insecurity and illiteracy by providing modern equipment: electronic, mechanical and devices needed for DEP.
- Federal Republic of Nigeria should provide media for the education of the learners. At least three hours daily. Hence, the commercialization of the media in Nigeria should be reversed to create chances for mass education if Nigeria is to survive from the effect of mass illiteracy.

- The characteristics of Hybrid Learning is its sheer generosity and generality, it needs supports internally and externally to be able to achieve the desired level of success in Nigeria. All it takes to boost DEP is just a change of heart by the Nigerian Learners.
- The Leadership should protect and promote the interest of masses through encouraging and massifying education of its people.
- The current National policy on ICT and the establishment of Television Viewing Centers in 774 Local Government Areas of the country. This proposal should be pursued with sincerity and vigour if DEP will make impact on National Level of Literacy [37]
- Setting a very strong professional body of Distance Educators with full political will to carry out regular training and retraining, organizing conferences, seminars, workshops and courses for its members and other interested reference groups.

7. Conclusion

Hybrid Learning allows flexible learning and makes Teaching and Learning more practical. Thus the knowledge acquired can be transferred to other areas of endeavor [38]. The education systems in different kinds of societies in the world have been, and are very different in organization and in content. They are different because the societies providing the education whether are formal or non-formal has a purpose. The purpose is to transmit from one generation to the next the accumulated wisdom and knowledge of the active society and to prepare the people for their active participation in its maintenance or development [36]. Affordances of the emerged Hybrid Learning can be directed so as to create the environment that is most supportive of the people to learn.

Developing countries like Nigeria that wish to Design a DEP should learn from the systems that have worked well elsewhere. The rational for Government or Institutions to clearly understand Distance Education Systems and sub-system is for achieving reasonable expectations experiences and insights into a useful order.

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Research on Teacher Collaboration: A Case Study of Team Teaching

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Abstract. Along with the time development, education makes so much challenges to teachers that the traditional form of teaching alone with one's efforts has not satisfied the need of teaching practices. The purpose of this research is to investigate teacher collaboration through a case study of team teaching practice. We collected the research data through classroom observation and depth interview of the participations. The results showed that teacher collaboration during the team teaching was mainly on exchange of ideas and sharing of resources. Although three teachers believed team teaching had effects on teachers and students, the educational environment, time and energy made them be preferable to use the "preparing lessons collectively before the class and teaching alone in the class" mode of team teaching.

Keyword: Teacher Collaboration; Preparing Lessons Collectively; Team Teaching

1 Introduction

Nowadays, most people recognize that the collaboration is more useful for study than competition. In order to change students' traditional competition relationships, many educational researchers make their efforts to popularize collaborated learning in teaching practices. However, most researchers limit the collaboration research on students and pay little attention on teacher's collaboration. Therefore, many kinds of teaching modes have been used in teaching practice, but the traditional teaching form of teaching alone with one's efforts is the only form yet. However, Along with the time development, education makes so much challenge to teachers that the traditional form of teaching alone with one's efforts has not satisfied the need of teaching practices. The purpose of teacher collaboration is to change the condition of teaching alone and solve the teaching problems better.

There is many ways to carry out teacher collaboration, such as teaching and research community, blog groups and so on. These ways is to make teachers collaborate after class, and the collaboration often has an indirect relation with the student's learning. As we know, teacher's most important responsibility is to improve student's learning, so we have to choose some method related with learning directly. So far as I know, team teaching is a collaborated method referred in many foreign

articles, which is related to learning directly. The concept of team teaching, proposed by an American scholar, means that two or more experienced teachers collaborate to finish the teaching tasks[1]. There is two kinds of modes of team teaching. One is that teachers prepare lessons collectively before the class and teach alone in the class, and the other is that teachers prepare lessons collectively before the class and teach the same class collectively. Team teaching has been used in many universities in American, and most American scholars believe that the application of team teaching in teaching practices is the future tendency [2]. As the interdisciplinary courses receive more and more attention, Team teaching method has been regarded as the main method in interdisciplinary courses. In 1990s, team teaching was introduced to Taiwan, and Taiwan's researchers advocate to use team teaching method in nine-year integrated course. Besides the use in elementary and secondary school, Taiwan's researchers also applied team teaching in universities. For example, Central University used team teaching in carrying out the national general education courses. Also, many universities invited famous scholars to make lectures alternately and after the lectures the Teaching Assistants organized the discussions. In order to popularize the application of team teaching method in university, Fo Guang Humanity & Social Science College even revised the "the application method of team teaching in courses".

In this paper, we investigate teacher collaboration through the application of team teaching in mainland China. It took us one semester to finish this study. The question we studied includes:

(a) The condition of teacher collaboration during team teaching
(b) The attitude of participated teachers toward team teaching
(c) Teachers' acceptance toward two different modes of team teaching

2 Method

2.1 Participants

The main participants of this research are three teachers from Basic English Department of The College of Foreign Language, including Ms Jiang, Ms Guo and Ms Wang. They are responsible for the course "Basic English" for the English major freshmen. Ms Jiang has more than ten years teaching experience, while Ms Guo and Ms Wang both have one year teaching experience. All the teachers have no experience about teacher collaboration.

2.2 Procedure

The investigation lasted for a semester, including four units' learning contents. According to two different modes of team teaching (shown in Fig. 1.), we divided the investigation into two stages.

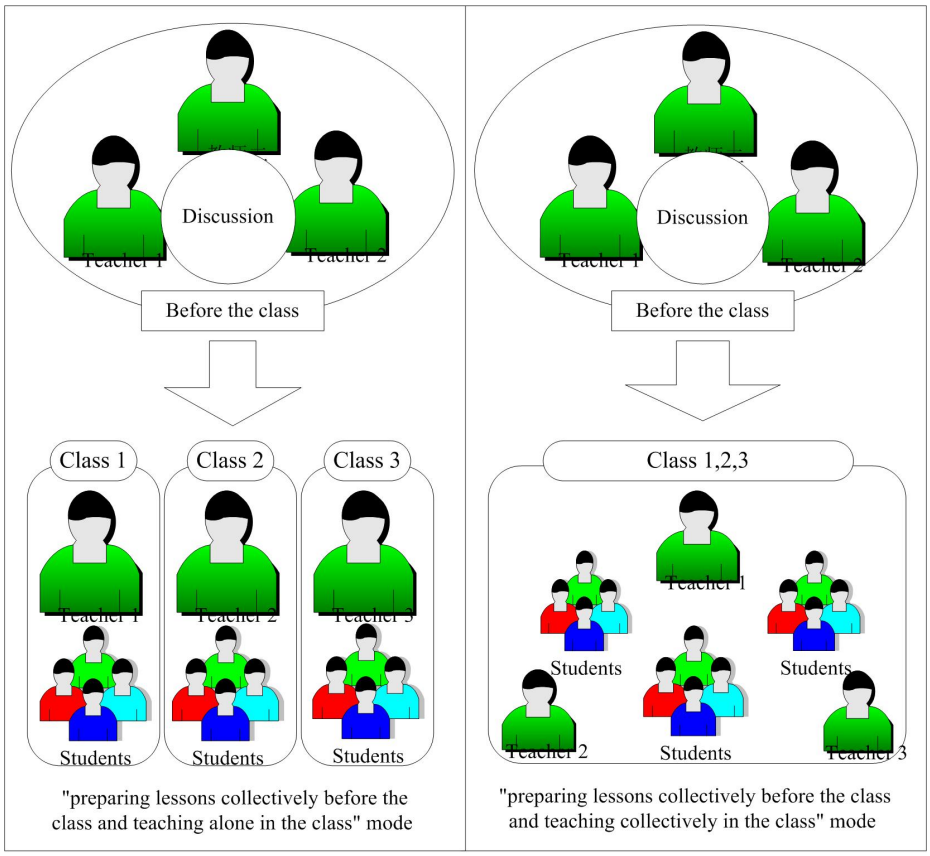

Fig. 1. Two modes of team teaching

In the first stage, teachers prepared lessons collectively before the class and taught alone in the class, including the fourth to the sixth unit's learning content. In the second stage, teachers prepared lessons collectively before the class and taught the same class collectively, including the seventh unit learning content. Teachers preparing lessons collectively means that three teachers have an one-hour meeting in their office every Wednesday. The meaning of teaching alone in the class is that three teachers go back to teach in whose class alone, while teaching the same class collectively means that students stay together in a class and three teachers teach them collectively.

2.3 Data Collection

In the process of research, researchers observed the whole procedures as observers and made a depth interview toward three participated teachers after the practice. The time of the interview for each teacher lasted for an hour. The question we interviewed included:

(a) How is the procedures of team teaching?
(b) What attitudes toward team teaching?
(c) How about the two different modes of team teaching?

The interview discourse was recorded by recording equipments. And we transcript the discourse to words, and then imported them into Nvivo 8.0, an analytic software, to have a depth analysis.

3 Research Results

3.1 Situation of Teacher Collaboration during Team Teaching

Three teachers instruct the same grade and course, and the teaching pace, teaching material and the level of students in three classes are in substantial agreement. Although three teachers are in different age groups, they all have the educational background of English major and engage in English teaching jobs after they graduated from school. Therefore, the basic condition of three teachers is almost similar and their collaboration belongs to the same-background department-inside collaboration.

According to the results observed and interviewed, in the process of preparing lessons collectively, teacher collaboration is mainly on exchange of ideas and sharing of resources. Each meeting they held every Wednesday contented two parts of discussion. One is the reflection for last lesson, and the other is the plan for next class. In the reflection part, teachers shared their acquisition about last class and discussed the problems which they met with. The plan part is the key part of the meeting. They enunciated their opinions on the understanding about text first, and then had a negotiation to get a common plan. If their opinions are consistent or one's opinion gains acceptance from others, they will get the common plan through secondary processing to the accepted opinion. However, if there is too great a difference in their views, the negotiation will be gained by someone's compromise or concession. Sharing of resources is also an important aspect of teacher collaboration.

In the process of teaching collectively, the way of teacher collaboration is one teacher play the leading role in class and others assist her. The learning content was divided into seven parts, including background, new words, text, special words, deepening the theme, metaphor of the text and speech contest. Every teacher was responsible for two parts learning content, including the text instruction and the activity organization. Therefore, three teachers played the leading role alternately based on their teaching task.

3.2 The Attitudes of Participated Teachers toward Team Teaching

According to the results, we can see the attitude toward team teaching is mainly on the influence team teaching brought to the teachers and students.

The Influence on Teachers

Team teaching makes teachers convince the value of teacher collaboration. Three teachers all referred their suspicions toward the value of teacher collaboration before the team teaching practice. Ms Jiang said "This is the first time I collaborate with other teachers. And at the beginning of the practice I am so worried about the collaborated result. As you see, we are in different age group, so I am afraid there may be some problems in our communication." She was suspicious of the value of collaboration yet. "I have more than ten years experience, while others only have one year experience, and what I can learn from them?" As a younger teacher, Ms Guo said "Before the practice, I thought my teaching experience is so few, and maybe I only to learn something from others." However, after the team teaching practice, they all confirmed the value of teacher collaboration. Ms Jiang said "the team teaching practice made me believe the feasibility of teacher collaboration. And the doubt that what I can learn from other less-experience teachers were declared to be untrue, because I learned something from them indeed." Ms Guo said "To my surprise, when I engaged into the discussion, team teaching made me generate some new opinions. And I found during this procedure I not only learned something from others, but also did my contribution to the collaboration. And maybe as a younger teacher, I have a more active mind and generate some new ideas."

Team teaching makes teacher know more enough about students' need. In the process of team teaching, teachers' communication about students can make them know more about students' learning need. As Ms Guo said "Every class have one's characteristic, and students' feedback toward the same learning content is also different. These different feedbacks will make teacher know about students more completely."

Team teaching intensifies teachers' understanding of teaching. Team teaching provided a communication space for teachers. And during the discussion, teachers have to express their understanding of teaching clearly. This is the procedure of teachers systematizing their knowledge, and it will make them understand their opinion more clearly. After the expression for one's opinion, the discussion made teachers think deeply from the questions, develop from criticizing and thus burst out inspiration.

Team teaching promotes teachers to try out new teaching methods. Team teaching made three teachers have a common objective, which make them feel more purposive with their teaching. Ms Jiang said "When I do the teaching alone, I almost chose some familiar methods for my teaching. But after making the common objective, we often attempt to look for some new methods to gain the higher objective. Ms Wang emphasize that the Comparison of teacher's opinion made her deepen her thought about teaching. She said "Before that, I chose the materials and methods in light of my opinion, and I never know of other better methods. But now after three teachers' discussion, we may find some better methods for the learning contents.". Ms Guo believed that the pressure of gaining a higher quality teaching is the reason that she had a trail on method improvement. Ms Jiang also mentioned the sense of belonging

generated by team teaching was a strong support for her experiment, which made her feel that there is a kind of collective effort on her experiment.

Team teaching makes more serious to teachers' time and energy. Team teaching asked a high request on teachers' available time and energy. As Ms Jiang said "Teachers are so busy that we often have difficulty in looking for a common available time to have a meeting, which is an important part for team teaching." Moreover, for lacking the support from college, they have to merge three class into a class to have the teaching collectively. Three classes, 90 students, made some difficulties in the class management for the teachers. "There are so many students in class that we can't do our best in teaching."

The Influence on Students

Team teaching promotes students' interests on leaning and broadens their minds. The teaching materials and activities that one teacher offered are so limited, while the achievement made by three teachers can provide students a rich learning experience. And when the students learn together in a class, they have a sense of comparison, which makes them express themselves actively. Ms Guo mentioned that "The advent of three teachers in a class can fresh students' felling, which make them engage in learning." Each teacher has one's mode of thinking, which can be reflected from their teaching. Following one teacher to study for some time, students are easy to form a mind-set on solving problems. While using team teaching method, students can be in touch with different teachers and experience different habits of thought. And this can prevent the students' mind-set and broaden their thought.

Passive students are easy to be neglected in the process of teaching collectively. When three teachers teach collectively in a class, the different voices and teaching styles can rich students' experience. It is good for the active students. But for the passive students, they have a high possibility to be unnoticed by teachers and other students. As Ms Wang said "some students believed that there were so many students in class that the teachers were not sure to ask me to answer questions.". That is said that the passive students had no pressure to listen to the teachers or to join in the activity in teaching collectively, which reduced their enthusiasm on learning.

3.3 Teachers' Acceptance toward Two Different Modes of Team Teaching

According to the results, we can see that three teachers are adapt to approve the "preparing lessons collectively before the class and teaching alone in the class" mode of team teaching. They believe that this mode not only can provide them some help and support, but also can develop one's initiative and creation. The teaching initiative and creation was high regarded by Ms Wang, and she said "if we taught collectively in all the class, we had to make our teaching practice consistent with others." Three teachers all expressed their interests on the "preparing lessons collectively before the class and teaching collectively in the class" mode of team teaching. However, they

thought this mode asked a high request for the support from school, and a quick change on these environments is not possible in short meter. Therefore, at present, they are preferable to the "preparing lessons collectively before the class and teaching alone in the class" mode of team teaching.

4 Conclusion

Through this team teaching practice, we have a complete understand of team teaching in mainland China. The results make us know more about the situation of teacher collaboration in team teaching, the attitude of participated teacher toward team teaching and the acceptance of two different modes of team teaching.

Teacher collaboration during team teaching is mainly on exchange of ideas and sharing of resources. Team teaching brought some influence on teachers and students. For teachers, team teaching certained them the value of teacher collaboration, made them know more about students and teaching, and promoted their enthusiasm to try out new methods. For students, team teaching improved their learning interests and broadened their minds. The insufficient of team teaching is that it cost teachers so much time and energy, and had a possibility of neglectting passive students. What needs to explain is that these two aspects of insufficient of team teaching is partly influenced by the large class in this study.

Although three teachers expressed their interests on team teaching, the limitation of environment, time and energy made them be preferable to the "preparing lessons collectively before the class and teaching alone in the class" mode of team teaching and keep a nonsupport attitude toward teaching collectively. From this practice, we can see that teaching is in a complicated education environment, and so many factors in this environment influence directly or indirectly on teacher collaboration. For mainland China , with limited teacher resources and a large number of students , it is not so reality to use the teaching collectively mode of team teaching. Therefore, for most schools, it is wise to use the "preparing lessons collectively before class and teaching alone in class" mode of team teaching. While for some schools with good teaching environments and good supports, using the teaching collectively mode of team teaching will do improvement on teaching.

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Instructor-led Online Learning at School of Distance Learning, Peking University

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Abstract. Self-regulated online learning provides a free and open learning environment so that the learners can arrange their learning process independently according to their own time and characters, which guarantee the self –regulation of learners. But in the mean while, just because learners' self regulation involves too much in their learning, it leads to difficulties in exerting teachers' guidance and then results in the learners' weakness of system and continuation in their learning. It is our highlighted questions for the School of Distance Learning, Peking University to actively explore how to realize teaching and learning in online learning environment so that students can pursue their study both self-regulated and systematic with their teachers' guidance and direction that is so called instructor-led learning during the whole process, and in such a way, can we achieve better study results and elevate students' abilities in understanding, application, analysis, evaluation and innovation of their knowledge.

Keywords: self-regulated online learning, instructor-led online learning, application at Peking University

1 Introduction

Hybrid online learning may usually be divided into two categories, the content –cored online learning and the communication-cored online learning. The content-cored online learning means that learners can study online course freely by the aid of the content, and the communication-cored online learning emphasizes online teachers' guidance during students' online learning process where teachers can wholly participate with them. Instructor-led online learning accentuates providing students opportunities to communicate and cooperate, pay attention to interpersonal interaction among students, encourage learners to take an active part in study discussion, and incubate their analysis capabilities. Its key point lies on how to guide learners to fully utilize diversified learning resources and how to support learners' study. In order to guarantee interpersonal interaction among students and their efficient study, teachers make steps of learners' online study time, which in certain degree possess advantages of real-time teaching and employ non real-time strong points. Hence, instructor-led online leaning defines like the following: with teachers'

guidance and instructions, students learn appointed online course contents according to certain plans with certain aims and in certain time. The main part of online course is the interactive learning activities between teachers and learners which is also a main approach for learners to acquire knowledge.

Characteristics of instructor-led online learning are mainly the following:(1) taking online class as a small class, and strictly controlling learners' quantities; (2) organizing courses weekly; with teachers' pilot learners will finish appointed content study in prescribed time; (3) the main part of learning is online discussion and communication between teachers and students as well as that among students; learners study mainly through various interactive learning activities; (4) teachers play an important role in online courses; online teachers not only participate prophase design of online courses but also involves in learners' whole process of study; (5) teaching management system is strict; any learner who can not catch up with learning schedule will be found in time and be arranged with certain measures.

2 Instructor-led Online Learning and Course Design

Taking an example for Online Training Courses of Educational Technology for National Primary and Middle School Teachers developed by School of Distance Learning, Peking University, we introduce characteristics of instructor-led online learning. With modern distance education idea, the course overcomes the disadvantage of some online courses which only consists of course resources but neglects teaching process. In course development and design, we emphasize actual effectiveness, operability and pertinence through instructor-led online learning. In teaching process, we fully exert the interaction between teachers and students, among students and that between students and experts, and finally reach the unification of learning, teaching and examining.

2.1 Course Idea

Based on using successful experiences and research results in distance education and teachers training fields home and abroad, we optimize and integrate training mode, content, methods and approaches in this course. Starting from distance training and learning principles, we experiment some new methods and try to construct a new mode of educational techniques and skills training for primary and middle school teachers, a mode suitable for our country's situation in network technique environments. It mainly embodies in the following.

Taking social construction theory as basis. It fully embodies humanity spirits to pilot teaching, control process, support multiple teaching (repositories of educational technique subjects, and manual storehouses of internet applications manipulation) and to study interactively between teachers and students in appointed time and with purposes and plans. And thus solve senses of loneliness and alienation and high dropout rate in distance learning.

Blended learning mode in training course. It is a widely recognized learning though of blended learning in today's distance education and training. In the teaching design of our course, we flexibly adopt multiple approaches in blended learning. Students can study through various modes such as face-to-face participating training, network video and audio conference, network course platform and so on. They can learn by means of team cooperation and activate their participating spirits so as to finish cases research and other activities.

Training goals of combining learning with application, and integrating learning with examination. In our course content, we extract teaching innovation experiences in primary and middle schools home and abroad, take application requires as starting points of training contents and activity design, and try to design feasible authentic task environments. We design our teaching main line, teaching content and learning activities by means of tasks drive (finishing teaching design of informational technology and course integration), and combine learning with testing to make learners grasp and apply knowledge during the course of study. Only by knowing well about the exams outline requests, can they deepen their understanding and application of their educational techniques.

Taking cases teaching as measures. Creating issues environment by means of cases, we can elevate understanding of course contents and students' learning interest. It can guide students' self-regulated learning much better to take cases research all over the training process, design assistant cases analysis of bracket issues, index concerned knowledge by means of knowledge cards, and supplement with quick check handbooks of software skills.

Tree structure of teachers employed. In order to strengthen the actual effects of teaching and ensure teaching qualities, we add teaching assistant parts in teaching process. We fully exert local teaching resources and teachers resources. With the lead of authorities and experts, central leveled trainers cultivate local backbone teachers and select excellent learners as assistant teachers of educational techniques and skills training for primary and middle school teachers in Peking University who are responsible to train and assistant local learners. Central leveled trainers guide and supervise their teaching, select the superior assistants and drop the inferior by double check and evaluation from experts and first-line learners.

2.2 Course Structure and Characteristics

As a network course, it should conclude teaching contents and teaching process. And in order to support interaction between teachers and students as well as among students in teaching process and timely gain feedbacks and formative evaluations, we must have a teaching platform to support dynamic teaching process, that is,

Network Course = Teaching Contents (Network Course wares) + Teaching Process (Network Teaching Activities) + Platform Supporting

2.2.1 Online Courseware

Structure of course wares takes main steps of teaching design (that is modularized network training contents) as “longitude”, and takes teaching process (that is teaching organizing tactics inside modules) as “woof”, as illustrated in the following. It links abundant related teaching cases and resources while teaching (Figure 1). On the one hand, network course wares is the detailed explanation of original teaching materials, difficult and key points and reflecting exercises, and on the other it emphasize interaction between learners and experts, among learners and that between learners and network courses.

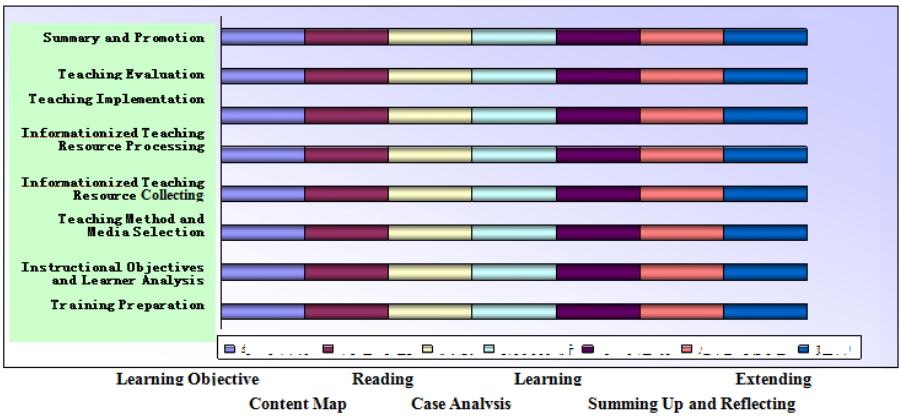

Fig. 1. Structure of Online Courseware

2.2.2 Teaching Process Design and Monitoring

In our training courses, we adopt pilot online learning mode, emphasize pilot and interaction in the process of teaching, the interaction between learners and computers, teachers and students, and that among students. We take tasks drive (finish teaching design of information technology and course integration) as our clue, and organically blend together the basic theory of educational technology, teaching design steps, the theory and practices of information technology and courses integration, and information techniques manipulating skills. Thus learners gain wholly upgrade from aspects of knowledge, techniques and so on. We adopt the evaluation tactic of e-portfolio (electrical learning archives), which realize consummate combination of network distance self-regulated learning with teaching and learning process control.

The notion of teaching pilot and process control embodies in the following three layers.

The first layer, it refers to equip every teaching class (about 100 learners) with a teaching group (one expert and two assistant teachers) who is responsible for providing learning support and help for learners (including pilot teaching, discussion participating, tutorship, learning work evaluation and so on) during the whole course of teaching; the expert and two assistant teachers will experience network training

process together with their learners. In this process, it fully embodies interaction between learners and courses, among learners and that between learners and their teachers.

The second layer, it refers that teaching personnel will open in turn teaching contents of special topic modules according to teaching schedules; and according to distance training characteristics of education technology, the teaching contents in every module is supplemented with refined teaching design. And reasonable network learning flow are established for learners, including the following parts such as course wares learning (target presentation, content guidance map, reading, cases analysis, learning activities, summary and reflection, unfolding and extension), taking exams, participating discussion, finishing homework and so on.

The third layer, it refers to courses evaluation of learners which adopt e-portfolio evaluation tactics (this is a kind of process evaluation mode). In the process of learning courses, we will fully record learners' learning experience (including time length of online learning, late login time, posters delivery number, posters reply number and so on; quantities and qualities of posters and homework will be the foundation of examining and evaluating learners).

By adopting the teaching notion of teaching pilot and process control mentioned above, we can efficiently overcome many disadvantages in most present network courses where development of course resources are only emphasized while control and pilot are neglected in the teaching process. Thus we solve the problems of learners' senses of loneliness, alienation and high dropout rate in the past network training, and make training possess more real effects and manipulation.

2.3 Teaching Platform

Our notion needs a platform to support. The implementation of network courses needs a fine teaching platform to support. Concerned with the above course design, we choose a platform Moodle which most meets our demands. According our detailed requests, we reconstruct this platform and through self-regulated second development, we form a pilot teaching platform of School of Distance Learning, Peking University.

This network teaching platform support both teaching and learning in training period and continuing study after training. The platform includes all the resources and cases directly supporting teaching, course wares, extensive reading materials, learners' study results, communication records between teachers and students as well as virtual environment of teachers' teaching etc.

Main characteristics of this platform are the following. It takes pilot online learning as its main design notion. It pays much attention to interpersonal communication, design and supervision of learning activities, which can lighten learners' burden to adapt this platform to the most degree. It can fully record learners' learning experience. Its management system adopts layer style. It can flexibly set up evaluation and management tactics according to requests, which is convenient for local administration to manage. Utilizing abundant interactive instruments, teachers and students can both take part in real-time and none real-time intercourse and cooperation.

The following is our pilot online learning flow chart (Figure 2).

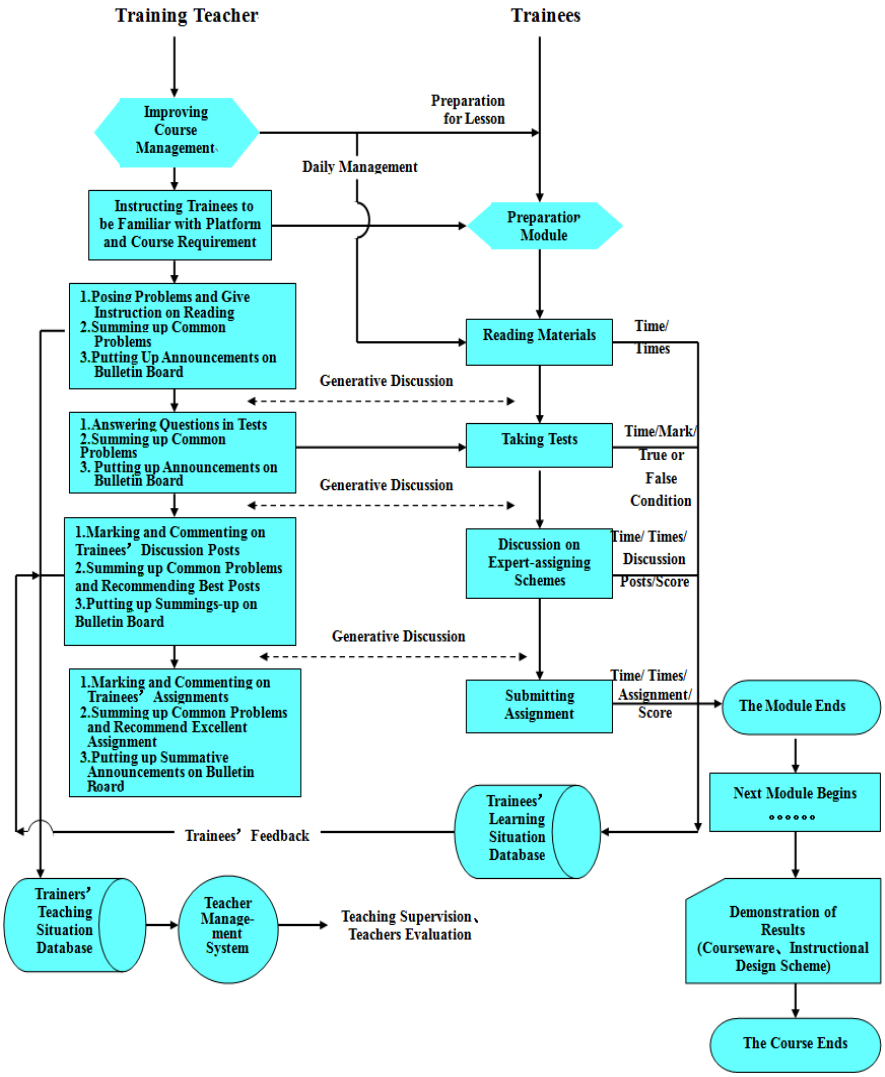

Fig. 2. Online Instructor-led Learning Flow Chart at School of Distance Learning, Peking University.

3. Teaching Management Mechanism

In the process of courses implementation, our School of Distance Learning, PKU is responsible for the organization of teaching group to teach. The teaching group has three layers. The first one, experts group, they are experts of the subject, education

technology; the second layer, professional teachers group, they are fulltime, professional and high academic degree teachers group; the third one, teaching assistant group, they are assistant teachers passing training and exams.

Assistant teachers are not only a communication bridge between students and experts, but also the ones to carry out and implement detailed trainings. They are selected from the first-line primary and secondary school teachers who participated in this network training curriculum of our Peking University. These teachers not only have first-line teaching experiences, but were trained by us and have passed our exams, so they understand the notion of curriculum and learning methods. Before attending training and assistant teaching, they should be trained by our trainers and then they will acquire assistant teacher (the trainer) qualification. Thus can they train and tutor local primary and middle school teachers. In order to guarantee the teaching quality of large-scale training, our Peking University adopts a whole set of strict employment mechanism and evaluation mechanisms to manage these assistant teachers.

3.1 Employment Mechanism

The employed teachers should have a certain degree of education and teaching experiences and basic knowledge of educational technology. They should have a higher enthusiasm on network education, hope to exert their own values in distance teaching, and desire to promote the popularization and development of in-service teachers' network training through their own participation. Assistant teachers are selected from the following three ways: the trained outstanding students, who possess the capacity to train teachers; successive training teachers, in accord with the employment standards; outstanding teachers without participation in our training but recommended by experts and local education management department.

After the training of trainers, the employed teachers pass the comprehensive evaluation and are recommended by their training teachers. Then they will be examined and approved by our School of Distance Learning, Peking University and acquire the qualifications of assistant teachers.

Teachers qualified with our employment conditions will be inputted into our training teachers network database of educational technology abilities by our School of Distance Learning, PKU; according to the specific requests of a certain training, our school will select training teachers for this certain training term from that database concerned with the training period, the trainees, the disciplines, geographical regions and other factors.

3.2 Evaluation Mechanism

Our school of Distance Learning, PKU is responsible for the comprehensive evaluation of training teachers' virtues and cultures, professional levels, work attitudes and work results etc.;

Our evaluation sticks to principles of impersonality, impartiality, actual effects concentration, convenience and feasibility etc. We listen to plenty of advice from the training teachers themselves, local educational administration and the learners;

Based on the evaluation criteria of network training teachers' educational technology capacity, our evaluation adopts the combination of qualitative assessment and quantitative evaluation, and one term takes one evaluation;

Our examination results are indicated by quantified forms, and the full marks is 105 points, including an additional 5 points;

In addition, they will be regarded as failed as long as they have any condition like the following: fail in completing their teaching tasks, or their teaching qualities or attitudes are poor; fail in the evaluation of their political or ethical thoughts; mislead students in political thoughts while training and result in adverse effects.

In order to guarantee teaching quality, our School of Distance Learning, PKU has set up two specialized supervision posts, the teaching quality supervision and technical implementation supervision posts. On the one hand, they will carry out effective teaching supervision and inspection; on the other hand they will fulfill the real-time monitoring of the teaching technical support services so as to ensure the fluent network flow while teaching. We not only set up a supervisory position, but also develop a whole set of management system and work flow to ensure the effectiveness of these settings.

4. Training Results

Peking University has carried out network distance training of educational technology successively in Guangdong Province, Liaoning Province, Yunnan Province, Jiangsu Province, Xinjiang Autonomous Region and Xinjiang Production and Construction Corps, the Inner Mongolia Autonomous Region, Fujian, Shaanxi, Shandong, Heilongjiang, Shanxi and other places. Now the total quantities attending our training have added up to more than 50,000. The training effects are satisfactory and encouraging, and widely acclaimed by trained learners from different provinces.

4.1 Learners' Evaluation to Network Training Courses

Two teaching and learning activities are established in the final module of this course: conducting a questionnaire survey of trainees and the "interview" (using the approach of network discussion), so that the trainees' reflections after this training curriculum will be collected. The questionnaire survey is not marked, and the "Interview" is given full mark as long as the learners deliver a post.

According to the illustration of post-training survey data, our students' average satisfaction to the curriculum is above 97%. The vast majority of teachers think that through distance training they have mastered the application of the concepts and basic methods of educational technology in their teaching practice and have improved the integration capacity of information technology and subject teaching, which improve and promote their teaching. The outstanding rate and pass rate and satisfaction statistics of this network training in some provinces are as follows (Figure 3):

The satisfaction degree to this training of Yunnan Province is up to 100%. Its pass rate is 94% and excellence rate is 54%.

The satisfaction degree to this training of Guangzhou Province is up to 97%. Its pass rate is 93% and excellence rate is 78%.

The satisfaction degree to this training of Liaoning Province is up to 95%. Its pass rate is 95% and excellence rate is 75%.

The satisfaction degree to this training of Xinjiang Province is up to 96%. Its pass rate is 95% and excellence rate is 57%.

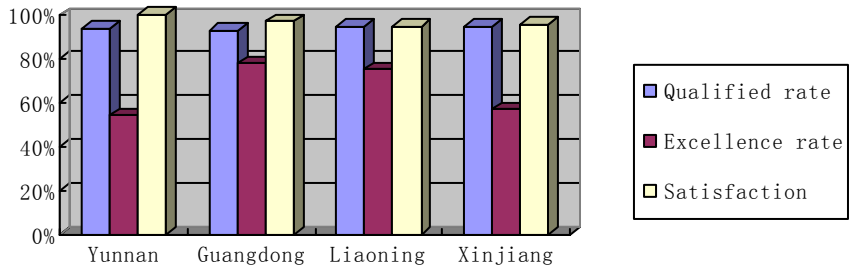

Fig. 3. Qualified rate, Excellence rate and Satisfaction of Training Result in some provinces and municipalities.

Analyzing the learners' questionnaire data, we can see that 48% students consider e-learning is "more effective" than traditional classroom teaching; 47% students think they are "as effective" as each other; and only 5% students think traditional classroom teaching is more effective than e-learning. 83% of the participants consider e-learning is "more effective" than the self-study; 17% students think they are "the same effective"; and none thinks that self-study is more effective than e-learning. So it can be seen that network training is better than face-to-face training, and much more effective than self-study (Figure 4).

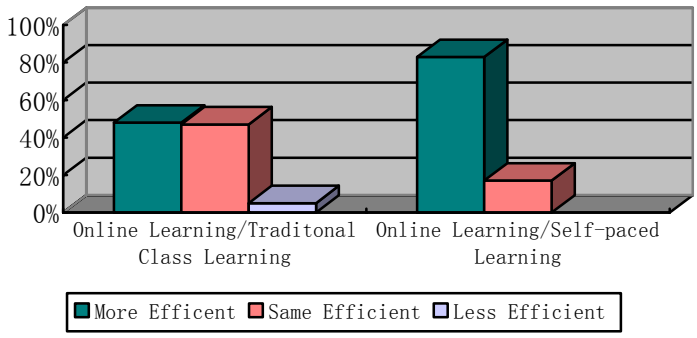

Fig. 4. Survey Data of Trainees' Recognition of Online Training and Traditional Training

4.2 Resource Analysis of Students' Satisfaction

Based on the above analysis, learners' evaluation of this network training is satisfactory. Their satisfaction mainly comes from the following aspects.

Freedom in time and space brought by network training to teachers. Many learners speak of time and space freeness of distance training in their network interview.

"In this training, we have free study time. We do not deliberately take the time to rest over the weekends while learning. This really does both in one time!"

"E-learning possesses many advantages such as self-regulated study, free learning time, choice locations, and shared resources. Students can broaden their fields of vision, conveniently communicate, interact with their teachers and encourage one another to improve together. If I were given a chance to re-elect once more, I would still choose the network study. That is I enjoy what I choice."

Discussion Parts---Viewpoints Collision. While talking about their favorite parts and biggest harvests, almost all students refer to discussion and communication parts. In every module, we have designed a real case context for the discussion topic, which is closely connected with the trainees' real teaching situation, and stimulate students to think more and express more. And it can bring them a lot of unexpected harvest to communicate with their elite peers. The following are their original words in the interview.

"The most exciting thing is that we can communicate with so many teachers about our views together. We will acquire new inspiration after hot collision, which make me benefit most."

"It makes teachers speak more in this network training than in conventional teaching and research. They will not reserve because of worldly sophistications, not follow blindly because of the authority, and not be nervous because of immaturity. Our teachers can post their perspectives on the forum, and other teachers will be able to actively participate in the discussion and debates. There are no ill feelings between our teachers. Once arguing, we will use sharp and pointed language, which will be very beneficial to themselves and others' improvement. "

"I feel that the discussion topics are the parts giving me the biggest harvests. Since each topic of the discussion is closely aiming at our teachers' most concerned about, the most perplexing, and the thorniest issues to raise requirements to study, explore and communicate. That is the crystallization of our consideration, our viewpoint collision, and our shining wisdom."

Pragmatism in Content--- "Integrating theories with practices". On course content design, we mainly take such measures to implement the guideline of "theory with practice": first of all, each module applies case introduction; Secondly, after every major theory contents, there should be cases required to illustrate and promote study transfer; thirdly, in the teaching process, new cases or samples are provided either in discussion or homework, which provides supports for further knowledge transfer and ground.

Many learners talked about this point in the interview: "I think this network training activities permeate all the way a real mission whose drive forms organize the training. It is the important basis of learners' mission completion to evaluate whether it is finished and whether it is effective. It is the real mission throughout the entire training to complete the teaching design of an integrated course of information technology and curriculum and to develop courseware resources". In the whole teaching materials, this mission is the main line to design teaching, arrangement teaching content and learning activities. It can press close to teachers' real teaching background to organize the training process with the real mission, which enables trainees to form visible and materialized results so as to greatly inspire their studying power and enhance their sense of participation."

"Through learning the reading parts, I can organically combine my theoretical knowledge, best experiences of others with my actual teaching, which will be of great help in my future teaching."

Process Evaluation. With the support of the platform, there is no final examination in this training course because the evaluation process is throughout the learning process all the way and the cumulative achievements constitute students' final scores. This evaluation model guides the participants to invest enough time in their study and their input ensures their learning results. Therefore, the satisfaction of the trainees comes to a large extent from their study and reflections on their own.

Some learners assess our process evaluation in the network training as the following: "It adopts the value orientation attaching equal importance to objectives and the process, and conduct a comprehensive evaluation on the study motives results, process and non-intelligence factors closely related with study. It is diversified of evaluation content and its subjects, and the evaluation is very timely. This contributes to the improvement of teachers' qualities."

Assistant Teachers' Dedication to their Career. In network learning process, it is the important features of this network curriculum to timely score and feedback, and the most powerful impetus to pilot students' study. Trainees, as adult learners, feel just like "returning back to the students time", desire to try hard to finish well their homework and gain good evaluation. For some of the problems encountered in students' learning proces, assistant teachers will always communicate positively with multiple aspects so as to solve the problems as soon as possible. Benign interaction formed between assistant teachers and student has gained learners' favor in a large extent, and has ensured the teaching quality of this network training course. Evaluations on teachers from the trainees are always such words as "very serious and dedicated", "appropriate and timely feedback" and so on.

5. Prospects

As the rapid development of network education in our country, It has become the concern focus of educators and researchers to improve the quality of network education. Our practices of network training course have fully proved that: advanced

notion is the fundamental basis of high-quality courses, and with effective technical support, high-quality curriculum resources will be able to achieve better teaching results.

At present, instructor-led online learning is not widely applied and researched in some reasons. We can effectively solve some of the problems existing in online self-regulated learning with the application of pilot online learning mode.

Instructor-led online learning has certain limitations in its application such as the relatively high requirement of teachers, stronger capabilities of network curriculum design and management required of teachers, and in the mean while a lot of time urged from teachers to fully participate in trainees' learning process etc. However, we believe firmly that pilot online learning will gain a wider range of applications because of its unique advantages.

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Analysis and Application of Feedback Information in Distance Learning: From Theory to Practice

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Abstract. In this paper we introduce our experiences in analysis and application of feedback information in distance learning system to improve instruction design and to enhance distance learning in distance education. We analyze some critical factors and their information in the system based on dynamical system, statistics and system theory. We give four kinds of feedback information classifications and an application model for compensation instruction. At last we introduce four examples in a case study.

Keywords: feedback information, information analysis, compensation instruction, distance learning.

1 Introduction

Distance education is a complex system that consists of learning, teaching, design, communication, and management [1].It is a vital aspect to maintain and improve the quality. But it is difficult for the complexity.

With Saba's hierarchical system model [2], the system has seven subsystems and instructional/learning subsystem is one of them. Many factors affect learning efficiency in distance learning system, such as distance learners, course knowledge, media resources, instruction design, learners support services, technological tools, and social-culture factors [3].

Feedback adjustment in time is a general method to control a complex system in system control theory. Feedback is a critical process of instruction design for a learning system in distance education [4]. For distance learners, feedback can promote their distance learning [5]. But any feedback has to rely on the collection, analysis and application of the feedback information from the system.

In this paper, we introduce our experiences about the analysis and applications of feedback information of a distance learning system for improving the system in open and distance learning in our university.

2 Methodology

2.1 Background

Our work is a continuous research plan on collection and analysis of feedback information, application for instruction design improvement, learning support service and evaluation in distance learning system.

The object is setting up some application strategies and promoting distance learning for open and distance learners in Chinese radio & TV university system. The university has been trying to make a blended delivery way for teaching and learning (Ge, 2006). It mixes online learning with face-to-face teaching, multimedia learning materials with printing textbook, synchronous action with asynchronous interaction, and self-paced learning with group collaboration learning in the instruction system. This instruction mode is a blended learning system (Graham, 2003; Young, 2002).

2.2 Research Method

The study use qualitative analysis method, quantitative analysis method, and case study. We analyze the content, meaning, description, and classification of the system information with system theory, distance education, instructional design, text analysis, and information theory.

We introduce dynamical system and statistics to our data analysis. Two mathematical functions are introduced to describe the dynamical learning behavior in dynamical system with continuous time or discrete time.

Space, time, participant (learner, lecturer, tutor, technician), and instruction objects are four basic variables that are introduced to describe the state of the learning system. The space dimension can be divided into online environment and true geographic space. The first space can be further divided into different subspaces in learning management system, content management system, and bulletin board system (BBS). The object includes the content and knowledge item of a course, interaction, and technological tool. We chose some courses in the university as a case study.

3 Distance Learning System Analysis

3.1 Critical Factors in the System

Based on system theory (Bertanlanffy, 1973), the process of implementing distance teaching and learning can be considered as a system with some critical factors. These factors must be reviewed prior to even considering how the course will be presented

and how it will function. They come into play in determining the design of course before we even look at its learning goals. They include [6]:
- learners' characteristics.
- learners' geographic locations.
- technologies and tools available to the learners.
- learners' goal.
- delivery cost.
- the goals and missions of the learning organization.
- some other factors.

In many instances, these factors will dictate the technologies we use. Bonk built a web-based instruction system [7] and the factors are following:
- psychological justification of online learning.
- participant interaction.
- levels of technology interaction.
- instructor and student roles.
- pedagogical strategies.

Le (2005) built a network-based instruction model that includes active role system, activity system and media system [8]. Interaction is important and necessary in distance learning (Moore, 1989; Bates, 1991; Chen, 2004). Except for interaction, course/curriculum requirements, learning & teaching activity, learning design, and the environment context are basic factors in a blended learning system [9]. Media-based knowledge presence for a course instruction is another important factor. Some surveys revealed that there are strong preferences for students in using multiple forms of media in learning (Vermeer & Murphy, 2004; Chan & Law, 2007; Jun, 2008).

Base on the above system, we outline our critical factors for a distance and blended learning system in course-level. These factors are following:
- course knowledge system.
- teaching & learning objective.
- learner characteristic.
- interaction.
- multimedia learning resource.
- technology tool.
- delivery mode.
- pedagogy strategy.
- online learning community.
- learner support service.
- the environmental context.

3.2 The System Structure

Based on system theory, we think that a distance learning system includes following ten subsystems in our environment:
- online learning environment.

- instruction design.
- interaction.
- space.
- time.
- curriculum.
- learning material.
- online learning community.
- instructional behavior.
- learning support service.

3.3 Online Learning Environment

Online learning environment is a technology system to support knowledge transmission, social interaction, and capacity building. The system is mainly consisted of web-based online learning management system, web-based content management system, web-based video-conference system, e-monitoring system, and some Internet communication tools such as email, instant message, and BBS.

The system is a basic active space for the learners. The stability and access chance for a distance learner are two important conditions for the system function. Delivery mode, content service, interaction and knowledge sharing depend on these factors. Based on the log data and monitoring data of the system, we can get the feedback information about the operation, the resource using and the learning behavior [10].

3.4 Interaction

Interaction has been identified as a key factor in the success in the distance education. Moore (1989) gave the common definition of interaction and it included three types of interaction: learner to learner; learner to teacher, tutor, and service worker; learner to learning content.

Moore (1989) thought that the depth of talk, the flexibleness of self-paced learning and the structure intension of the course design affect the learning efficiency. The instruction design needs to blend interaction technology-based and F2F into the system.

The Anderson and Garrison's model has three kinds of interaction: learner to learner, learner to teacher, and teacher to content. The last one can promote deep and meaningful learning [11].

In fact, we only pay an attention to the dialog topics, problems of course knowledge and skill, learning experiences, learners expecting, interactive methods and participants in interaction. They can provide most of the feedback information in an interaction system.

3.5 Online Learning Community

Online learning community can be viewed as a virtual organization with strong ties, and enables people to develop social networks for collaborative knowledge sharing. Learning networks are communities of learners who work together to build and share knowledge through computer network (Lin, 2007).

In distance education, it has become a typical organization form for distance teaching and learning activity. It can promote distance learning to afford learning flexibility and support service, and plays an important role in distance education today (Quan-Hasse, 2004; Southard, Cranford & Woods, 2005; Kretovics, 2008). In recent years, some web 2.0 tools have been used in the system design (Zhang, Olfman & Ractham, 2007; Deng & Yuen, 2007; White, 2007).

The problems, topics, experiences, members and behaviors in the community are main feedback information of the system.

3.6 Learner's Characteristic

The instruction design based on learner-centered for a distance learning system needs to integrate the learners' characteristics. These include: the personal background of education and work experience, physiology, psychology, learning geographic place, information and communication equipment, learning skill, learning preference, learning motive and wish, learning behavior, and viewpoint on distance learning [12].

During the process of distance learning and system improvement, some active characters are our analysis factors, such as learning difficulties, learning goal errors, and self-paced learning behaviors.

3.7 Learning Goal Error in a Curriculum

Before learning a course, the course objects are beforehand established. But many factors can cause learning goal errors. The course knowledge distribution, the learner' skill levels and region distributions are three important factors. Learning goal errors can be discovered by formative evaluation and summary assessment.

In fact, it is the most important to collect and analyze the feedback information of the system in learning process to predict or find errors, and to build an error descriptive model. Then we can find some causes in order to improve learning performance dynamically. This is one reason to introduce feedback information analysis.

3.8 Learning Support Service

Distance learners usually have many difficulties (Robinson, 1981; Rowntree, 1992; Moore, 1998) and especially need individual learning support services (Moore, 1998; Granger & Benke, 1998; Dennen, 2002; Francis & Raftery, 2005; Trapp, 2006). The main services are information, resource, people, interaction, technological establishment, tutoring assistance, counseling, and personal development (Tait, 2003).

In a word, we need to help our distance learners to overcome obstacles and to reduce learning goal errors in learning process. We also need to provide some support services to improve the problems in instruction design system. The obstacles, errors and problems can be discovered by the feedback information from the distance learning system.

4 Feedback Information Analysis

4.1 Feedback Information Classification and Feature

We classify the feedback information of the distance learning system into four kinds according the delay period of feeding to teacher and information life cycle. They are immediate, short period, medium period, and long period. Each kind has its' features.

For the immediate feedback information, it has following features:

- collecting occasion: during lecturing.
- collecting channel: face-to-face interactivities.
- statistical feature: non.
- pedagogical use: more unilateral view.
- psychological use: response of the visual or aural, but less induction.
- instruction improvement: give further explanation at once.
- learner understanding knowledge: no time for thinking the relevant knowledge over.

For the short period feedback information, it has following features:

- collecting occasion: after lecture or school every day.
- collecting channel: homework, interview after class, and formative assess.
- statistical feature: easy.
- pedagogical use: with more profoundly understanding by earnestly review and have done their homework.
- psychological use: more induction and connection between the knowledge points.
- instruction improvement: giving special lectures or explanations in next class time.
- learner understanding knowledge: have no enough time for thinking over all of relevant knowledge.

For the medium period feedback information, it has following features:

- collecting occasion: in the end of a term.
- collecting channel: examination.
- statistical feature: compare with other samples using multi-classes or historical records.
- pedagogical use: review systematically and profoundly understand the whole subject knowledge.
- psychological use: make the whole subject knowledge as a chain.

- instruction improvement: couldn't help to the current grade learners.
- learner understanding knowledge: have had a good review on the whole knowledge of the object and reconstructed a complete frame of the relevance subjects.

For the long period feedback information, it has following features:

- collecting occasion: after graduation.
- collecting channel: investigation of tracing alumni, anniversary, parties of alumnus, mail, etc.
- statistical feature: complex statistic method.
- pedagogical use: good evaluating on the educational mechanic system.
- psychological use: good understanding on all academic knowledge, after practice as a social member and less unilateral view. But less detail.
- instruction improvement: promoting the subject innovations planning.
- learner understanding knowledge: comparing the knowledge in the learning with their job experiences.

4.2 Analysis Function Definition

One behavior that relates continuous (discrete) time can be described by a dynamical system. Online learning can be considered as an action which relates time (continuous or discrete), such as click a file, download files, read web page, read flow media materials, watch web-broadcast live, and talk in the system. In here, we introduce two functions to describe these behaviors.

Definition 1 (Visiting Function):
Suppose a learning system has k kinds of learning materials and n knowledge units, separately to use vector M and vector Z to denote, $M= (m_1, m_2, \cdots, m_k)$, $Z = (z_1, z_2, \cdots, z_n)$, t is time, x is learner numbers, the relation between t, x, M, Z is called a function, denoted as F, $F = F(t, x, M, Z)$. We called F as a visiting function.

As generally, t time unit can be second, minute, hour, day, week, etc. The common model function is a statistical average function, denotation as F_0. F can describe general online learning behavior. For example, F describes the relation between click action and people number in time t. If F changes much larger, we need to analyze the cause.

Definition 2 (Visiting Time Function):
Suppose from t_0 to t, the system has x persons to learn k kinds of learning materials and n knowledge units, the time and x persons can be denoted as G, $G=G(t_0, t, x, M, Z)$. We called G as a visiting time function.

Function G can show learning time in M and Z. From the time changes, we can analyze the using rates of M and Z, so that we can analyze cause of the goal error by the dimensions of learner, knowledge, media resource (Le, 2005).

5 Application Practices

5.1 Compensational Instruction Model

Compensational instruction is a serial of organized teaching and instruction design improvement processing in the same instructional environments. The continuing analyzing issues (teaching actions) and organizing a serial of teaching actions will compensate the learning goal errors and reduce these errors. If there are no improvement actions, the course destination will not be finished.

Under some special conditions, some serious errors influence on the learner deep learning. These errors can be detected on statistical analysis of feedback information. In here, immediate feedback information and short period feedback information are our discussing objects.

Before we prepare some new actions or course materials for the compensational instruction, we have to know what kind errors happened in the learning process.

For feedback information application, we build a compensational instruction model for teaching and learning improvement in distance learning. The process of compensational instruction has four blocks: measuring, detecting, compensational instruction design and artificial intelligence controlling. They are followings:

- measurement: collecting and analyzing feedback information in the system, finding the teaching and learning goal errors.
- statistics analysis: analyzing the learners' characteristics, and the distribution of their knowledge, regions and skills.
- instruction design: improving the former instruction design, modifying the contents of the course, media materials and delivery ways.
- practice: making compensational actions for teaching and learning, doing knowledge management and building an expert system.

5.2 Application

Here we introduce our application examples in the processes of distance teaching and learning in the course, "Tax and Accountant", in the university. The first three examples are from the spring term in 2007. There were 120 registration learners and 15 weeks' data.

Example 1.

The following Table1 describes the click number of the most interested 36 papers for public discussion in the BBS. The number of the paper can reflect the attention degree on the discussion, question, or experience.

By the analysis, we find that there are 6 topic papers that are put by teachers, among them there are 5 papers belong deep learning problems, that are 2 case materials, 2 open problem that design for problem-based learning, 1 is a showing the tool using method.

Table 1. The click Numb. of some papers in the BBS.

Paper Code	P_1	P_2	P_3	P_4	P_5	P_6	P_7	P_8	P_9	P_{10}	P_{12}	P_{12}
Click Numb	27	28	29	30	31	32	33	34	35	35	37	38
Paper Code	P_{13}	P_{14}	P_{15}	P_{16}	P_{17}	P_{18}	P_{19}	P_{20}	P_{21}	P_{22}	P_{23}	P_{24}
Click Numb	38	38	41	42	43	44	45	52	53	54	54	57
Paper Code	P_{25}	P_{26}	P_{27}	P_{28}	P_{29}	P_{30}	P_{31}	P_{32}	P_{33}	P_{34}	P_{35}	P_{36}
Click Numb	57	60	62	62	66	82	96	112	128	129	156	246

During these 30 papers from the learners, there are 6 papers are personal, and 24 papers are group cooperative experiences and work results. These group learners distribute 6 different regions and have 23 learning group. There are 7 papers from the same learning center and different groups. This shows the learners region distribution. Some regional learners need to be attended. By the content analysis from the 30 learners' papers, there are 5 learning goal errors that relate 8 knowledge units. We need to give compensational instruction by new learning case materials, online or face-to-face lectures, and individual services.

Example 2.
The following Fig.1 is a function curve. These curves describe the numbers of distance learners that take part in reading a subject of the course in the system in each day for a week period in 15 weeks in the term.

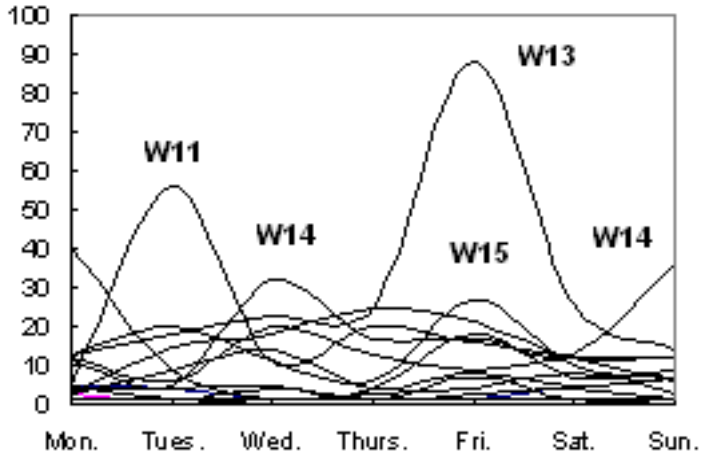

Fig. 1. The online numbers of each day in a week for 15 weeks.

If one's online reading time is not enough, we need to connect this learner or these group learners to look for causes and to use new delivery mode, and improve the materials. From the picture, we find that in the fourteenth week, the reading numbers are the most, 88% learners participating in online learning on the topic. Except these people, we find that 10% learners need some different support services for their knowledge and delivery method. In the last weeks of the term, learners online times add.

We can find the learners' problems on the feedback information from the conversation topics in the course. They may be about the course knowledge, technology, learning method, and skill, etc. In general, the discovering method of the problem is web text analysis. Our personal support services rely on the existing problem discovered from the short period feedback information. The following is an example.

Example 3.
The degrees of the interaction and conversation in the community are our important analysis objects. Theme, remark, member, and region are main discussing factors. The following Table 2 is a statistics form about 10 themes that their remarks are the most in the term.

Table 2. The degree of the conversation in the course.

Theme Code	Th1	Th2	Th3	Th4	Th5	Th6	Th7	Th8	Th9	Th10
Remark Numb	53	42	24	23	23	21	21	20	17	17
Group Name	G1	G2	G3	G3	G3	G3	G4	G3	G4	G3
Region Code	SG	JY	GZ	GZ	GZ	GZ	GZ	GZ	GZ	GZ

From the above table, we find that the most interested theme, remark, active group and the region distribution. Since the theme, remark, group and region are concentrated, we adjust our instructional strategies for special groups and share their experiences for all learners in the community by analyzing these connotative problems in the conversation.

Example 4.
Interaction between learner and learner is a challenge problem (Moore, 1989). The interaction can show some problems and interested points in their self-paced learning processes. In the first term and second term in 2008, there were separately 264 and 365 registered learners in the course.

In the first term, there were 951 papers or topics for discussion in the BBS, and 219 ones of them were put by learners. In the second one, the numbers were 1268 and 455 separately. About 10% learners were active talkers and leaders in the forum. In the first term, each individual of the active learners gave average 14.73 talk topics or remarks. In the second one, the number is 11.18.

In the last term, there were 17 papers on some different themes that are the most interested; the learner's click number is 1168. These good problem-based cases from the learners' talks would add our knowledge repository. Based on the problems, we should provide some individual support services.

6 Conclusions

The feedback information of distance learning system in course-level can help us to improve instruction system design and to help distance learners to enhance their

learning. Our system model includes most of the critical factors in the system. Based on discovering of the instructional goal errors from the feedback information, we can chose some different strategies for compensational instruction and provide personal support services.

Our works are only in the beginning. Some new analysis methods and application practices will be introduced in our works in the future.

Acknowledgements

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Re-Ranking Mechanism for Learning Resources

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Abstract. There're lots of relevant systems for supporting teachers or students to get involved in e-learning environment. When creating the learning materials or doing learning activities, it is essential to collect useful resources which have higher relevance to the working materials. But how to find these resources with an efficient way would be a challenge to system developers. In this paper, we proposed a novel mechanism named "User Expect Value" to calculate the relevance between working materials and resources in existing repository. We not only utilize the similarity coefficient proposed before but also take the essential IEEE LOM elements into consideration. Through the search interface, users could get the resources efficiently. After that, the results of author expect value could re-rank the original search result from the back-end repository in relevance order. As a result, it could help users to reduce the overall cost of time on collecting useful resources.

Keywords: information retrieval, learning resource, e-learning system, IEEE LOM

1. E-Learning Background and Motivation

CBT (Computer-based Training) and WBT (Web-based Training) have provided a different learning style from traditional one since 1960. With the improvement of internet and communication devices, people are eager for getting knowledge at any time and everywhere. Hence, distance learning has become more and more important in nowadays. With the popularity of personal computers and the increase of internet and multimedia technologies, the relationship between teachers and students is not restricted by the traditional learning style. It makes students don't have to carry the backpack with heavy textbooks and go to school daily. Instead, the only thing students have to do is get on the internet, connect to a specific learning system and then do the learning activities arranged by the teachers in advanced just with simple mouse clicking or dragging.

Researches of online education or e-learning have already been last for a long time. Most of these research topics could be mainly separated into three parts: the creation of the learning materials (Authoring System), the virtual classroom for teachers and

students to interact with each other (learning management system: LMS), and the database for storing the learning object (Learning Object Repository: LOR).

The learning objects could be considered as the basic components like web pages, multimedia files or text files in the e-learning environment. In the aspect of teachers, they could make use of these learning resources to generate vivid learning materials for his/her students. In the aspect of students, they could get more advanced information or knowledge through these learning objects. As stated above, we could define learning objects as a kind of reference data for pushing the learning activities ahead and for bringing the convenience.

Although teachers and students could directly benefit from the learning objects stored in the LOR, still lots of learning resources in the LOR are not relevant to the working materials at all. That is because anyone easily creates learning objects through any kinds of tools. In order to make resources deliver and to communicate with other distance learning systems, the utilization of a common standard seems to be the optimal solution.

In our previous works [1], we've already developed a LOR for stored the learning objects based on IEEE LOM (Learning Object Model). We focus on the learning objects in web page (Hyper-Text Markup Language: HTML) format. According to our previous LOR, we utilized the metadata to classify the learning resources. Besides the storage process, our LOR would calculate the importance of the learning resources based on the Google Page Rank [2] mechanism.

In our LOR, the users could only get the resources in citation order. However, the most cited resources might not be the most relevant one for the current usage. It will cause that the relevant resources might appeared in the lower order. According to this situation, how to assist the users in getting the most relevant resources would become the challenge. In the authoring aspect, teachers would like to get the relevant learning resources to create the learning materials. In the learning aspect, students could get more extra information by utilizing the relevant learning resources.

In this article, we would like to propose a ranking mechanism added on the previous LOR system. The mechanism would firstly calculate the relevance value between resources from LOR and the material which was using now by teachers or students that we called "User Expect Value". Then our proposed mechanism would also take the citation value originated from LOR into consider. After the calculation process, we could list the query results in the order of sum of citation value and relevance value. That is, the teacher and students could get the most useful learning resources and reduce the cost of time in sieving the information.

The remainder organizations of this paper are as follows. Section 2 introduces some relative research issues, including some acknowledged e-learning standards, similarity calculation mechanism we utilized in our work. Section 3 illustrates our proposed system architecture and the ranking mechanism. Section 4 will illustrate the implementation and the evaluation our mechanism to prove it is down-to-earth. And we'll make a brief conclusion and talk about the future works in Section 5.

2. Acknowledged Works

The current state of e-learning environment becomes more and more diverse. In order to make resources could achieve the reusability and sharability, we have to follow certain standard in advanced. As we mentioned in the previous paragraph, there are many standards for us to adopt. We would like to describe the IEEE LOM specification in the beginning of this section. We especially focus on the metadata components of IEE LOM to realize the background of learning resources.

After that, we also have to take the relationship between learning resources into consideration. The LOR we developed stored the learning resources based on the IEEE LOM and then calculate the weight based on the Google Page Rank mechanism. In accordance with the previous works, we go further to calculate the similarity between working materials and the resources stored in our LOR. There are lots of mechanisms for calculation of the similarity which were widely used in IR (Information Retrieval) environment. We would like to evaluate these mechanisms then improve and change it for our works.

2.1 IEEE Learning Object Metadata

IEEE LTSC (Learning Technology Standard Committee) proposed five-level architecture to describe the possible information for available learning resources. For instance, in the third level, they focus on the precise definition of system components and the related learning content database. They also introduced the IEEE LOM to provide a unified description of learning resources. Metadata can be considered as a sort of information about information. By using the IEEE LOM, the learning resources can be retrieved and acquired easily among the e-learning society to realize a "standardized diverse world." The IEEE LOM (IEEE 1484.12.1-2002 LOM v1.0) is now serving as the principal standard internationally to specify learning objects. Some acknowledged e-learning specifications are also based on the IEEE LOM. The IEEE LOM mainly comprised of 9 categories as follows: General, Life Cycle, Meta-Metadata, Technical, Education, Rights, Relation, Annotation and Classification, to annotate learning contents in a comprehensive perspective. Besides, each category has its own classification to describe the learning resources in detail.

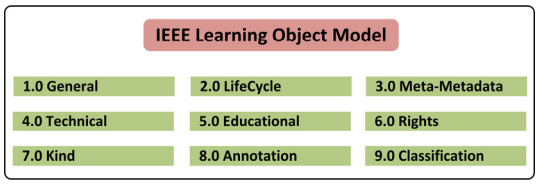

Fig. 1. The first-level elements of IEEE LOM.

According to the IEEE LOM, each learning resource will be stored in organized classification. The use of metadata will reduce the cost of time in information retrieval. The metadata elements of IEEE LOM are illustrated **Fig. 1**.

2.2 Similarity Computing Mechanism

In the research of IR domain [3, 4, 5, 6], the common method is to use the keywords that authors set for each document to be the attribute of it. There are lots of methods to achieve this goal like Simple matching, Jaccard coefficient, and so on. All of the methods we mentioned above could calculate the similarity between different documents through the keywords of them. In comparison with Simple matching coefficient, the Jaccard coefficient has taken the standardization into account. In this situation, it seems to be the optimal calculation mechanism. Hence, Jaccard coefficient becomes the widely used mechanism in this domain.

As regards the automatically classification, it utilizes the similarity between each document and classifies them into several classification groups. The document in the same group will have higher similarity. In other words, the similarity value of documents will be low in the different groups. A correct classification mechanism could help users to find relevant resources and could also reduce the cost in filtering a large number of resources. It is impossible to classify those resources manually because many mistakes and problems are always made. Therefore, the calculation mechanism would cause the results of the classification. We have to adopt the suitable mechanism for specific types to get the optimal classification result. There are five main mechanisms to calculate the similarity between resources, including Simple matching coefficient, Dice coefficient, Jaccard coefficient, Overlap coefficient, and Cosine coefficient. In the following paragraph, we will introduce the similarity calculation mechanisms stated above in the specific example and shown in **Table 1**.

Table 1. The definition of the similarity calculation mechanisms

Definition:
Assumed that there are N documents in our database and each of them (Dn) could represent as a vector in the space model. The vector of document Dn will be Dn=(w1, w2, w3, …, wn) and the w are the numbers of keywords. The |Dn| represents the value of the vector Dn.

Calculation Mechanisms	Description	Formula
Simple matching coefficient	Simple matching coefficient is useful when both positive and negative values carried equal information. In other word, the simple matching coefficient for two presence/absence distributions on a set of sites simply counts the number of sites which have the same status (presence or absence) in both distributions.	$Sim_{smc}(D_1, D_2) = \lvert D_1 \cap D_2 \rvert$
Jaccard coefficient	The Jaccard index, also known as the Jaccard similarity coefficient is a statistic used for comparing the similarity of sample sets. It's defined as the size of the intersection divided by the size of the union of the sample sets. Jaccard's coefficient indicates maximum similarity when Sim is 1.0 and maximum dissimilarity when Sim is 0.	$Sim_{jacc}(D_1, D_2) = \frac{\lvert D_1 \cap D_2 \rvert}{\lvert D_1 \cup D_2 \rvert}$

Dice coefficient	The Dice coefficient is similar to the Jaccard similarity coefficient but gives twice the weight to agreements, emphasizes similarities (2|D1∩D2|), and yields mean values much nearer the mid-point of its range.	$Sim_{dice}(D_1, D_2) = \frac{2\lvert D_1 \cap D_2 \rvert}{\lvert D_1 \rvert + \lvert D_2 \rvert}$
Overlap coefficient	The overlap coefficient is a measure of agreement or similarity between two probability distributions. The idea of the overlap coefficient is to determine the degree in which the sets D1 and D2 overlap each other.	$Sim_{over}(D_1, D_2) = \frac{\lvert D_1 \cap D$ $\min(\lvert D_1 \rvert, \lvert$
Cosine coefficient	Cosine similarity is a measure of similarity between two vectors of n dimensions by finding the cosine of the angle between them and the denominator involves the lengths of the vectors. It's often used to compare documents in text mining and web mining.	$Sim_{\cos}(D_1, D_2) = \frac{D_1 \cdot D_2}{\lvert D_1 \rVert D_2 \rvert}$

The Cosine coefficient takes advantage of the concept of VSM (Vector Space Model) proposed by Salton in 1983. The VSM could extract the characteristics representing the source files and change them into vectors. After extracting the characteristic vectors, VSM would compare them with the original one and then calculate the similarity between them. The Cosine coefficient could improve the disadvantages of Jaccard coefficient when processing the keywords and other elements. It is because that Cosine coefficient only calculates the angle among two vectors. It wouldn't affect the similarity between resources because of the quantity of the keywords set in the resources. The illustration of the Cosine coefficient is shown in Figure C

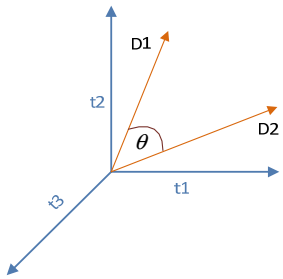

Fig. 2. The similarity between document 1 (D_1) and document 2 (D_2)

Because the Cosine similarity coefficient is the most widely reported measure of vector similarity, and it is sensitivity to the relative importance of each word. Besides, it would have lower influence on the numbers of items in the document gathers. In **Table 1**, we list out the original formula. Assumed that the document D_1 has

keywords W_1 and the document D_2 has keywords W_2, so the similarity between D_1 and D_2 will be calculated by the following formula. It scales the similarity by the geometric mean of the number of "1" bits in the two rows:

$$Sim(D_1, D_2) = \frac{\overrightarrow{D_1} \cdot \overrightarrow{D_2}}{\left|\overrightarrow{D_1}\right|\left|\overrightarrow{D_2}\right|} = \frac{\sum_{i=1}^{n} W_{i,1} W_{i,2}}{\sqrt{\sum_{i=1}^{n} W_{i,1}^2} \sqrt{\sum_{i=1}^{n} W_{i,2}^2}}$$

In this situation, we conclude that the Cosine coefficient measure achieves better performance than the Dice, Overlap and Jaccard measures in our scenario. In the next section, we will introduce the system architecture in our works and introduce the ranking mechanism we utilized to calculate the similarity among learning resources.

3. Proposed Methodology

Our aim is to provide a common way to the users who are not experts or are first time to get in touch with the e-learning systems. Through our LOR, we could get the value of specific learning resource through calculating the citation links from other resources. After that, when users access to the LOR and request for a query result through our search UI, our system would list the results in the order of the value that we named it "citation value". That is the common method that every search engines and systems do. In this situation, users still have to spend lots of time to filter the search results and then get the items that he/she really need. In order to reduce the complexity when searching the reference information through the authoring system or LMS, we propose a novel mechanism added on our LOR system. Besides, we also developed a simple run-time on both authoring and learning sides for the usability evaluation.

The three-tier system architecture of our LOR includes the client systems, search user interface (UI), and the system repository. The detail is shown in **Fig. 3**.

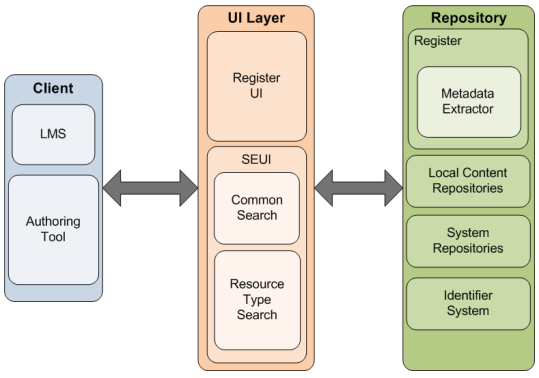

Fig. 3. The system architecture of our previous LOR

Every learning resource stored in our LOR would have a unique metadata file. The structure of the file "imsmanifest.xml" is illustrated in **Fig. 4**.

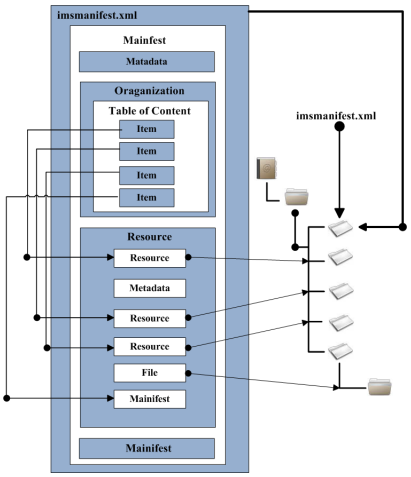

Fig. 4. The structure of "imsmanifest.xml"

Our aim is to provide relevant resources which are more close to the working materials, so we don't have to take the whole categories or elements into consideration. We only have to adopt some essential parts of them. In this situation, we only adopt the General category and Educational category to complete our works. The other categories pay more attention on the technical issues but not mention to the learning aspects.

When users log in our proposed system run-time and choose the specific learning materials to edit or to do some learning activities, the system would firstly check the selected materials. If the selected materials are following the specific e-learning standard like SCORM, then the system would extract the learning materials; get the xml file named "imsmanifest.xml" inside them. After getting the description xml file, we could easily analyze what the content of learning materials is.

As mentioned above, not all of these elements are useful to the analysis results. We selected several elements form the metadata which is essential for our works. The information of selected elements mainly focuses on the "General" and "Educational". The details will be shown in **Table 2.**

Table 2. The selected elements from IEEE LOM metadata

1.0 General		
Number	**Name**	**Description**
1.2	Title	The name given to this learning object
1.3	Language	The primary human language or languages used within this learning object to communicate to the intended user
1.5	Keyword	A keyword or phrase describing the topic of this learning object
1.6	Coverage	The time, culture, geography or region to which this learning object applies
5.0 Educational		
Number	**Name**	**Description**
5.2	LearningResourceType	Specific kind of learning object
5.5	IntendedEndUserRole	Who will be the end user to take this resource (author, learner, …)
5.7	TypicalAgeRange	Age of the typical intended user
5.8	Difficulty	How hard it is to work with or through this learning object for the typical intended target audience
5.9	TypicalLearningTime	Approximate or typical time it takes to work with or through this learning object for the typical intended target audience

In the category 1.0, the metadata element here groups the general information that describes this learning object as a whole. We use these elements to realize the overview of the learning resources. In the category 5.0, it describes the key educational or pedagogic characteristics of this learning resource.

In Figure F, the original search process is that users input the keywords or selected requirements to LOR then system would list the search results in order of citation value. The results in the list might not be suitable or relevant to the learning materials selected when users logged in. The most important thing we have to solve is to find out the similarity between selected learning materials and resources stored in the LOR. To meet this situation, we propose a calculation formula named UEValue (User Expect Value). After that, we add citation value and UEValue together to be the new ranking list (RL). The list would show relevant resources in higher order and irrelevant ones in lower order.

To prove our formula, we would take following as an example. Supposed that there are N elements of IEEE LOM that we want to calculate similarity between the "imsmanifest.xml" file in selected learning materials and the metadata of the resources in LOR, we defined a match list (ML) to represent it. We also defined a response item (RI) to represent the metadata of learning resources from the search result list. After those two items, we have to define a match item (MI) to represent the element array that contains the number of matching items among original "imsmanifest.xml" file and learning resources. In the formula, we assumed selected material (D_s) and resources in LOR (D_r) would have a similarity value. We refined the Cosine coefficient mechanism and the proposed formula of UEValue is shown below:

$$UEValue = \beta * Sim(D_s, D_r) + (1-\beta) * \frac{1}{|ML|} \sum_{n=1}^{|ML|} \frac{MI_n}{|RI|} \quad \beta \in [0,1]$$

In this formula, we firstly compare the keywords between selected learning materials and resources in LOR through the original Cosine similarity coefficient. The system will load the selected elements from the working materials and the learning resources in LOR and then create temporary memory arrays to record the metadata information. In order to take the other essential LOM elements into consider and get more relevant resources, we give this formula a beta parameter to balance the keywords and the other selected LOM elements. In the second part of this formula, we would calculate the matching situation through the RI in MI which appeared in the ML.

That is because the common way to find out the relationship between two learning resources is to compare the keywords that teachers or authors give it. To improve the quality of relationship, we make use of the selected metadata elements stated above. That is why we defined the outcome value is UEValue. After that, we also have to take the original citation value named LOR coefficient (Rcoe) from the LOR. The value Rcoe will be given when the learning resources which were uploaded to the LOR in the first time. The Rcoe is not a fixed value. It depends on the latest uploaded resources. In this situation, the learning resources in our LOR would be changed when uploaded events happened.

The sum value of these two parameters would make the resources in LOR more relevant to the selected materials and filter some resources might not so appropriate for current use. Through these two essential parameters, our ranking list "RL" is as follows:

$$RL = \alpha * Rcoe + (1-\alpha) * UEValue \quad \alpha \in [0,1]$$

After the calculation mechanism work in the background, we would illustrate the system interface in the following section and find out the optimal threshold value for alpha and beta.

4. Implementation and Evaluation

To demonstrate the implementation of our proposed works, we assumed a scenario that there is an author involved. He / She logged in our proposed system and have already picked up a "Photoshop" course to edit. The default user interface is shown in the **Fig. 5**. We separate the interface into three panels and each one is responsible for specific functionalities. The left panel represents the aggregation structure of the selected "Photoshop" course content and the reference resources pool in the lowest of panel. The right panel represents the user's personal profile and other information. The central panel is for the representation of the materials content.

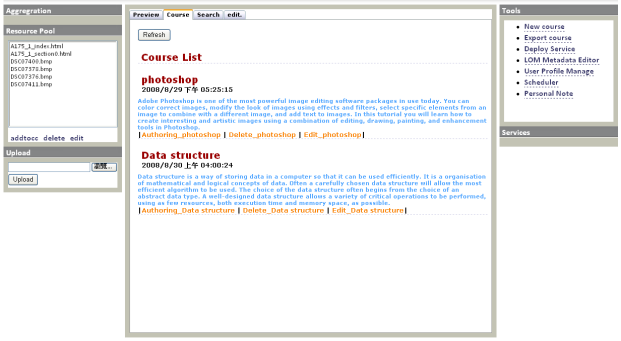

Fig. 5. The interface of our system

When users search for some relevant resources to make themselves realize the content deeply, they could press the search function in the top of central panel. The common way is that users input specific keywords to retrieve the resources from LOR, and LOR would then return the results and list them in order of the importance value of them. Based on our proposed mechanism, the user could utilize the alpha parameter in the scroll bar to change the original order. That is, the users could make the results in the order of original importance or the relevance. The **Fig. 6(a)** indicates the original search results by inputting the keywords "introduction". The **Fig. 6(b)** shows the re-rank result based on our mechanism when alpha parameter value equals to 0.5.

Fig. 6(a). The original search results

Fig. 6(b). After re-ranking results

Through our proposed mechanism, the users could get the resources based on the original citation value or the relevance degree that users set to the alpha value. Our aim is not to provide a recommendation but to let users could make their own choice in retrieving the resources. In this works, we also evaluate the mechanism in the beta of UEValue and the alpha of the RL.

In order to find out the optimal parameter for alpha and beta, we make an experiment for testing them. First, we put all of the learning resources into the evaluation process of UEValue to calculate the hit ration for each resource. We selected a "Photoshop" course and input the keyword "introduction" in query string. There are thirty-three results when we input this keyword. Our system would calculate the similarity between both keywords and selected metadata elements to get the UEValue. For example, the UEValue of the "Item 0" is 0.275 when beta value is 0.2. We separate the beta value into five parts as "0.2", "0.4", "0.6", "0.8", and "1". According to the results we could get the match chart for beta shown as Figure I. It is not difficult to find out that we could get the optimal UEValue when beta is "0.4" based on **Fig. 7**.

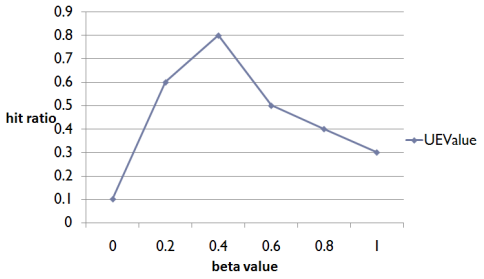

Fig. 7. The optimal beta value for UEValue

After getting the optimal beta value (0.4), we would like to continue the same experiment on proposed RL. When giving the RL formula a fixed beta value (0.4), and we'll get the results in backend system.

According to the RL results, we could get the match chart for beta shown Fig. 8. The baseline is the default Rcoe value. We could see that the RL would be shown as a curves line, and we could get the optimal alpha value for our RL mechanism on "0.6".

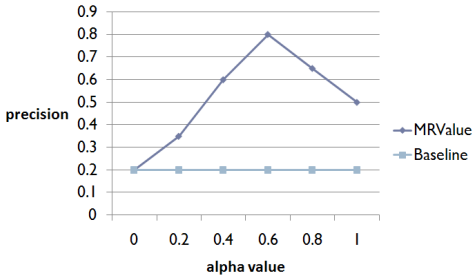

Fig. 8. The optimal alpha value for MRValue

After the evaluation, we found that we could get the optimal results when beta parameter equals to 0.4. And we use this beta value to find out the optimal value for RL which is located on 0.6.

5. Discussion and Future Works

The development of authoring system, learning management system, and repository indeed plays an important role in e-learning environment. In the past, we have already developed a LOR system for storing the learning resources. In terms of the web-based system, the retrieval of learning resources in our proposed system is getting important. Another critical issue to note is how to assist the users in getting the relevant resources in an efficient way. In this paper, we focus on the web page resources. We make use of the similarity calculation coefficient to compare the similarity between working materials and the resources in our LOR system. In order to make the similarity more precisely, we also integrate the IEEE LOM metadata into our calculation formula to get user expect value (UEValue). Besides, the original search results have the default citation value which generated from the Google Page Rank mechanism. Through combining the UEValue and importance value, we could get a new rank value named ranking list (RL). Besides, our aim does not provide a recommendation to users. We let users could choose the relevance value through the scroll bar inside the search interface and find what they want. After that, we evaluate the calculation formula to provide an optimal parameter for the RL.

Our next step is to refine the calculation formula and add the other factors in IEEE LOM to increase the accuracy and to evaluate our proposed system in different ways. We would also like to enlarge the search range to the whole internet environment and integrate it with other separated learning environments.

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Proposals for the Construction of the Electronic Game Appraisal System in Educational Perspective

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Abstract. To promote the teenagers' growth healthily, we analyze various factors for constructing the grading and classification standards in the appraisal system of electronic games based on educational perspective. And then a preliminary appraisal system is constructed using school divisions as the vertical standard and knowledge block as the horizontal standard.

Keywords: Educational perspective, electronic game, grading and classification

1 Introduction

As a typical recreational form in the information age, electronic games have become part of public entertainment. However, playing electronic games without control have serious impact on teenagers because of non-standard game development and operation, less selecting guidance and so on. It's obvious that there are lots of potential educational factors in electronic games that can do teenagers good. But now, series of social problems such as being addicted to electronic games cause deep concern of parents and teachers', and also make game producers do not know how to develop in the future exactly.

Many countries like United States, Britain and Japan have already enacted electronic game rating systems by learning experiences of movie grading system. In 2004, China Youth Network Association published the first standard in china-"Green Games Recommending Standard". Although there are already such game rating standards, they can't evaluate electronics games comprehensively and objectively and also can't select games for education facing the universal impact of games.

Now there is more and more research about the electronic games' educational value, such as its impact on young people, learning process and models in electronic games, learning motivation and strategies and so on. But study and extraction of educational factors in electronic games is far from enough, and it is necessary and imperative to analyze electronic games in educational perspective objectively, scientifically, comprehensively and systematically. We want to construct a rating system through an objective and in-depth study of electronic games, and exact the

educational factors in games and analyze their impact on individuals of different stages in different aspects intensively and carefully.

2 Analysis of the existing rating system

2.1 Current situation analysis

Here, we select and do research on electronic game rating systems of the United States, Japan and Korea's [1]. What's more, China Youth Network Association's Green Games Recommending Standard is included just like the form showed below [2]:

Table 1. Four countries' electronic game rating systems

Countries	Grading department	Levels	Specific targets
USA	ESRB（娱乐软件分级部门）	EC,E,T,M,A, RP	Details: violence, sanguinary scene, alcoholism , gambling, vulgar dialogue
Japan	CERO (电脑娱乐分级组织)	entire age, 12+, 15+, 18+	Details: pornography, violence, horror, gambling, drug and so on
Korea	KMRB (韩国媒体评等员会)	entire age, 12+, 15+, 18+	Details: violence, publicity, gambling and so on
China	China Youth Network Association (中国青少年网络协会)	entire age, 12+, 16+, 18+, dangerous level	Five static evaluation indicators: violence, salacity, horror, social morality, cultural connotations Seven dynamic evaluation indicators: PK behavior, illegal procedure, civil degree of chatting system, orders of social system in the game world, time limit, publicity of game image, social responsibility

First, they are negative classification models. The rating standards in the form use age as the standard to divide stages and analyze the negative factors in electronic games, such as violence, sanguinary scene, pornography and gambling. Such systems descript the extent of negative factors in electronic games and tell the public when it is suitable to let players play games in different levels. We can say that such rating systems are not only negative but also passive from the angle of educational. The reason of "negative" is that they can't display the internal mechanisms and content systematically and objectively, in other words, they just tell the negative factors in games, but not the positive. The reason of "passive" is that they let players avoid unsuitable games but can't tell players how to deal with such kinds of games when meeting them.

Then, there is one-dimensional hierarchical orientation in such rating systems. The standards above are all one-dimensional hierarchical orientation which adopts age as the clue to distinguish different levels. Such consideration is reasonable, and the reasons as follows: first, age is an easily grasped clue in the development of the individual. Teenagers in different age groups have different characteristics in cognitive ability. Then, such electronic game rating standards were established by using the experiences of movie rating system, which also make age as the clue to classify movies. But it may be pointed that although electronic games have some common ground with films, it is still far from enough just as a mirror of movie rating system. We make comparison among movies, electronic games and school curriculums the table blow, from where we can see the various impact of electronic games different from movies and school curriculums.

Table 2. Comparison of movie, electronic games and school curriculums

Compared items / Factors	Movie	Electronic games	School curriculums
Content	fictitious story	particular scenes with problems and barriers	static and structured knowledge
Process	passive acceptance: appreciate, understand and think about receptive plots	active input: real-time interaction; trial and error; conscious learning and unconscious learning; occupying more time and energy	teachers' guidance: systematic and conscious learning behavior
Environment	imaginary plot in films	virtual space:	construct the relationship between school knowledge and real life
Impact	the accumulation of indirectly life experiences	stimulate intrinsic interest and motivation; gain knowledge, skills and experience; develop some habits	accumulation of knowledge; reorganization of the knowledge structure; Less practical experience

Electronic games are interactive and realistic than movies and school curriculums. From the table above we can see that electronic game is relatively easy to stimulate young people's interest and motivation and make it easier to obtain knowledge than passive film appreciation and systematic school curriculums.

However, young people are in a erratic period of physical and mental growth. Sense of achievement in games makes them easy immerse in the game and it is difficult to extricate themselves from games, which is worried by people in general. Separating children from the games is neither feasible nor reasonable, so we have to place the positive and negative factors of electronic games before the public objectively. We shall not only concern the influence which electronic games cause in daily life, but also need to find the changes electronic games bring to teenagers in education perspective.

Third, lack of safeguard measures limits the implementation. After exiting electronic game rating system putting into use, they haven't work out well because less of safeguard measures. Series of social problems promoted by playing electronic games remind people of reconsidering existing rating systems. Some experts have realized such situation and call for establishing new classification systems of electronic games. More importantly, it is also necessary to unite various aspects' power to strengthen the implementation.

2.2 Enlightenment ideas to our rating system

So, we can see the defects of the existing game rating system, and some key ideas about our appraisal system are explained as follows based the analysis above.

(1) The standpoint to construct the rating system: education
Most of existing rating systems are established on entertainment stand and it's obvious that they can't describe the educational factors in games. Instead, it must be done to research the relationship between development of the individuals and the elements contained in electronic games. So, we want to focus on the educational significance of electronic games and try to construct a rating system positively.

(2) The attitudes we hold: positive and proactive
To establish appraisal system and regulate the development of electronic games, we shall keep positive and proactive. Being proactive means that the rating system can tell what can be accepted when noticing what should be avoided. Being positive means that we shall pay attention to educational factors in games and keep an eye on those factors' good effect on the development of teenagers.

(3) The two dimensions in the rating system: grading and classification
In our appraisal system of electronic games, we plan to investigate electronics games in two dimensions: the vertical dimension-grading and the horizontal dimension-classification. On one hand, the standard of grading needs to be established; on the other hand, how to work up the horizontal standard must also be done. It is to say that we must not only find a basis as the clue to classify games in different stages, but also need to distinguish so many educational factors in horizontal dimension.

(4) The implementation suggestions
It is obviously that the exiting rating systems have implemented not well. The coordination from all sides is badly needed. When our rating system putting into use, calling for coordination of different groups must be done.

Besides, we need to find the relationship between our appraisal system and the existing rating standards. It seems that coordination is needed between the two. The existing standards show us the negative factors contained in the games. The appraisal system we want to establish focuses on games' positive influence on teenagers. Maybe we can find a good way to weigh the pros and cons of the two and make them all effective.

3 A train of thought to establish the appraisal system

3.1The ideas about grading of electronic games

To fully coincide with the characteristics of the individual's cognitive development and educational growth demand in different stages, general considerations from various angles are badly needed to determine the classification dimension.

First of all, the theory about individual cognitive development stages is fundamental. It is obvious that cognitive development of the individual from birth to adult is not a simple accumulation of volume, but exists qualitative differences at every stage. Cognitive development is divided into four stages in Piaget's theory: individual sensory-motor stage, preoperational stage, concrete operational stage and formal operational stage [3]. We must perceive different cognitive features and diverse demand for suitable knowledge in different stages, and ensure that the system is scientific and rigorous.

Second, age is a clearer clue. Until now, both movie rating standards and electronic game rating standards adopt age as the basis of dividing levels. Age is relatively easy to control and causes little dispute when putting into use. Individuals' internal development can be grasped through external age.

Third, school division is close to educational practice. School division (Kindergarten, primary school, middle school, high school) is familiar by us and it has been proved scientific and feasible. Students in different grades show great differences in cognitive competence, knowledge and skills. If we adopt school division as the clue to define the levels of games, educational factors in games should be extracted and distributed in different stages according to the characteristics and knowledge needs of players in different grades.

It is clear that only the three clues above is not enough, and other materials involved may be added as the research carrying out more and more deeply. However, the following principles should be followed when the classification standard is finally made. First, comprehensive consideration of so many factors is badly needed. For example, theory about cognitive stage is the basis to make the classification standard. Age and school division are easy to control once putting the rating system into use. Second, the relationship between different levels should be treated critically. It means that the whole grading system is progressive and can reveal the development of individual.

3.2 The ideas about classification of electronic games

Children at different ages need to receive different types of knowledge and skills, so it is more scientific to classify the educational factors. How to make the standard of classification? The clues below may show us how to do.

First of all, Gagne's theory about study results. Gagne's theory is fundamental to our research. He generalized five types of study results, and they are verbal information, intellectual skills, cognitive strategies, motor skills and attitudes [4]. There is no doubt that such elements are hidden in electronic games. For example, players may use verbal information to help themselves know what to do in the games;

intellectual skills and cognitive strategies can tell players how to play well; playing games can exercise players' abilities of operation, coordination and flexible response. All these are closely related to motor skills. Players face up with a series of challenges and choices when playing games. Meantime, they also feel culture and ideology infiltrated in some games. Under such situation, moral character is cultivated.

Then, Howard Gardner's Multiple Intelligence Theory. Howard Gardner divided intelligence into eight kinds: linguistic intelligence, logical-mathematical intelligence, spatial intelligence, bodily-kinesthetic intelligence, musical intelligence, interpersonal intelligence, intrapersonal intelligence and naturalist intelligence. This theory broadens our horizon and provides us a more flexible theory as the basis of our research. We may classify the educational factors according to their effect on development of some smart. As we all know, all kinds of intelligence develop from lower level to higher level, so we can focus on the development of all kinds of intelligence from low to high level.

Third, curriculums offered at school. Curriculums generally include learning of languages, natural science, art and humanities in schools of China. Learning how to read and write Chinese and English are widely taught at school. Chemistry, geography and biology can be called science. Humanities may be subdivided into a lot of small indicators. Art shows children how to draw and sing. Ideology, common sense and self-awareness are part of humanities. Besides, physical and mental health are also worthy of attention. Undoubtedly, knowledge of curriculums is contained in electronic games more or less. From this point of view, we may get some useful clues that can guide us to set up the horizontal standard. Besides, curriculums are familiar by teachers and parents, so it is much easier for them to choose suitable games for children.

What's important is the analysis of capacity development trained in games. The development players got in games is limited and specific. It is important and critical to exact the factors and elements which can do good to players. First of all, there are always grand and beautiful scenes in games, which attract players most. Then, sense of accomplishment and satisfaction is obtained when upgrading. More importantly, players can learn knowledge and train skills. These knowledge and skills can not only promote upgrading in games but also help us learn and teach well when being transferred to the real world.

To sum up, there are also some principles to follow when setting up the horizontal standard. In the first place, all kinds of ideas have the common ground. For example, verbal information in the theory of Multiple Intelligence corresponds to Chinese and English learning in some degree. Logical-mathematical intelligence has some similarities with mathematics and cognitive strategies. Secondly, it is necessary to consider the positive and negative effects of electronic games in general. Our research is keen on the positive influence of games, but it is not to say that we can ignore the negative effects. Based on objective perspective, we will weigh the two factors when trying to demonstrate the educational and positive effects.

3.3 The prototype of initiative appraisal system

Based on the analysis above, we plan to set up our initiative appraisal system adopting school division as the vertical standard and knowledge block as the horizontal standard. School division is divided as follows: kindergarten, primary school, junior middle school and senior middle school. Considering that the stage of primary school is longer, it may be divided into three levels. As a result, the vertical levels show as follows: k (kindergarten), primary school (1-2, 3-4, 5-6), junior middle school (7-9), senior middle school (10-12).

Knowledge block can be divided as three kinds of educational factors: **subject knowledge**, which goes hand in hand with the knowledge gotten at school. Once this kind of knowledge can be mastered through playing games, it is helpful for teaching and leaning at school. **Skills and strategies**, which can be trained in games, such as abilities of physical coordination, decision-making, dealing with thorny problems and so on. These skills and strategies trained in games will promote individuals to study and behavior well. **Extended abilities** mean the abilities seen as the basis and preparation for the future's success, such as willpower, abilities to cooperate and reflect. It is not easy to obtain such abilities from games directly, but playing electronic games can do good to excise such capabilities.

So, let's see initiative appraisal system in the table below. (KB- Knowledge block. SD- School division)

Table 3. The initiative appraisal system

KB / SD	subject knowledge	skills and strategies	extended abilities
K	learning words, reciting poetry, reading stories, listening music	operating computers imitatively	relieving tension, experiencing joy observational ability
1-2	learning vocabulary, common sense, being familiar with the keyboard,	skills of verbal expression, ability of eye-hand coordination	ability of imagination, sense of independence
3-4	composition, mental math, drawing	skills of reading and writing, perceiving social rules	fostering good personality, enhancing memory ability
5-6	listening and Speaking English, natural knowledge, code of Ethics, knowledge about environment and society	ability to respond, interactive skills, ability of reasoning preliminarily, searching principles and rules	harmonious partnerships, positive character orientation, stimulating learning interest, enhancing self-confidence
7-9	two-dimensional space, music, knowledge about history, biology, and geography	dealing with thorny problems, evaluation different opinions, coping with the challenges, abstract thinking	cultivating reflective ability, ability of self monitoring and self-awareness
10-12	three-dimensional space, virtual scene, English reading comprehension, humanistic knowledge, information Literacy	competitive strategies, sense of unity, organizing and constructing knowledge, awareness of distance learning	cultivating aesthetic taste, enhancing intrapersonal capacity, dialectical thinking, foster a lofty ideal, sense of responsibility

3.4 How to make the system more scientific and precise

As we can see in the table above, the appraisal system is very initial and simple. Besides, the specific indicators need to be demonstrated further. So, choosing specialized methods to verify these indicators is our next work. Only doing the following work better can we set up a practical and scientific appraisal system in the next step.

We plan to adopt Delphi Method to construct the indicators in the rating system. There are such steps in the nest work:

First, establish a group of experts. Experts in the group must be familiar with research about electronic games. They do research on electronic games in different views.

Then, we need to set up an initiative indicator system with different levels. This system can be used as basic materials.

Third, the implementation of several surveys needs to be finished. The initiative indicator system and some reference material will be handed out to the experts. We shall modify and improve the indicators based the feedback from the experts. The final rating system will be established when the experts' views become unanimous.

4 Conclusion

Well, in the end we want to say that we shall not only do research from the academic angle, but also need to consider actual feasibility of the system. As the passage mentioned, the existing game rating systems have exposed a series of problems when implemented. In our country, some organizations can develop and publish relevant standards, but such organizations are unable to ensure the effect. So, we hope that we can gain the support of relevant government departments. Besides, calling for legal support and teachers and parents' assistance is also necessary. Only by these ways can we put the appraisal system into effect well.

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Learning Performance Support System (LPSS) *

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Abstract. People (adults) often encounter some problems or questions in their practical work, it is very expecting others advice or help. Through the advice or help to solve the problem, this process can also be called as a kind of "learning" which is simply called as the "learning by doing". This paper discusses how to realize a learning performance support system (LPSS) based on the ideas of electronic performance support system (EPSS), shows LPSS basic concept, system structure design, and system implementation, including some technical issues.

Keywords: Learning support; LPSS; Learning by doing; System design

1 Introduction

The main purpose of people study at school is for getting certain knowledge base and skills before going to work and society, such study can be called as “learning first, doing late”, but when people study on jobs could be referred to as "learning by doing". In a sense, the most studies should occur in real work, the so-called "lifelong learning" also shows this meaning.

With the rapid development of technology and the application in education, the concept of electronic performance support system (EPSS) was put forward for supporting leaning by doing in the early 90s. Of course, EPSS was first put forward to support some parts of the work (e.g., bank, consulting services) when people encounter difficulty problem on the job, also similar to an expert consultation system. With social development speeding up, new technology and knowledge up-to-date fast, people will feel their existing knowledge has almost hard with the actual work. This forces people to seek a kind of "learning by doing" or “timely study” way which can help or support to solve the practical work issues. In addition, the modern educational ideas need highlighting learner-centered, individualized learning, and on-demand learning. In this context, the PSS concept in different fields had a rapid development, especially in some developed countries, some big companies or enterprises. Some companies was also applied the EPSS system directly for the human resource development. And in the late 1990s, many developers in CAI field was turning to the

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EPSS development. Of course, from the angle of technical support, multimedia and network technology development are completely inseparable for the development and application of EPSS.

In China, although people know the EPSS concept, its real practical function, detail principle, structure, and especially practical development and application are still a complete blank. Many specialized companies are engaging in the development of learning software (such as courseware or learning resources) basically belongs to type of "learning first doing late".

2 EPSS concept

EPSS concept has a key word "Performance" that means people to perform, execute, or do a job or task. It is an action (more clearly refers as doing a job, means a process). But, many scholars in China think performance as a result or achievement, not a process. Although the target of EPSS is to improve the result or achievement for a task, the word "performance" in EPSS is a process that also means EPSS is expected to help or support such task process. In fact, EPSS is much like an expert system (ES) or computer aided design system (CAD), they are all the aided and support systems that help or guide people to solve some problems in the process of their work. Of course, there are many educational systems similar with EPSS, such as IDS (Instruction Design System), ID Expert (Instruction Design Expert System), CMI (Computer Managed Instruction System), or even CAI (Computer Aided Instruction System).

Gloria developed the performance support concept -- and works with numerous sophisticated clients in developing performance centered software applications. She given the definition of EPSS [1]: EPSS is an integrated electronic environment, more specific (any computer software), and can help employees reducing unnecessary procedures in the executing and completing tasks, it provides necessary information related to finish the task, or provide decision support to employees know the specific conditions. Also Angus and Thomas [2] was also pointed out: EPSS is a more integrated program software that can provide the required information to support work, including the expert system, hypertext, hypermedia, vivid animation, CAI courseware. This also means that EPSS is indeed a support system for information or knowledge which is embodied in the process of work. The process of support and help can simply called as "doing" or "learning by doing". Of course, because "learning by doing" has very strong purpose and direction, and providing support to help to solve the actual working problems, EPSS concept raises great interests and attentions in different fields.

3 LPSS structure and function

As LPSS is indeed a system for supporting learning, the key point is to have "learning in time" and "responding on demand" function. For users (or learners), it is a "learning in time" and "responding on demand" process when he or she can receive

timely help and support for the difficult problems encountered in their actual work. Here the word “learning” is to clear indicate the major function of LPSS system and its purpose is to reflect "doing" and “timely learning” characteristic. With any application system, LPSS structure is decided by its main function. As EPSS is a kind of strong purpose and direction system, the key is able to help people to solve the complicated problems in practical work. Purpose means to "can help to solve practical problems (answering difficult problems)”, and the direction refers to directly related to the actual work. Because of the strong purpose and direction, the structural design and the realization of function are more difficult than traditional system (tutoring type).

Basis on "doing" and "solving actual problem", the core characteristics of LPSS system should be composed of two major parts: Problem Comprehension and Problem explanation. Problem comprehension refers to analyze and understand the problem posed by the user (workers or learners) in their practical work. If a support and help system can not clearly understand user’s questions, how could give a correct answer. Problem explanting means to offer users some satisfactory answers and solutions. Of course, satisfactory answers or solutions are completely depending on the clear understanding for the problems (or questions). For a usable system, a friendly user interface is an indispensable part. Figure 1 shows the core structure of EPSS.

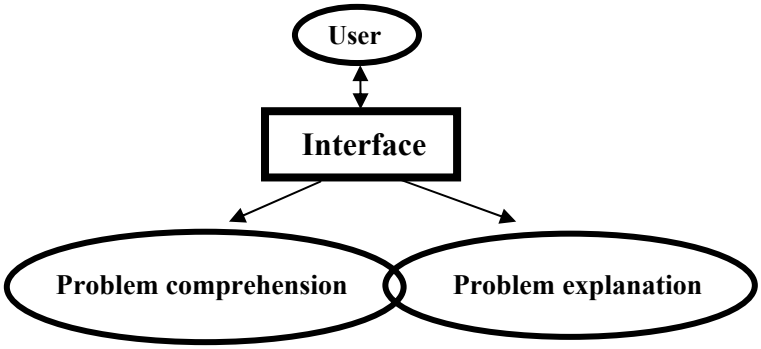

Fig. 1. Core components of LPSS system

(1) Problem comprehension

As a support system, especially for solving user knotty problem at work, the most important or most basic thing is to know what users want to know, support and help (simple says what specific needs or solutions are needed). The part of problem comprehension is in order to accurately understand and identify the user’s problem. The realization of such function must be taken into account from knowledge or problem expression, and semantic understanding, etc. Currently a feasible method to solve this kind of problem is ontology methodology, because the ontology can be used for expressing knowledge structure. For a given domain, its’ ontology will constitute the core of the system of knowledge representation, but also the basic definitions (terms) or the knowledge representation vocabulary. In addition, Ontology knowledge can be shared in the same field which is not to repeat the analysis process and can also share the knowledge representation language [3]. The process of problem

comprehension based on ontology is as follows: (detail processing method can refer to Wu Chenggang, etc. [4])

- Analysis question ontology (note: every ontology has already own concept - beforehand dictionary)
- Filtrate ontology not related to issues, find out ontology related to issues
- Rank according to the size of relevant degree
- Take the biggest relevant degree ontology as first analysis choice
- Figure out the problem type through pattern matching method (problem type usually divided into "What", "Why" and "How")

Through above steps, we can draw ontology and subordinate type of user questions. After determining the ontology and types of user problems, it is easily to realize searching for the corresponding answers. Of course, because the same field can build more than one sub-ontology (or sub-domain), and every ontology can represent a unit, a section, or even whole teaching units, the concrete implementation for a domain is directly to analysis question type, then search the answers. For the ontology analysis and correlation analysis, they usually need to spend more time and memory space.

At present, there are many methods to achieve problem comprehension based on the computer, but the actual application is very few. In some practical using systems of various support (including expert consultation, etc.), they are usually to show the question types to user, and then ask user to select one of them. This method in some cases can solve some problems and is more easy realized, but often many times are hard to meet the practical need to users (such case can be found everywhere in many application software). This situation is not only related to the induction for field questions by developers, but also includes the limited ways for problem representation.

(2) Problem explanation

An important part of LPSS system is to offer the answers to users for their actual work questions. The function of problem explanation is to provide correct answers based on the problem comprehension. In a sense, this part is equivalent to a FAQ knowledge base. Specifically, it is completely answer base according to probable problems of certain areas and created based on the ontology method. Usually, the process for building such base is mainly divided into several steps:

- Sum up all possible problems for a field, and establish a complete list of questions
- Create a complete set of corresponding answers according to the list of questions
- Use natural language and charts to describe field model and form ontology prototype
- Use knowledge representation language to code ontology model, for easy searching

It is a very important step to sum up all possible problems for creating a corresponding answers base for a field. This work is generally not according to the contents of textbook and must do by several experts with abundant work experiences. It is a real induction process based on actual work experience, which reflects the characteristic of LPSS system. Based on the induction, several experts start to work on all possible answers, eventually forming a complete answers base. Following the list

of questions, you can create prototype of ontology. Due to the knowledge expression in different areas could be completely different, the prototype can be fully different body. For example, a prototype body of ontology can be a word or sentence, also can be a section or paragraph. But regardless of the size of ontology prototype is big or small, it is the key to establish a keyword set based on the list of questions and how to extract a keyword. The keyword set contains all keywords, and each keyword has its number and weight value. The weight value indicates the important of that keyword. The size of each keyword weight depends on it usage frequency in the system, and is counted by the system, more use more value. Actually, the keyword is also called domain ontology or sub-ontology, and it has an important role for searching.

From the standpoint of practical application, the problem explanation base for any field LPSS should be dynamic. Because the user questions may exceed the scope of inductive problem beforehand, and each field development will constantly make the new knowledge and problems. This requires the content of problem base with constantly updated and increased. So in LPSS system, setting up a new problem base is necessary. Experts in the field will answer new problems in time and deposit the new answers to the regular basis.

(3) Basic process for problem comprehension and explanation

When LPSS system is using, user directly proposes own problems through a friendly user interface. Problem comprehension part will first compare ontology and extract keywords, and then determine whether understand to this problem. If it is understood, it will directly go to the answers base for searching answers. For the understood questions, they usually already are in the list of questions in advance, and the answers can be easily reached according to the list. If they are not understood, they will be stored into the new problem base and the system will inform the user that question can not temporarily be answered. The basic process shows in Figure 2.

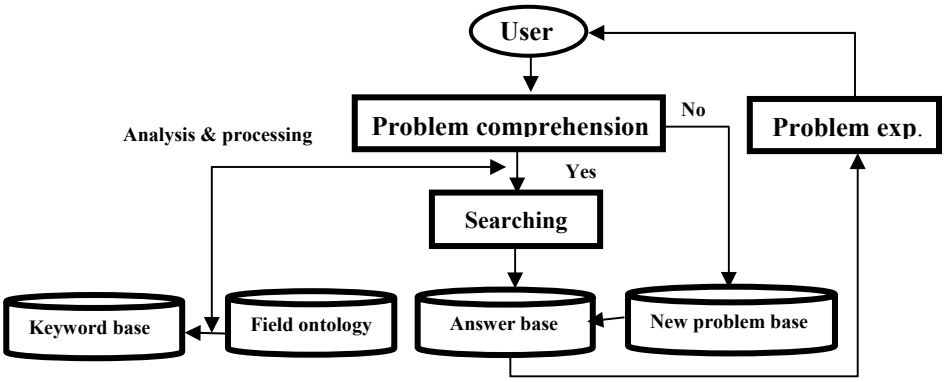

Fig. 2. Basic process for problem comprehension and explanation

4 Difficulty points of system implementation

LPSS as a strong objective and direction system, the key is "to solve or answer practical problems", especially difficult problem solutions and directly related to actual job (for satisfying customer demands). It means the system is dynamic (questions and answers not fixed), and the development and implementation for such system are not easy, at least following points are the key:

- **Determining and dividing for field ontology**

Ontology divided and determined are not easy, because the same words or sentences in different fields can be completely different meanings. In addition, any field (for example, education, industrial, commercial and military, etc.) is a large range in modern society, and each of them crossed and linked. Therefore, determining and dividing ontology should be directly with the field or even working position, and limit range as short as possible. If based on the position to determine the ontology, not only can limit the scope of knowledge clearly, but also can be greatly reduced the ambiguity of understanding. This task is usually needed very good cooperation between developers and field experts.

- **Forming problems and answers**

As forming (or collecting) problems and answers is not mainly to do by LPSS developers, it must be more specific domains (even practical working position) experts to work together. But the requirements of experts should have the rich practical experiences in their domain or working position. The first step is to sum up all possible problems in that field. The all problems are not only requires comprehensive and accurate, but also pertinence and unambiguous. Based on the problems summed, forming all corresponding answers is needed. This work can be attributed to the experts summed problems or can fully please other experts in same field to do it. Of course, the system developers must design a unity standard for problems and answers in advance, so that the all experts can form a required answers and problems in same format. As different domain (areas or position), different person (experts, developers, project manager), different users, such task is also not easy to reach.

- **Technical implementation**

For LPSS system, the keys of technical implementation are a friendly interface design, creating answer base (also problem list) and searching technology. Because LPSS is a learning support system facing different fields or job positions, a friendly interface design adapted different users is not an easy job. Designers could consider a basic interface framework that allows different user can choose a satisfied interface or their individualized interface. The interface is not only concise and intuitive, but more prominent characteristics are for convenient interactive, especially to consider how can the user easy input questions and show the answers. Creating answer base can use different available database technologies, but data storage in multimedia forms and quick searches are the main factors. And the answer base should be dynamic and extensible. Using different search technology will determine whether the system can

meet the customers with quickest speed to get the answer. Of course, all methods and ideas of various search engines in Internet can be referenced for realizing this, but the technical implementation is still more difficulty.

These aspects must face technical difficulties for the development of LPSS system. In fact, for the concrete implementation, the system will still involves many aspects of technical problems. For example, the system core architecture, layered structure, programming language, stand-alone or online (network) use, etc. Anyhow, LPSS development is larger project, it is worth to explore many issues in engineering technology and methodology, an also it is needed to have a large team to cooperate for reaching our ultimate target.

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The Use of Audience Response Systems Technology to Facilitate the Classroom Learning Environment

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Abstract. The development of information and communication technologies (ICT) has given universities an opportunity to improve their education services by implementing interactive learning technologies into the classroom. These technologies may facilitate more interaction between teachers and the learners hence enhancing the effectiveness of the learning outcomes in class. This study aims to identify the value of utilising an ICT technology — the Audience Response Systems (ARS) technology - clickers — in the classroom. In this study I have attempted to investigate how this technology can facilitate student learning. First year business students at Australian Catholic University (ACU National), Melbourne campus taking Accounting and Law units were selected for this study. The survey results reported in this paper represents the first step in a longitudinal study how to improve this technology for enhancing students learning in future.

Keywords: Computer supported collaborative learning, keypad clickers, first year experience, information and communication technologies (ICT).

1 Introduction

Penuel et al. suggested a generalization of earlier classroom response systems technology, Classroom Aggregation Technology for Activating and Assessing Learning and Your Students' Thinking which can produce sustained improvements in achievement and participation when coupled with an appropriate pedagogy of questioning [1,2]. Their literature review stated that Audience Response Systems (ARS) technology and the related pedagogy was a promising innovation for transforming classrooms to be more learner-, knowledge-, assessment-, and community-centred.

ARS allows large groups of students to vote on a topic or answer a question. Each student has a remote control with which they can select their options. Each remote control communicates with a computer via infrared receivers around the classroom. The lecturer asks a question in the lecture. Students choose their own options by pressing the buttons of the remotes. The system tabulates the results. The results are instantly shown on the lecturer's computer and displayed on a projector. Lecturers can choose tracking students' responses or not. If lecturers choose to track students' responses, the serial number of each remote control and student number are entered

beforehand in the lecturer's computer's database system. Hence the answer of each student can be identified when necessary [3]. ARS is also named as Classroom Response Systems, Personal Response Systems, Student Response Systems, response pads, wireless keypads, and "clickers" [4]. In the 1960's, a number of companies started to offer ARS. As mentioned in [3], ARS is very easy to use in educational environment as:

> *... audience response technology has evolved, taking advantage of Moore's Law, "The number of transistors and resistors on a chip doubling every 18 months" and Microsoft's dominance in presentation software to produce a product that was traditionally limited to polling specialists (typically required to implement a successful ad hoc polling event). Today's office professional (or professor) with average skills in Power Point can integrate audience response with credit card sized response pads running in a Power Point overlay to create powerful interactive presentations…*

Research projects for using ARS for teaching can be found in [5-15].

Most of our students are in Generation Y, who were born in between 1980 to 1994. They have lived through the age of the Internet, cable television, globalization and environmentalism. Such shared experiences during one's youth unite and shape a generation [16]. Traditional, teacher-centred, one-way lecturing instructional method is no longer suitable for their learning style. They enjoy sending SMS to their friends on their mobiles. They listen to the latest music on their MP3 players or ipods. Male students love to play electronic games. They are familiar and love Game boys, X-box, Wii and ipods - new technologies in their generation. It is time for us to reflect how we should make use of modern technology to enhance our teaching.

ACU National has followed the trend across the Australian tertiary sector of investing a significant proportion of its educational budget into ICT designed to improve the university's learning and teaching resources and capacity [17]. ICT projects at ACU National include Computers on Wheels – a portable computer laboratory – and enhanced wireless access [18]. Since the use of ICT is generally encouraged and has, to a large extent, become unavoidable in university educational settings, it is important to examine the use of some ICT technologies related to the teaching and learning context, particularly those related to current ACU National teaching practice. Hence, teaching and research grants were approved for the purchasing of clickers for this study (see Figure 1 below). The aim of this study was to stimulate students' interest in the class through the ARS technology - clickers. Two first-year units, ACCT100 Principles of Accounting and LEGL101 Introduction to Law, were selected for this study. Lecturers posted questions on the Power Point slides in the class from Weeks 4 to 11. These questions were either multiple choice or true/false questions. Students pressed the clickers to indicate their answers. Such tool encouraged students who were shy to express their views in the class. At the end of the semester, students were requested to evaluate the effectiveness of using clickers in the class by answering the survey. Students give their responses through keypads.

Fig. 1 A clicker used in this study

1.1 ARS enhances quality flexible teaching and learning at ACU National

Policy on Quality Flexible Teaching and Learning [19] was approved by ACU National Academic Board on 23 July 2008. The followings are some discussions on how ARS can enhance quality teaching and learning based on the policy which are listed in italic below.

- *The University will use current and emerging flexible technologies to enrich learning experiences where the mission of the University can be extended, value added for students, and cost effectiveness demonstrated.*

Students actively participate in the class as they need to respond to the questions that the lecturers ask. By seeing the results of the others students' response, they can learn from others. This technology can add values to students learning.

- *The University will adopt University-wide quality assurance processes to ensure the appropriate use of current and emerging technologies for teaching and learning, including planning, design and development, implementation, evaluation and feedback, and revision.*

The system can show instant responses from students. If many students do not get correct answers, lecturers can explain the concepts once more. Cooperative learning among students and lecturers are encouraged. The system can also help students in revision and consolidation of what they have learnt.

- *The University will support students to develop the abilities to use current and emerging flexible technologies to enhance their learning experiences.*

ARS is one of the most mature information and communication technologies and can be used to enhance students learning experiences.

2 Research Methodology

A qualitative, interpretive approach was adopted as the research method for this study. This study utilised both surveys and interviews. Two first year units in the Bachelor of Business at ACU National have been chosen for this study — LEGL101 Introduction to Law and ACCT100 Principles of Accounting.

The survey was collected (utilising keypad 'clickers' to record responses) in class in Week 12, the last week of the semester (see Appendix 1 for the Survey Instrument). This survey was administered via an independent staff who had no teaching responsibility in either of the units being surveyed. This removed bias

or fear from students that they should respond with what they thought the teaching staff would require and that their results would be completely anonymous so that no repercussion was experienced from providing negative feedback (that is, completing this survey was completely independent of the results they would get for the units). In addition to the survey data, interviews were conducted with five students selected from each unit (see Appendix 2 for the interview questions). The plain language statement and the informed consent form were presented to the students prior to the survey and before the interview. The survey responses were entered into a Microsoft Excel spreadsheet for data analysis preparation. The interview results were analysed using quantitative and qualitative data analysis techniques.

2.1 Research Questions

This research explored the following questions:

Research Question 1
Can the use of keypad 'clickers' in classes support the different learning styles of students?

Research Question 2
Can keypad 'clickers' assist to offer a classroom learning environment where students and staff feel comfortable to interact, discuss and collaborate?

Research Question 3
Does the use of keypad 'clickers' improve feedback to students in the class?

3 Results Findings and Discussion

The survey results utilising keypad 'clickers' to record responses in the class in Week 12 and the findings of interview are discussed in Sections 3.1 and 3.2 below.

3.1 Survey results

The survey results are listed in Tables 1 and 2 below.

Table 1 Survey results of Principles of Accounting students (a total of 33 students)

SD – strongly disagree; **DA** – disagree; **NE** – neutral / not sure; **AG** – agree;
SA – strongly agree; **IN** – invalid; **NR**- no reply given

Questions	SD	DA	NE	AG	SA	IN	NR	Total
Normally it is easy for me to speak up or ask questions in class.	6%	0%	24%	33%	24%	9%	3%	100%
Normally I find it hard to stay focused in class.	6%	21%	21%	21%	9%	6%	15%	100%
Normally I wish someone else would ask the questions.	12%	18%	39%	24%	0%	6%	0%	100%
Since the introduction of the clickers, the class is more interesting.	18%	15%	21%	30%	9%	6%	0%	100%
Since the introduction of the clickers I am more confident in my knowledge at the end of the class.	21%	27%	18%	24%	0%	6%	3%	100%
I think I learn more in class with clickers.	27%	18%	21%	21%	3%	9%	0%	100%
Since the introduction of clickers I get more feedback in class which helps me to have a better understanding of the materials.	18%	27%	18%	12%	6%	12%	6%	100%
Since the introduction of the clickers, I come to class more often.	42%	15%	12%	12%	9%	9%	0%	100%
I think there has been more interaction in class using the clickers.	21%	6%	18%	30%	12%	9%	3%	100%
The clickers do not make any difference.	21%	21%	15%	15%	18%	9%	0%	100%

Table 2 Survey result of Introduction to Law students (a total of 46 students)

SD – strongly disagree; **DA** – disagree; **NE** – neutral / not sure; **AG** – agree;
SA – strongly agree; **IN** – invalid; **NR**- no reply given

Questions	SD	DA	NE	AG	SA	IN	NR	Total
Normally it is easy for me to speak up or ask questions in class.	2%	4%	28%	48%	13%	0%	4%	100%
Normally I find it hard to stay focused in class.	4%	22%	30%	35%	7%	0%	2%	100%
Normally I wish someone else would ask the questions.	7%	26%	28%	28%	11%	0%	0%	100%
Since the introduction of the clickers, the class is more interesting.	11%	22%	17%	39%	9%	2%	0%	100%
Since the introduction of the clickers I am more confident in my knowledge at the end of the class.	17%	33%	30%	17%	2%	0%	2%	100%
I think I learn more in class with clickers.	22%	15%	26%	24%	7%	2%	4%	100%
Since the introduction of clickers I get more feedback in class which helps me to have a better understanding of the materials.	13%	33%	22%	24%	4%	0%	4%	100%
Since the introduction of the clickers, I come to class more often.	39%	24%	22%	9%	7%	0%	0%	100%
I think there has been more interaction in class using the clickers.	15%	22%	20%	35%	9%	0%	0%	100%
The clickers do not make any difference.	13%	30%	9%	11%	35%	2%	0%	100%

Research Question 1

Can the use of keypad 'clickers' in classes support the different learning styles of students?

Survey results and discussion

- 30% of Accounting and 34% Law students feel uneasy to speak in classes or ask questions in classes.
- 30% of Accounting and 42% Law students found it hard to stay focused in classes.
- 39% of Accounting and 48% of Law students found that classes were more interesting since the introduction of clickers.

There is not sufficient evidence to support this research question. However, the result indicates that a reasonable portion of students prefer to have clickers in the class.

Research Question 2

Can keypad 'clickers' assist to offer a classroom learning environment where students and staff feel comfortable to interact, discuss and collaborate?

Survey results and discussion:

- 24% and 19% of Accounting and Law students found themselves more confident in their knowledge at the end of the class since the introduction of clickers.
- 24% and 31% of Accounting and Law students thought that they learn more in class with clickers.
- 21% and 16% of Accounting and Law students claimed that they come to class more often since the introduction of clickers.

The survey results indicate that clickers may not reach their maximum effect of offering a classroom learning environment where students and staff feel comfortable to interact, discuss and collaborate.

Research Question 3

Does the use of keypad 'clickers' improve feedback to students in the class?

Survey results and discussion:

- 18% of Accounting and 28% of Law students believed that they had more feedback in class which helped them to have a better understanding of the material.

The survey results indicate that clickers do not improve feedback for the majority of students in class.

3.2 Results findings from the interviews

The survey results indicate that students prefer to have clickers in the class. It may be due to Generation Y students prefer technologies particularly pressing the buttons type. However, the results do not have positive outcomes on the areas such as "clickers can support the different learning styles of students"; and "students and staffs feel comfortable to interact, discuss and collaborate". Five students from each unit were interviewed to consolidate the survey findings. Their responses are summarised below.

The interviewed students, in general, found the clickers could increase students' participation in the class but not the interaction. It is particularly useful for those shy students. Students appreciated the instant response so that they know instantly whether their answers are correct or not. Students suggested increasing the time allowed for answering each question. Lecturers usually set 30 seconds as a norm for answering each question. Students' feedback was that thirty seconds were not enough for them to think about the questions thoroughly and that they had no chance to discuss with others. They preferred to have more time for each question so that it allowed sufficient time for them to discuss with their classmates in order to achieve the objective of "interact, discuss and collaborate" by using the clickers technology in the class.

The interviewed students suggested not registering their student numbers with the clickers as their perception that their responses would be recorded for their performance. We did not realise such impact to the students, as registering student numbers on the clickers was only for us to keep track of the clickers.

Students are excited to see the results of the answers in a graphic form. However they commented that the lecturers did not explain the results thoroughly. They expected the lecturers to explain the results in more detail such as why their answers are wrong. This would then enhance their learning in the class.

Students also suggested clickers may be used in the class in "some" weeks but not most of the weeks, otherwise they would get bored. Other forms of technologies could be used in order to make the class more interesting.

Besides Law and Accounting units, the interviewed students believe that this technology can be adopted in the class of other units such as Marketing Research and Management units.

4 Conclusion and Future research

Seventy nine students participated in the survey in the last week of the semester. The survey results indicate that clickers offer a minority of students the opportunity to achieve better outcomes through a change in the learning environment. Lecturers found that it was very time consuming to set up the equipment and software. However, some students found the classes more interesting since the introduction of clickers. Clickers are most effective when they are used to capture some students' attention and to engage them intellectually with their lecturers.

Further investigation should be carried out (before and after using the clickers) on student perception and their learning styles. Student survey should not be undertaken in the last week in the semester, as the attendance rate is generally low.
I realised that the clicker technology implemented in this study is not as successful as other similar projects or cases. Through our interviews with students, I realised that the key reason for such unfavourable feedback from students and staff may be attributed generally to the timing of each question. Points to be addressed include, firstly, students do not have enough time to think and discuss the questions, and secondly, lecturers should explain in depth how and why students' answers were wrong. Moreover, student numbers should not be registered on the clickers as students could have a perception that we are checking their performance.
In future research, the above mentioned problems must be solved and then we should concentrate on utilising different pedagogical design in using the 'clickers' in class with an emphasis on determining students' *perception* of:

1. effective feedback on their learning during class,
2. satisfaction with learning at the end of class, and
3. student engagement in class.

Further research on Generation Y students learning style and communication methods, e.g. similar study as in [20], will be undertaken. Various technologies such as online multiple choice quiz, online discussion boards for hybrid learning will be incorporated into the functions of the clickers in order to increase students' learning motive.

5. Acknowledgements

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Appendix 1

Class Survey Instrument

The Use of Keypad 'Clickers' to Facilitate the Classroom Learning Environment

You have been selected as a student enrolled in LEGL101 / ACCT100 (delete one) where clickers have been used in your class this semester to participate in this research. Please answer all questions. Your results will remain anonymous and confidential and no student names or numbers are collected or recorded with the data.

Please press the number on the clickers to register your response.
1 – strongly disagree
2 – disagree
3 – neutral/ not sure
4 – agree
5 – strongly agree

Questions:

A. To what extent do you personally agree/identify with the following three statements:
   1) Normally it is easy for me to speak up or ask questions in class.
   2) Normally I find it hard to stay focused in class.
   3) Normally I wish someone else would ask the questions.

B. To what extent do you agree or disagree with the following statements about your experience in the LEGL101 /ACCT100 (delete one) classroom since the introduction of the Keypad 'Clickers'**:**

   4) Since the introduction of the clickers, the class is more interesting.
   5) Since the introduction of the clickers I am more confident in my knowledge at the end of the class.
   6) I think I learn more in class with clickers.
   7) Since the introduction of clickers I get more feedback in class which helps me to have a better understanding of the materials.
   8) Since the introduction of the clickers, I come to class more often.
   9) I think there has been more interaction in class using the clickers.
   10) The clickers do not make any difference.

Appendix 2

Focus group interview questions

Five students will be interviewed from each unit — LEGL101 and ACCT100.

Answers will be sought from each of the following questions:

1) What do you think were the good things about clickers?
2) What do you think were the bad things or problems with clickers?
3) Have clickers helped increase your own participation?
   If yes, then ask "How?"
   If no, then ask "Why not?"
4) Do you feel the introduction of the clickers has helped increase overall class interaction in LEGL101 / ACCT100?
5) Do you think the introduction of clickers in LEGL101 / ACCT100 makes class more attractive to students?
6) Are there other units that you think might be suitable for clickers?
7) What didn't you like about using clickers in the class?
8) Do you have any suggestions on how to improve the use of clickers in class?

Pragmatic Elements on Distance Learning Transformation

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Abstract. The Distance Learning (DL) courses of the School of Continuing Study and Professional Studies (SCS) at The Chinese University of Hong Kong have a well-run traditional regular paper-based DL business model. This study is to reinvent the traditional business model by investigating the steps needed to re-engineer the old practice in line with the advance of IT development. After the DL Business model is reviewed, a number of critical success factors (CSFs) that are crucial in shaping our DL students into the 21st century are identified. The DL change model consists of three ingredients: cultural change, operational change, and other parallel changes in supporting the new scheme. To minimize the impact and risk of drastic changes, a three stage process is highlighted. Many research studies indicated that the best model for Internet-based DL in the higher education sector is the "blended-learning mode". So far, the transformation has demonstrated satisfactory results.

Keywords: distance learning, eLearning, critical success factor, blended-learning, global knowledge economy, ICT, learner-centered.

1 Introduction

The University's Department of Extramural Studies was established in 1965 and renamed to the School of Continuing Studies (SCS) in 1994 and later renamed to the School of Continuing and Professional studies in 2006 due to the changing School missions. Since then, SCS has been providing quality continuing education programmes and services to meet the changing needs of Hong Kong. Hong Kong has transformed from the manufacturing industry of the mid 1970 to the current service industry. The recent downturns of the Asian Financial Crisis in 1997, the SAR in 2002 and the recent Global Financial Tsunami have prompted the public concern in the future of Hong Kong's competitiveness. This 21st Century is characterized by business development at Internet speed, short product cycle, short knowledge life span, changing "literacy" requirements, more career switching and continuous learning. In parallel to the flux of globalization, Hong Kong has an urgent need of key strategies in re-building its competitive human capital to meet the new age challenge. SCS has risen to this challenge.

Knowledge is a key element in driving the global knowledge economy. Knowledge not only aids our innovations but re-shapes our services by adding values. To cope with the need of continuous knowledge enhancement of our students, SCS has taken this opportunity to initiate changes in our current DL practices in line with the advance of Information and Communication Technologies (ICT) development.

Effective integration of ICT and pedagogical use of technology to bring about traditional DL transformation has been eagerly studied in the past ten years. Even after the Internet burst in 2001, various countries have put in place the strategic importance of ICT in education. For examples: The UK government published a public consultation document titled "Towards a Unified E-Learning Strategy" in July 2003 [1]. In Taiwan, e-Learning even became a National Project in December 2003 with a committed five years budget of US$229 million [2]. This project had ambitious seven tracks: e-Learning for everyone, Narrowing the digital divide, Mobile learning devices, multi-function e-schoolbag, Network science park for e-Learning, R&D of advanced e-Learning Technology, Fundamental research on learning and cognition in e-Learning, and Policy guidance and manpower cultivation.

A local interview survey of Internet learning for Hong Kong education stakeholders was published in 2000 [3]. The survey concluded that the Hong Kong education stakeholders are familiar with using Internet technology. The ICT infrastructure, skill competency and social acceptance are quite mature. The report had identified that the significant elements for successful deployment in distance learning are as follows: incentives to teachers, good supports from administrative and technology staff, a clear growth and conversion plan for the traditional teaching material to on-line learning material, and a blended learning approach. The HK eLearning scenarios have a strong support from the HKSAR Government. The "Information Technology for Learning in a New Era: Five-year Strategy-1998/99 to 2002/03" had laid down a good foundation for the vision in the use of IT to enhance teaching and learning for teachers and students with a view of preparing students in the information age and also fostering collaboration among schools, parents and the community [4]. The current study is just another step in implementing some of surveyed ideas plus views of various researchers.

2 Implementation

ICT can help to create learning environments very differently from the traditional model by engaging students to be learner-centered with different supporting elements. The DL change model that is being adopted consists of three ingredients: cultural change, operational change, and other parallel changes in supporting the new scheme. To minimize the impact and risk of drastic changes, a three stage process is highlighted in Figure 1 with the business model shown in Table 1. This table has re-engineered the old model into the new model in a three stage progressive time steps. Table 2 illustrates the three major ingredients with the CSFs to be involved in respective time processes.

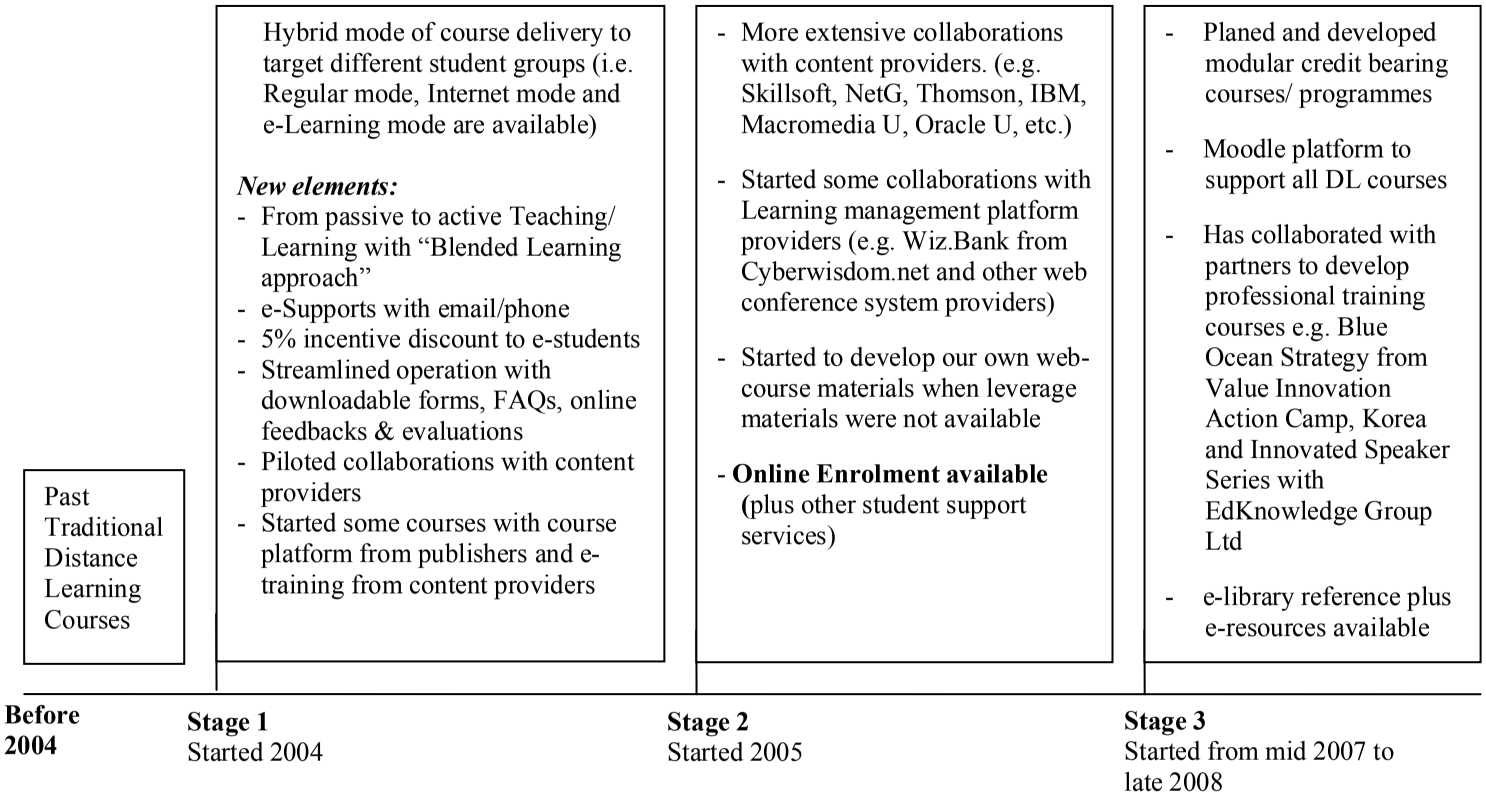


Fig. 1. Stages of Distance Learning Transformation

Table 1. The Re-engineering Model of Distance Learning (DL)

Change Agent	Traditional DL System (Paper-based delivery)	New DL System (Hybrid mode with IT enabled processes)	Achievable Stages (see targeted periods)		
			First Stage (Started 2004)	Second Stage (started 2005)	Third Stage (started at mid 2007)
Model	- Paper-based - Just-In-Case	-Just-In-Time (with 21st century skills) -IT enabled (i.e. Web-based) -Student can participate, engage with peers & tutor/mentor/coach -content updated with time & be extensive Blended approach: Intervention (tutor/coach/mentor, self-paced, virtual, Collaboration /Performance support)	Mixed modes -establish groups with shared needs -mentor/tutor intervention -online content - build long term relation (no walls with SCS)	Same (more extensive) -support to tutor/mentor with web-conferencing -provide collaborative /Performance support	Entrenched eLearning into SCS culture -Blended Learning in DL difficult subjects -Individualize Teaching/ Learning
Market Spectrum	Targeted groups: -not focus -for professional / personal development -few awards bearing	Market approach: 1. 20/80 principles was applied to re-engineer focus groups in 1st stage re-engineering to popular courses in language, social science, management/business; 2. In 2nd stage, more courses were added to popular areas from online content providers e.g. Skillsoft, Thomson, etc; 3. In 3rd stage, course content for all: - modular courses with credit /award bearing; - non-credit professional /personal development.	All non-credit general DL courses	Some credit-bearing programmes were added	Suit all targeted groups with JIT.
Notes in re-engineer		Strike the right balance between Pedagogy, tools and resources for success	20% IT enabled	More extensive (60%)	Entrenched (100%)

Table 2. Three major ingredients involved in the new business model of Distance Learning (DL)

Change Agent	Traditional DL System (Paper-based delivery)	New DL System (Hybrid mode with IT enabled processes)	Achievable Stages (see targeted periods)		
			First Stage (Started 2004)	Second Stage (started 2005)	Third Stage (started at mid 2007)
1) Culture					
	Lonely Learners without much support, no intervention when students face difficulties	***Community Building Teaching/Learning elements Introduced:*** interaction, engagement, Intervention ***Add*** ***(***tutorial / phone / email, threaded-discussion)	***Help student*** establish groups in orientation with IT training workshop. ***Incentive for online students*** – 5% off course fee	**Online enrolment available**	Online e-library references available plus e-resources (e.g e-dictionary, Wikipedia, etc)
i) Course materials	- Registered mailing	e-Course materials with audio & video streaming	***Incentives*** for e-students to attend the orientation (IT training, emails/tutor phone, peer groups, important hardcopies notes)	Leverage with full-fledged e-Learning materials from publishers & content providers	With full features of eLearning with different assortment of courses to suit different individuals
ii) Assignment	- Registered mailing	-eLearning environment/ blend	Through email & mailing (non-Internet users)	Same	Same
iii) Assessment	- Graded by markers	- e-quiz /tests for learners' engagement/ interactivity with e-mentors	Graded by tutors only	Limited online quizzes & tests	More extensive

2) Operation					
i) Student support	- Very limited course advising, counseling & social support	***New services to be added:*** Orientation session for students to: - form study group - use e-support tools (discussion groups) - peer support group with e-mentor/tutor - help desk (email / phone) - FAQ service (learners find solution of usual problems) - E-chat / Web conference	-Provide orientation, help desk (email / phone)	-Web-conference added -Online registration with payment	-E-chat added -Complete online services available -Eventually with pre-enrollment services (recruit, promotion, orientation, etc), counseling & advising online
ii) SCS service audit	- Written comments by individual student / marker	- Online evaluation - Systematic review of support services / procedures	-Written/online feedback -Download forms for student services	-e-forms to streamline all student services	-Complete student e-support
3) Others					
i) Promotional image	- Printed leaflets/brochures - Newspapers / magazine - DL website	- ***Slogan*** (learners with skills of 21st century)	-Redesign all promotion materials	-Seek professional advice for media promotion	-Entrenched into whole SCS culture
ii) International 21st century image	-none	- Pilot in launching some popular courses / programmes to overseas		-Start pilot collaboration -Promotion materials with global and trendy images	-Entrenched in whole SCS

From Table 2, the three ingredients that distinguish the new DL with SCS traditional DL are contrasted and described below:

2.1 Culture Change:

The new DL model has been inspired with a new face, the **Flexible Just-in-Time (JIT)** "Distinct Blended Learning Approach for 21st Century" which can be taken at one's convenience with a connected community. For example, e-tools, help-desk by phone or email and discussion forum are in place to give students the sense of connectedness. Students are allowed to choose either a regular mode (traditional paper-based) or an online mode (Internet mode and e-Learning mode) of our DL courses. Online mode reduces much of our operational complexity.

2.2 Operations changes:

Costly manual processes are streamlined into IT enabled processes for both cost and operation effectiveness.

Table 2 stipulates the agents of changes to be achieved in 3 stages. It is quite important to balance the following three areas: Pedagogy (active, collaborative, transmission, etc), Tools (synchronous and asynchronous) and Resources (reference & course materials, questions, assessment and examples, etc.)

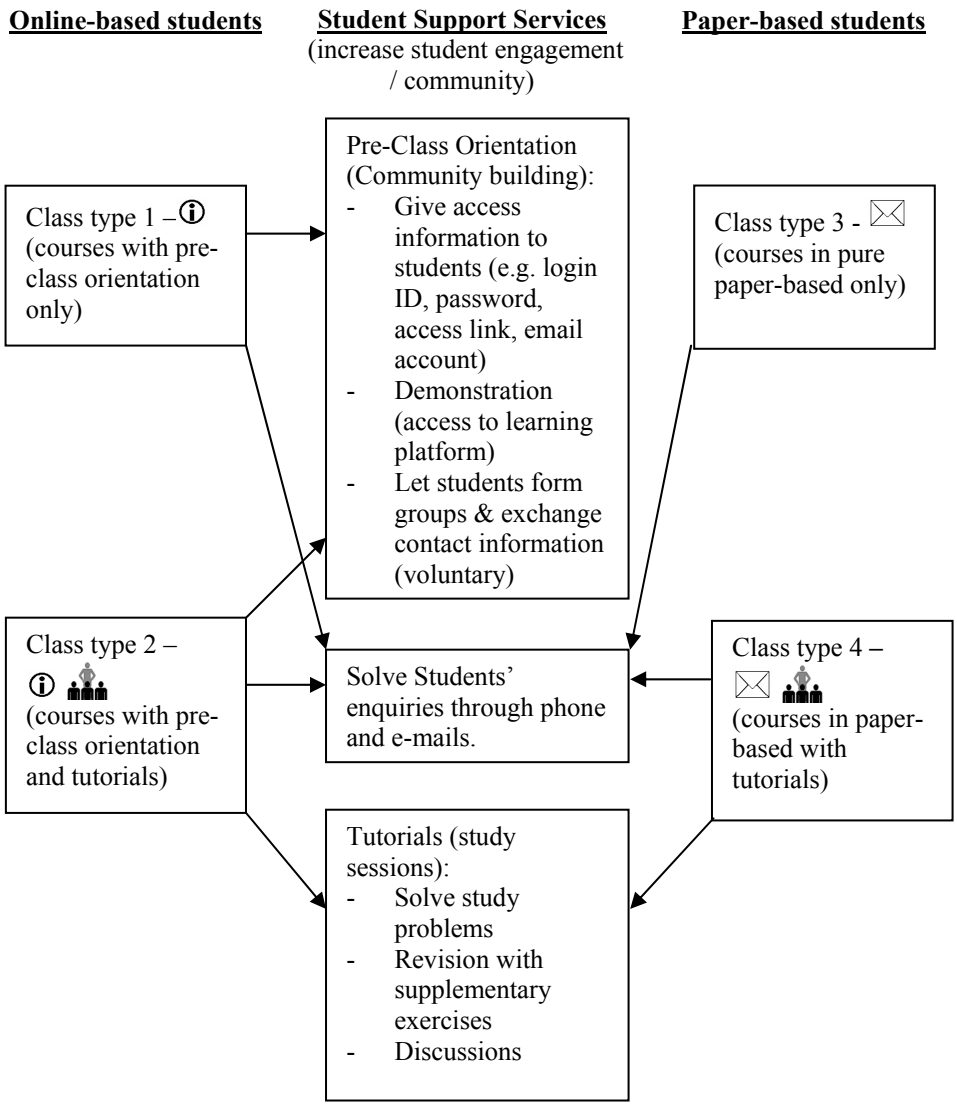
The ultimate aim is to provide learner the flexibility of study anytime, anyplace in a JIT mode. Study resources and helps (academic advice / technical support / peer support) are available via the virtual learning environment at anytime and anyplace.

2.3 Other parallel changes:

The changes in 2.1 and 2.2 above require the coherent changes in our promotional materials with new image and the course delivery structures such as choices of delivery modes and tutorial sessions.

Table 3 shows the operational differences of different classes of students registering different delivery modes.

Table 3. Diagram showing the Operational Differences of different Web-based and Paper-based Students



Legend:
Students recruited under different mode are indicated by
Internet modes: ⓘ only and ⓘ with Blended learning
Regular modes: ✉ only and ✉ with Blended learning

3. Discussions

In the first stage of change, we applied the "20/80" principle [5] from the Pareto analysis to the class enrollment profiles to identify the most popular courses to be offered starting 2004 Spring Term where each term lasting about four months. This 20/80 principle also helps us to select key new ICT processes in place to bring out these CSFs in the simplified three ingredients processes.
These CSFs are:

1. The fundamental Cultural Shift from a "lonely learner" to a "communal learner" environment with attractive courses that come with good e-support services that enhance good learner/tutor relationship.
2. Leveraging e-DL students with better trained IT skills which enable them better team building, collaboration and critical problem solving skills through the eLearning elements.
3. e-Learning DL is ubiquitous with great flexibility in meeting the personal and career goals with on-demand learning environment as "Just-in-time" than rather "Just-in-case", these will enable e-DL with access across international borders, and more attractive lower fees.
4. Good e-DL environment has to be equipped with good infrastructures such as adequate hardware, good bandwidths for access and e-library and other student e-services support.
5. Good training programs to help SCS staff and instructors to adapt to the e-learning culture.

These CSFs require an integrated understanding of e-learning plus the good training programmes at the initialization stage. These will render sustaining changes in later stages. This new learning environment removes traditional barriers inherent in our traditional DL model and helps SCS to have better connections or relations with our students.

Tables 4 to 7 in Appendix show the demographics of our DL student population. Table 4 shows the Students' Age Distribution in each term. The 60-70 % of students falls in age groups 20-to-40 years old given that slight percentage of students not giving their ages. Figure 2 clearly shows this majority of students in the age range from 21 to 40 while the age group of 41-50 is of third larger group. Table 5 in Appendix shows students' education profiles are mostly of secondary level up to university level (also see figure 3). The DL population is also shifting to more of post secondary and university level as shown in figure 3. Both figure 2 and 3 demonstrate that these age groups and their education profiles are more comfortable with eLearning methodology.

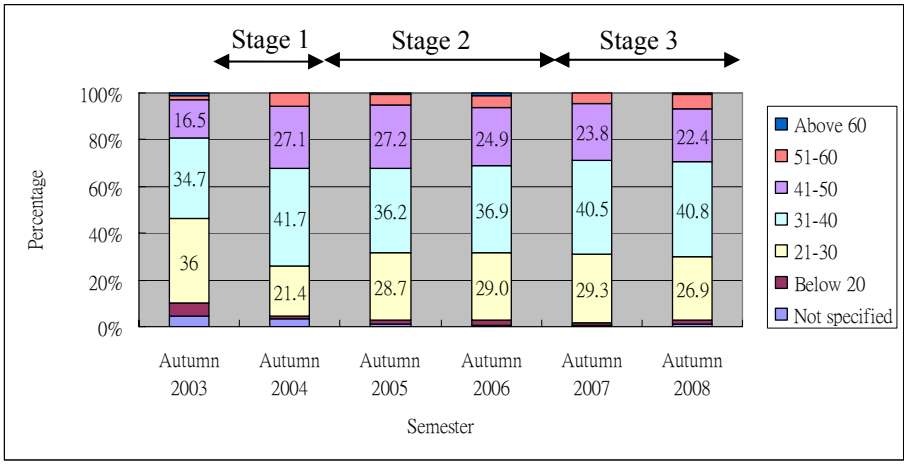


Fig. 2. Diagram showing students' age distribution

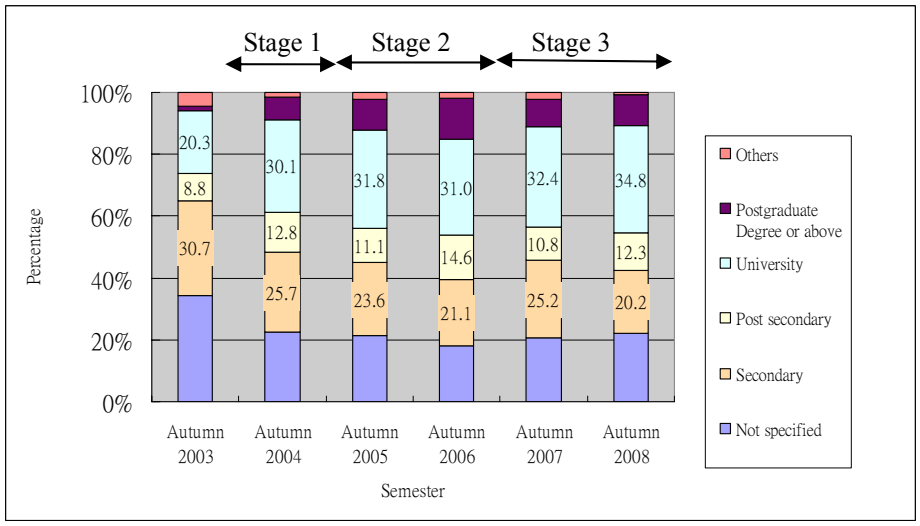


Fig. 3. Diagram showing students' education distribution

Table 6 of Appendix (also seen in figure 4) shows somewhat the DL student group are changing from the likely "home-makers" (Not specified group) to those from commercial, education and professional background during the stages of transition. The high female to male student ratio of 2:1 as show in Table 7 of Appendix (also seen in figure 5) just reflect the nature of SCS DL courses are of more personal enhancement rather than more career oriented courses.

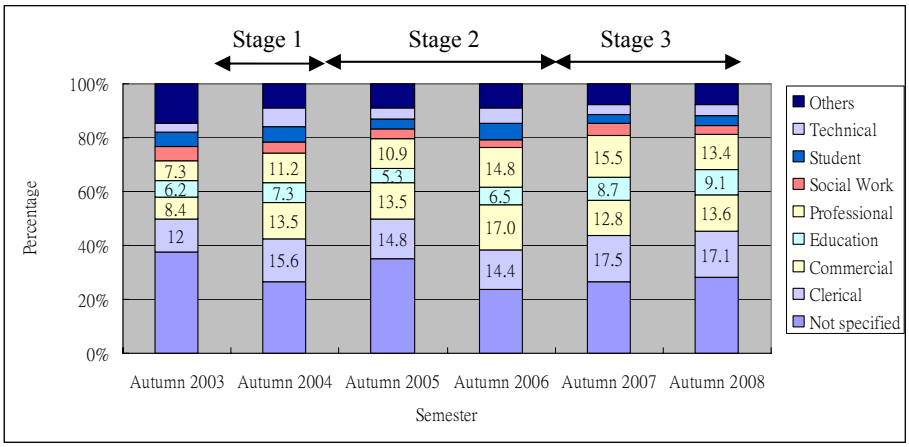


Fig. 4. Diagram showing students' occupation distribution

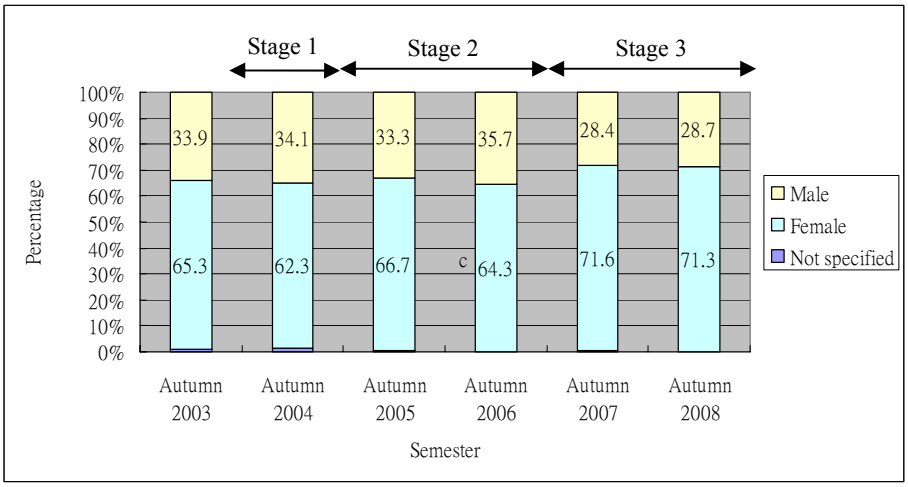


Fig. 5. Diagram showing students' gender distribution

4. Conclusions

The DL Transformation has been completed. It involves researching with different e-learning content providers in providing higher level interactive contents. These will help students to sharpen their spectrum of knowledge skills through different online interactive sessions. Learning supports like message board, e-mail and chat room encourages students to stay in contacts with our staff and classmates as well. This allows more immediate feedback and discussions. Students can help each others through responding to questions and tutors act as facilitators in the discussions.

According to the course evaluation, tutorials have proven to add significant value to the distance learning components in teaching and learning process. Students can learn more effectively through the blended learning mode. So far, both our experiences and outcomes are quite satisfactory with steadily increasing enrolment.

In the transformation during the first stage [Spring, Summer and Autumn of 2004 (i.e. 041. 042 & 043)] to second stage of implementation [starting Spring 2005], there is gradual increase in the enrolment numbers after key IT enable processes and additional courses selected for choosing (see figure 6).

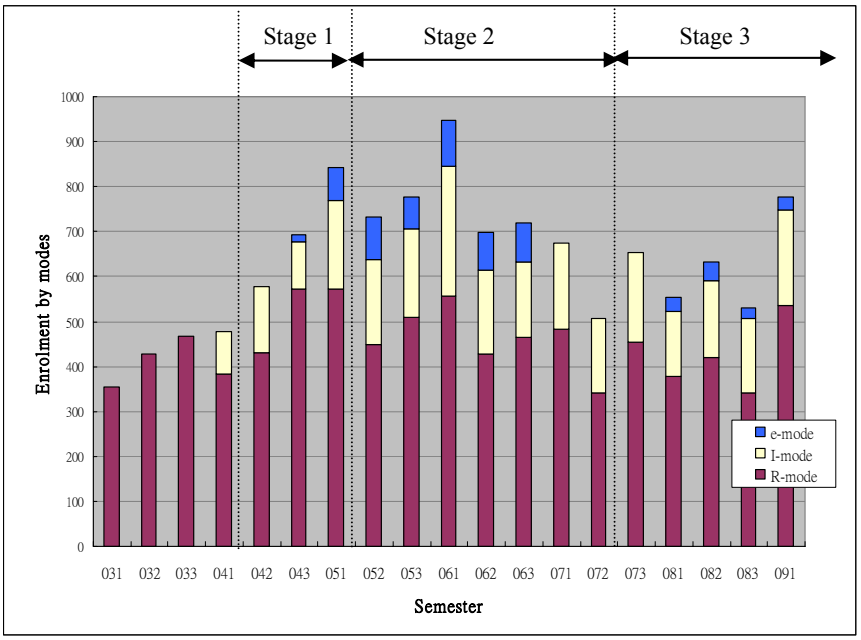


Fig. 6. Enrolment report by modes (2003-2009)

The significant increase in online mode students has demonstrated that there is such a demand. Incorporating significant Internet and e-learning components really cater for the diverse needs of students. Students not only can choose their study modes but also have their flexibility of getting the learning resources and support anytime and anywhere. In addition, the online mode also reduces the administrative manual costs of the school.

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Appendix

Table 4. Students' Age Distribution (Autumn 03 – Autumn 08)

Semester	Not specified	Below 20	21-30	31-40	41-50	51-60	Above 60	Total
Autumn 2003	4.3	6.0	36.0	34.7	16.5	1.5	1.1	100.0
Autumn 2004	3.3	1.1	21.4	41.7	27.1	5.1	0.3	100.0
Autumn 2005	1.0	1.7	28.7	36.2	27.2	4.8	0.4	100.0
Autumn 2006	0.6	2.3	29.0	36.9	24.9	5.0	1.4	100.0
Autumn 2007	0.4	1.2	29.3	40.5	23.8	4.7	0.0	100.0
Autumn 2008	1.2	1.8	26.9	40.8	22.4	6.1	0.8	100.0

Table 5 Students' Education Level Distribution (Autumn 03 – Autumn 08)

Semester	Not specified	Secondary	Post-secondary	University	Postgraduate Degree or above	Others	Total
Autumn 2003	34.3	30.7	8.8	20.3	1.7	4.3	100.0
Autumn 2004	22.7	25.7	12.8	30.1	7.3	1.4	100.0
Autumn 2005	21.4	23.6	11.1	31.8	9.7	2.3	100.0
Autumn 2006	18.3	21.1	14.6	31.0	13.1	1.9	100.0
Autumn 2007	20.6	25.2	10.8	32.4	8.9	2.2	100.0
Autumn 2008	22.1	20.2	12.3	34.8	9.8	0.8	100.0

Table 6 Students'Occupation Distribution (Autumn 03 – Autumn 08)

Semester	Not specified	Clerical	Commercial	Education	Professional	Social Work	Student	Technical	Others	Total
Autumn 2003	37.7	12.0	8.4	6.2	7.3	5.1	5.4	3.2	14.8	100.0
Autumn 2004	26.7	15.6	13.5	7.3	11.2	3.9	5.8	6.9	9.1	100.0
Autumn 2005	35.0	14.8	13.5	5.3	10.9	3.6	3.8	4.2	8.9	100.0
Autumn 2006	23.9	14.4	17.0	6.5	14.8	2.8	6.3	5.4	9.1	100.0
Autumn 2007	26.4	17.5	12.8	8.7	15.5	4.4	3.1	3.6	7.9	100.0
Autumn 2008	28.2	17.1	13.6	9.1	13.4	3.0	3.8	4.0	7.8	100.0

Table 7 Students' Gender Distribution (Autumn 03 – Autumn 08)

Semester	Not specified	Female	Male	Total
Autumn 2003	0.8	65.3	33.9	100.0
Autumn 2004	1.2	65.1	33.7	100.0
Autumn 2005	0.6	66.4	33.1	100.0
Autumn 2006	0.1	64.3	35.6	100.0
Autumn 2007	0.4	71.3	28.3	100.0
Autumn 2008	0.0	71.3	28.7	100.0

A Survey on the Readiness in Adopting e-Learning among Teachers and Students

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Abstract. This paper studies the readiness of students and teachers in adopting e-learning as the method of learning based on extensive survey conducted by HKU SPACE in 2009. The survey focuses on students and teachers, including those on part-time and full-time basis. Similar questions were set for the two groups of respondents seeking to ascertain their views on the benefits brought by e-learning tools as well as the difficulties encountered. The results indicate the extent to which students and teachers are ready to incorporate e-learning into their studies and teachings. It also reveals the possible areas for improvement. Respondents were being asked for additional comments and suggestions, which are included in this paper. It is concluded from the results that students and teachers are generally ready to adopt e-learning. However, the results show that the current SOUL system is inadequate and some useful features available in other platforms and tools are lacking. The results show that improvement is required in certain areas so as to increase the efficiency and effectiveness of the e-learning as an educational tool.

1 Introduction

1.1 Background

The HKU SPACE is committed to providing high quality continuing education programmes and learning opportunities for the community. Besides offering academic programmes of well-recognised quality, the School provides support to students and teachers through well-designed and advanced facilities, one of which being the web-based Learning Management System (LMS). The LMS is available to all registered HKU SPACE students and teachers. In 2004, the School adopted a Blended Learning Policy which aimed at introducing a blended approach for learning. It combined traditional face-to-face classroom learning with e-learning features, for students of award-bearing programmes. With the successful introduction and implementation of the Policy, more and more courses in HKU SPACE used the LMS to supplement their teaching services.

1.2 L earning Management System (LMS)

A Learning Management System (LMS) is software often utilized in training and education that delivering course contents to learners, tracking learners' learning progress and managing their records (Valuisky, 2005). Most LMSs are web-based in order to make the content and administration to be easily accessed through Internet. There are different focuses on various web-based LMSs, for instances, on the way of communication, on the technology used and on the content (Mason & Rennie, 2006). Chuah (2007) explained that LMS is an alternative means to deliver instructions other than in classroom which provides a virtual and rich learning environment to backup teachers that allows them to create and manage learning materials by using of various information and communication technologies (ICTs) in both synchronously and asynchronously ways. Generally, the formulation of e-learning policies and pedagogies may vary by the practical needs of different organizational structures and their cultures (Freitas, 2003). The objectives of design of a LMS should be learner-centered and goal-oriented, in order to take into an account for different backgrounds of different learners (Jolliffe, 2001).

Along with the concepts of e-learning evolved, several web-based LMSs in the market were developed. Some of them are commercial products such as WebCT and Blackboard. According to the studies conducted by e-School (2006), it is found that they hold 83 % market share in higher education and universities. On the other hand, some of the LMSs are free to use, such as the open source software MOODLE and Sakai. Their functions and features are even comparable to the commercial ones. A web-based learning system should contains four main functional features, they are, "curriculum design, communication and discussion, performance assessment and course administrator." (Cheung, 2007, p. 220)

Cheung (2007) further explained that curriculum design is refer to the tools of content sharing, course templates, instructional design and interface customizing; Communication and discussion includes tools of discussion forum, chat, e-mails and file exchange among students and teachers in ways of synchronous and asynchronous; Performance assessment allows more flexible in self-assessment, scoring assignments and tracking study progress; Course administration refers to system administration such as student and course data maintenance, user authentication and levels of access right differentiation.

In addition, with the impacts of social learning models (Palincasr, 1998; Forman, 1988; Resnick, 1996), the new e-learning tends to focus on a more "user-centered, social networked and open communication" learning approach (Downes, 2005, p1). This should also be considered in the design of a LMS. E-learning has been widely adapted in many Universities, higher education sectors and continuing education as a supplement to the traditional face-to-face classroom learning environment (Tetiwat & Igbaria, 2000). It allows learners to acquire knowledge, access instructional materials and obtain online assistance at any time and any place. It provides an alternative way to learn online. For the advantages of its better access, flexibility and convenience, e-learning has become one of solutions to meet the large demand of learning in many fields (Chuah, 2007).

1.3 Objectives

The purpose of this paper is to compare and evaluate on the extent which teachers and students are ready to adopt e-learning as the method for learning. It is done by sending online survey through invitation emails to full-time and part-time students and teachers of HKU SPACE asking about their views on the impact and benefits of e-learning to students. The results of the survey will help to locate difficulties encountered by users of the e-learning system. It will also help to spot the possible areas for improvement. The results are important in terms of the work on betterment of the School since it is an important part of the School's commitment to provide quality teaching and learning support to teachers and students with the latest educational technology.

2 Survey Results and Findings

2.1 The Survey

An online user survey was conducted by the e-Learning Support Team of ITS unit from January 20, 2009 to February 22, 2009 to study the impacts and benefits of e-learning to students. Invitation e-mails were sent out to full-time and part-time teachers of HKU SPACE, as well as to that of students of 40 subject groups. Among the 538 invitation emails sent to teachers, 78(14.3%) valid responses were received. At the same time, 22,227 invitation emails were sent to students and 2,051(9.2%) valid responses were received.

Among the 2051 student respondents, 990(48.3%) of them were full time students while 1061(52.7%) of them were part-time students. The highest education attainment of the student respondents ranged from F.3 & below to Master/PhD. A total of 1011(49.3%) respondents attained the level of F.4 – F.7 as highest education attainment. 638 (31.1%) respondents achieved post secondary education while 310(15.1%) had University as their highest education attainment.

2.2 Results and Findings

2.2.1 Use of e-Learning Tools

The respondents were asked how often they used e-learning tools for different purposes. Major results are extracted and shown as follow.

Results & Findings (Students). Figures 1, 2, 3 and 4 show how frequent the students surf the Internet for information, use forum to participate in online discussion (asynchronous), use chat room to participate in online discussion (synchronous), and receive course announcements, respectively. From the results, over 70% of the student respondents regularly or very frequently make use of e-learning tools for purposes of surfing the Internet and using search engines for information. Over 50% of them use the tools to study course material online regularly. Over 67.3% of respondents also use the tools for receiving course announcements or other course-related information online. On the other hand, 69.2% of students claimed that they have very rarely, or never, used Conference or Forum for the purpose of online discussion. Also, as high as 70.7% of respondents claimed that they very rarely or never use Chat Room to participate in online discussions.

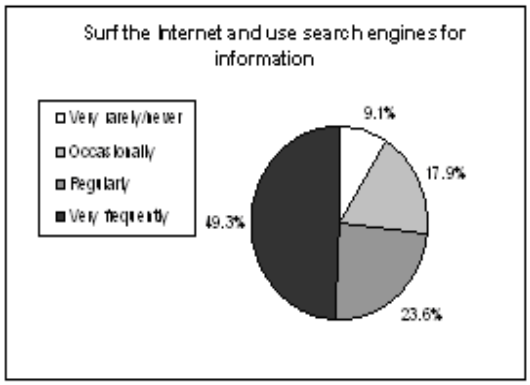

Fig 1. Frequency on surfing the Internet for information (Students).

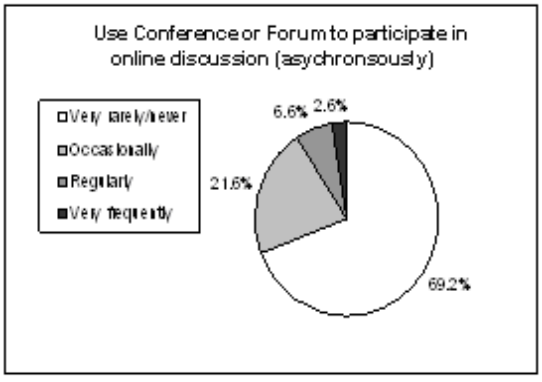

Fig 2. Frequency on using forum to participate in online discussion (Students).

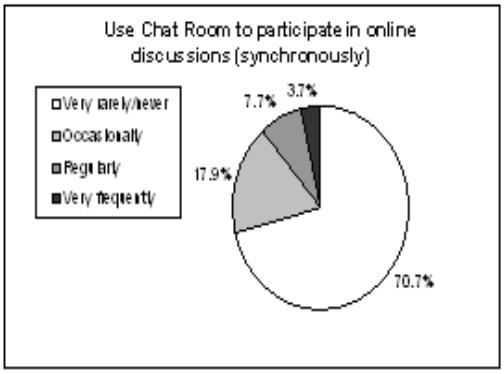

Fig 3. Frequency on using chat room to participate in online discussion (Students).

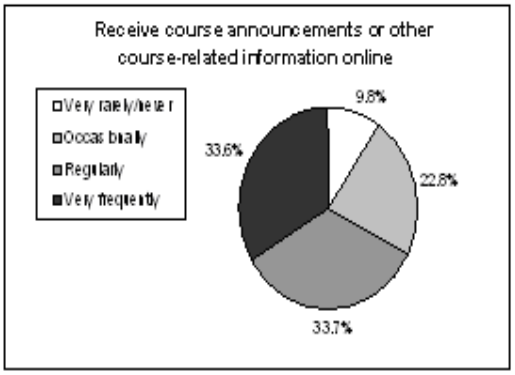

Fig 4. Frequency on receiving course announcements (Students).

Results & Findings (Teachers). Figures 5, 6, 7, 8, 9 and 10 show how frequent the teachers provide online course materials, communicate with learners by e-mails, use forum to participate in online discussion (asynchronous), use chat room to participate in online discussion (synchronous), provide online videos for lectures and tutorials, and accept online assignment submission, respectively. Around three-quarters of the teacher respondents claimed that they regularly or very frequently provide course materials online. Also, 76.9% of the respondents have regularly or very frequently communicated with students by emails. However, Over 80% of the respondents very rarely or never use Conference, Forum or Chat Room to engage student in online discussions. They seldom or never provide online videos of lectures or tutorials. In addition, less than a quarter of the respondents regularly or very frequently accept online assignment submission. As much as 62.8% claimed that they very rarely or never accept online assignment submission.

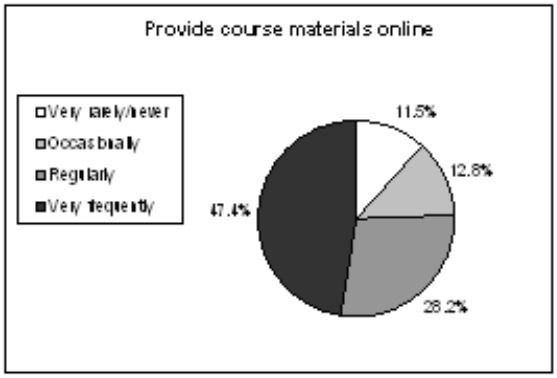

Fig 5. Frequency on providing online course materials (Teachers).

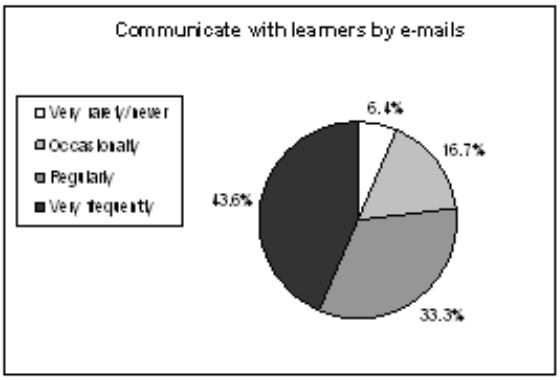

Fig 6. Frequency on communicating with learners by e-mails (Teachers).

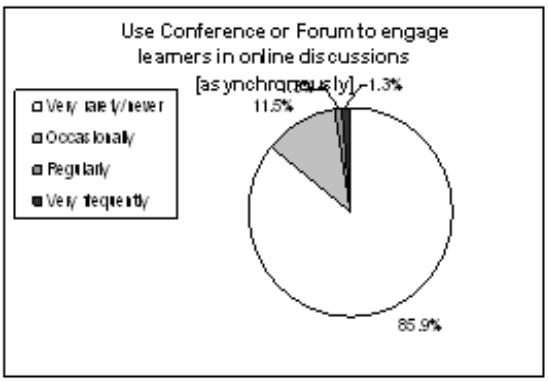

Fig 7. Frequency on using forum to participate in online discussions (Teachers).

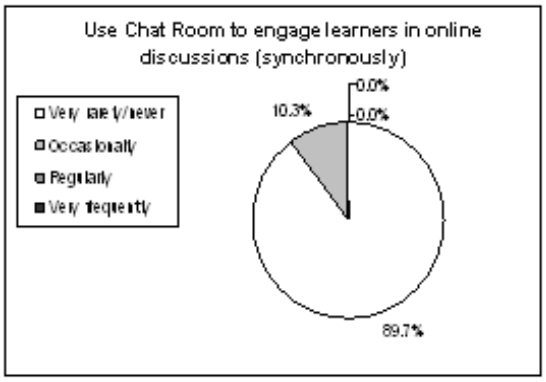

Fig 8. Frequency on using chat room to participate in online discussions (Teachers).

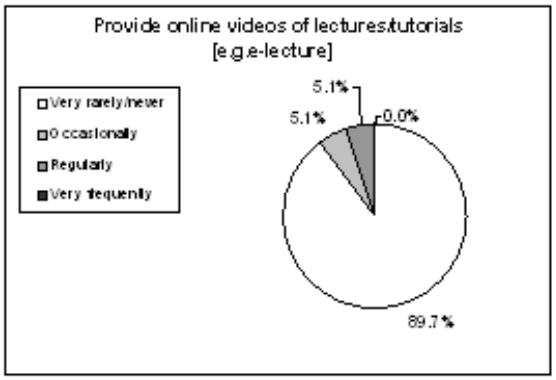

Fig 9. Frequency on providing online videos for lectures and tutorials (Teachers).

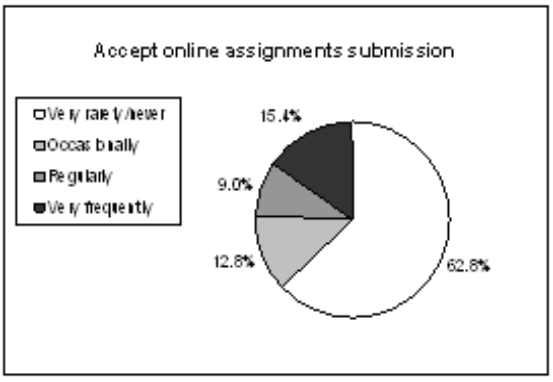

Fig 10. Frequency on accepting online assignment submission (Teachers).

Other Comments. For the use of e-learning, it is suggested that teachers should upload exercises or notes with answers onto SOUL. It is claimed by some respondents that the e-learning tools are good for communication between students and teachers but they are not being fully utilized. It has been frequently suggested that e-lectures should be provided. It is suggested to have lectures videotaped for students to review the recorded classes on SOUL and that announcements should be posted online.
From the comments provided by the respondents, SOUL's usefulness and user-friendliness is not sufficient. Some respondents claimed that the conversations in Chat Room cannot be saved and thus making it hard for teachers to give comments. It is being frequently complained that the upload size of file is too restricted. Respondents also claimed that it is inconvenient to upload learning materials to SOUL platform since the file name must be in English. Some of the respondents also claimed that their uses of symbols became gibberish. It is suggested that SOUL is generally a useful tool to facilitate communication but for the fact that a lot of students prefer direct contact through the phone.

2.2.2 Benefits of Using SOUL

Respondents were asked about the extent of assistance provided under the system and the benefits of the use of SOUL. The latter allowed for multiple selections.

Results & Findings (Students). Figures 11, 12 and 13 show the survey results of asking students the usages of SOUL. 63% of the respondents agreed or strongly agreed that the use of SOUL enabled them to get the most updated information about courses. These information included change of schedule and course news. On the other hand, 46.7% of the respondents disagreed or strongly disagreed that the use of SOUL helped them in communicating and collaborating with classmates. There were 44.9% of respondents claiming that the use of SOUL had saved their time and efforts while 34.6% claimed that they were benefited under the higher degree of flexibility and convenience towards their studies. However, more than a quarter of the respondents claimed that there was no benefit enabled under the system of SOUL.

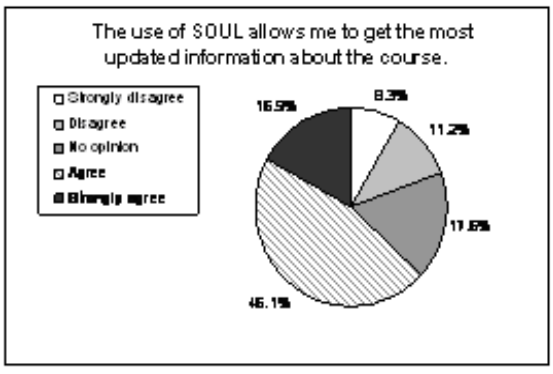

Fig 11. Survey on using SOUL to get updated information (Students).

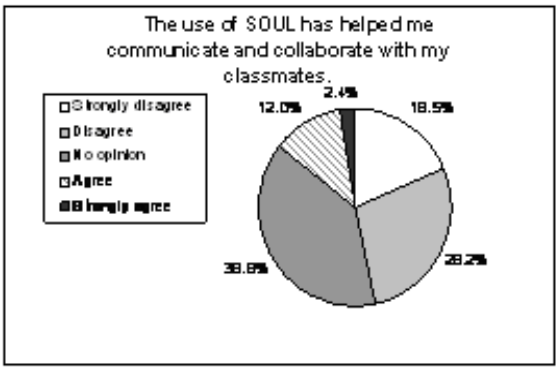

Fig 12. Survey on using SOUL to help in communication with others (Students).

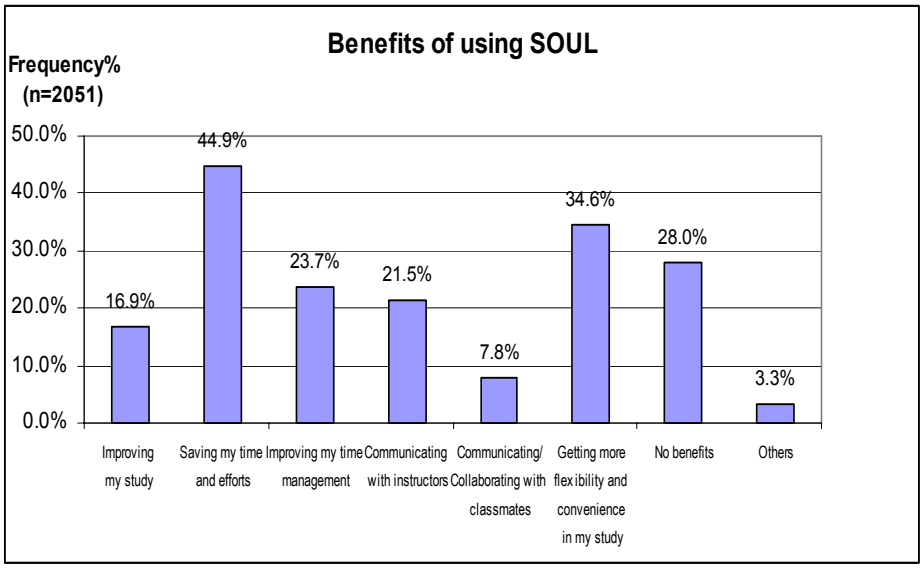

Fig 13. Survey on the benefits of using SOUL (Students).

Results & Findings (Teachers). Figures 14, 15, 16, 17, 18, 19, 20 and 21 show the survey results of asking teachers the usages of SOUL. From the results, it can be seen that there are a total of 62.8% of teacher respondents agreeing or strongly agreeing to the role of SOUL in enhancing their teaching which would, in return, be beneficial for the students. 87.2% of the respondents agreed or strongly agreed that the use of e-learning had increased students' access to the learning materials while 61.6% claimed that the interaction between students and teachers was increased as a result of the use of the e-learning.

When asked to describe their own experiences in using SOUL, over half of the respondents (57.7%) agreed or strongly agreed that using SOUL in their courses met their needs. Also, 64.1% of the respondents agreed or strongly agreed that using SOUL in their courses helped them to teach more efficiently. Almost half of the respondents (48.7) agreed or strongly agreed that the use of SOUL provided them with more opportunities for the purpose of knowledge sharing. There were 59% and 60.3% of respondents agreeing or strongly agreeing that the use of SOUL enabled them to share more online resources and helped them to communicate better with students respectively. However, almost one-third of the respondents (35.9%) disagreed or strongly disagreed that the use of SOUL had resulted in prompt feedback from students.

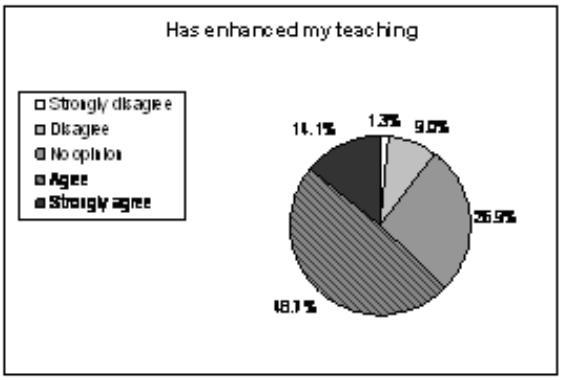

Fig 14. Survey on using SOUL to enhance teaching (Teachers).

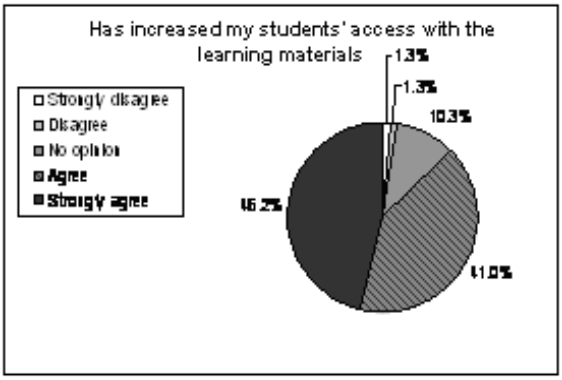

Fig 15. Survey on using SOUL to increase students' access to materials (Teachers).

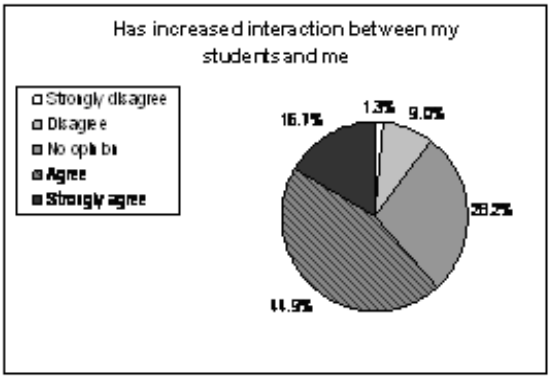

Fig 16. Survey on using SOUL to increase interaction with students (Teachers).

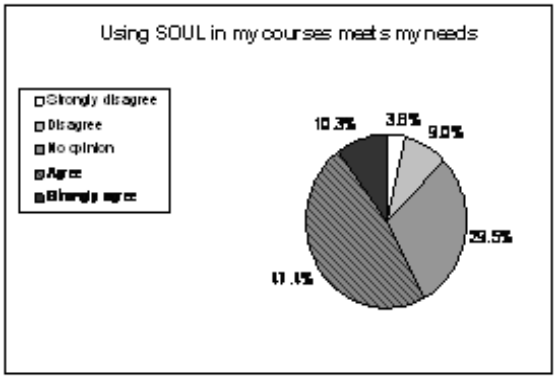

Fig 17. Survey on using SOUL to meet teaching needs (Teachers).

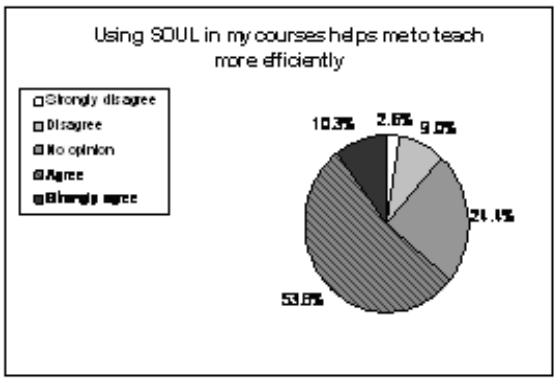

Fig 18. Survey on using SOUL to help teach more efficiently (Teachers).

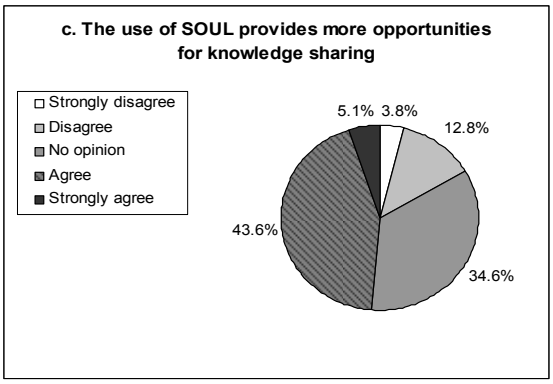

Fig 19. Survey on using SOUL to promote knowledge sharing (Teachers).

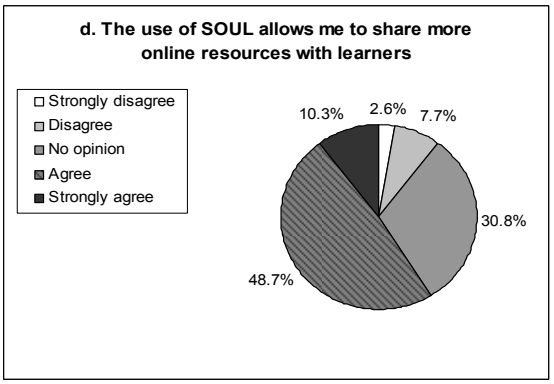

Fig 20. Survey on using SOUL to share online resources to learners (Teachers).

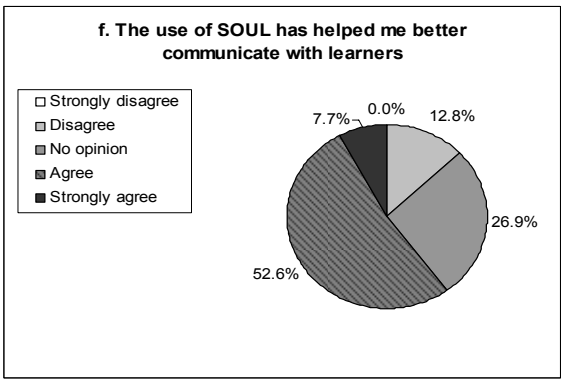

Fig 21. Survey on using SOUL to better communicate with learners (Teachers).

Other Comments. Many respondents raised the point that no course notes are available on SOUL. Respondents claimed that most lecturers do not use SOUL and thus it is seldom being used as the means of communication between teachers and students. It is mentioned in the results that the user interface of SOUL is not user friendly. It is suggested by some respondents that it should be made compulsory for students to submit their assignments in SOUL so as to create a learning atmosphere in SOUL. This can serve as providing students with incentive to access. Some of the respondents think that SOUL is a platform more of administrative and organizational value than educational and that the extent of benefits depends largely on the personal motivation of individual students. It is also claimed that SOUL lacks a sufficient degree of flexibility for adoptions or making changes of materials as the system only allows for exact copying of contents of materials from one class to another.

2.2.3 Common Problems Encountered

Students and teachers were asked about the common types of problems encountered when using SOUL. The majority of respondents (41.5% for students and 38.5% for teachers) claimed that no problem has been encountered when using SOUL. For the student respondents, 33% found the major obstacle being that the teachers were not making use of SOUL. 31.4% claimed that teachers were used to the current teaching methods while 27.3% claimed that the nature of the course being unsuitable for online learning served as the major obstacle. For teacher respondents, 19.2% of respondents claimed that the major problems were encountered in marking online assignments while 16.7% claimed that it was the posting of course materials being the most common problem. Two of the most commonly complained obstacles are that the nature of the course being unsuitable for online learning (29.5%) and that the functions in SOUL are of low flexibility (24.4%). It is frequently being complained that the file size limit of assignment submission set is too small. Obstacles are posed when course administrators do not provide course information to students. They prefer to use other tools for instant communications such as MSN.

2.2.4 Other e-Learning Platforms

Students and teachers were asked about their use of other e-learning tools/Learning Management Systems besides SOUL. Multiple selections were allowed. For the student respondents, 80.4% responded that they have not other e-learning tools besides SOUL. 11.9% of the student respondents have used WebCT and 5.3% used have Blackboard before. Among the 2.1% of student respondents who have used other platforms not specifically listed in the survey, a lot have used e-Class. As much as 26.4% of the respondents have used the e-learning tools for 1-6 months. For the teacher respondents, 42.3% have not used any other e-learning tools. Another 42.3% of the respondents have used WebCT while 33.3% have used Blackboard before. Among them, 10.3% of respondents have used other e-learning tools such as Connected Learning Community and Law websites. Half of the respondents (50%) have used those e-learning tools for 3 years or more.

2.2.5 Comparing between SOUL and Other e-Learning Tools

Students and teachers were asked about the features found in other e-learning tools which were useful but not made available in SOUL.

Common examples mentioned by student respondents included Search Engine, Dictionary, On-line Quizzes, and Database with information such as texts and lectures from specialists and professors. The results also showed that better discussion boards were lacking on the SOUL system. Other features included the announcement of examination results, facilities booking system, online assignment submissions and videos of lectures or recorded classes.

For teachers, the results showed that features such as Support Video Conferencing and access to Law Websites were lacking. SOUL has not provided the respondents with systems checking plagiarism such as Turnitin. Also, guest login by students who have not registered for a course was not allowed. SOUL has not integrated with examination systems and student services like timetable and marking online. Features allowing teachers to create folders to categorise teaching materials with recording function were missing on the SOUL system. Moreover, SOUL lacked the feature of transferring posted messages to the preferred email account of the students. On addition, there was the absence of features supporting dialogic and social processes that could result in knowledge creation, i.e. inquiry-based or project-based learning. From the responses obtained, it was revealed that SOUL had a better performance than Blackboard in terms of speed. However, the teachers believed that students preferred face-to-face or telephone consultation group. Some respondents found that other e-learning tools were more user-friendly than SOUL.

2.2.6 Other Comments and Suggestions

Some respondents claimed that SOUL System is useful in the sense that it can save time or students and teachers. Many respondents consider SOUL as a good channel to get information and teaching materials of the course, as well as to get access to teacher. It is considered as a useful tool for students who are unable to attend lectures. Respondents felt that the SOUL System would only be useful if the teachers were making use of it. Another major concern is that not all students access SOUL as a learning platform. Some considered it only as an online notice board. Respondents frequently complained that SOUL is not user-friendly and most of the functions on SOUL are not being well utilized.

It is suggested that the interface or screen should be re-designed to make it more up-to-date. The teacher respondents proposed that a private storage space should be provided for teachers to store files. The system should allow students to amend their email addresses and should be able to export assessment results to excel files. Respondents prefer a packaging function to allow downloading in mass. Respondents suggested that more references and course information for study should be provided on SOUL and more training should be provided for teachers on the use of SOUL. It is further proposed that forums should be set up for discussion in order to promote and enhance the use of SOUL.

3 Conclusion

The opinions and feedback from students and teachers resemble each other in many ways. Both groups of respondents have acknowledged the benefits and advantages of e-learning. It is suggested by both groups that the use of SOUL results in positive effects and impacts on certain aspects of teaching and learning. The respondents have also pointed out certain features which are useful but lacking in the SOUL system. Various suggestions were given by the respondents in promoting the use of SOUL and enhancing its usefulness.

Thus, it can be observed from the results of the surveys that the respondents generally recognise the positive functions and benefits of e-learning. The majority of their complaints are not concerned with the adoption of e-learning as part of the process for teaching or learning, but the inadequacy of certain features of the system instead. The results reveal the attitudes of both the students and teachers and their readiness in using e-learning. The use of e-learning is generally welcomed by the respondents although it can be seen that the current system is insufficient to fulfill the needs of the users. Therefore it is desirable to improve the system and to add in features considered useful by the respondents.

Through the enhancement and improvement, it is likely that the system can be better utilized by the users. Students and teachers should be encouraged to use e-learning more frequently and adequate training should be provided for the teachers as the attitudes of students depends largely on that of teachers. Under the acknowledgement of the intrinsic values of e-learning by the users, and the assumption that the suggested improvements are carried out, the purpose of the system serving as an educational tool can be fulfilled and the greatest extent of benefits can be enjoyed by the users.

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An Evaluation of a Blended Approach for Japanese Language: The Relationship between E-learning and Academic Performance

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Abstract. The purpose of this study was to examine the relationship between students' academic performance and a proposed blended model of Japanese language study in a sample of ninety-five university students in a local university. The findings indicate that students' academic performance is positively correlated with their frequency on using the e-learning materials provided on the Virtual Learning Environment. The paper provides implications for the design of course structure and content especially on language studies. It is believed that the blended model can improve students' motivation and performance while enhancing the effectiveness of teaching and learning as a whole. The result highlights the importance of the blended model in the prediction of students' learning outcomes.

Keywords: performance, language studies, Japanese language, e-learning, blended learning

1 Introduction

In the past decade, a great deal of research has been conducted on the area of e-learning or blended learning. E-learning has assumed greater importance in educational sectors as it has been recognized as contributing to the overall quality, effectiveness, convenience and cost of learning experiences [1]. In view of growing significance of blended learning in language studies, it is absolutely essential to develop efficient blended learning practices capable of providing excellent quality of teaching. Today, we can understand better how learning experiences could be improved by the "blended" combinations of both traditional and technology-based learning methods [1] and how it can contribute to students' learning processes and outcomes such as motivation, satisfaction and academic performance.

In this paper, we tested our proposed blended model and its impact on students' academic performance. This paper first describes the content of the blended model for Japanese language. Then we report the statistical results for the effect of the frequency of using e-learning materials on students' academic results based on secondary data. The study was conducted in a sample of undergraduate students studying Japanese language in a local University in Hong Kong. We hope that the

propositions of our recipe of blended learning could bring new insights to educational practitioners in similar academic disciplines.

2 E-learning or Blended Learning

E-learning is characterized by online resources and Virtual Learning Environments (VLE) such as WebCT/Blackboard [2] which supports self-motivated and self-paced learning. Meanwhile blended learning further complements e-learning by providing activities such as instructor-lead classes, role-play and discussion group alongside with e-resources. It is well believed that blended learning is a better learning paradigm than e-learning [3] because the use of hyperlinks and e-documents nowadays not only reduces the time and cost, but also allows rapid information dispersion at any time and anywhere.

In pedagogic point of view, e-learning and blended learning helps memory reinforcement since it encourages self-paced learning and self assessment during non-contact hours. In the long run, blended learning helps on class progress since it reduces the asynchronies and variance of progress among students. However, e-learning is not without limitations. Online resources and VLE also have short sides from time to time. One major problem is that students are generally inexperienced and hence personal guidelines and study models are needed in order to keep them from wandering around the sea of online resources without target. Another issue is that e-solution generally lacks personal interaction which is important in disciplines such as second language acquisition [4]. To conclude, we need tailor-made blended learning schemes for different subjects and careful stock picking of pedagogic activities is indispensable.

3 Methodology

The present research employed a mixed method or triangulation. We first used a case study approach to introduce our proposed blended model. Then we analyzed the secondary data in relation to the frequency of using the e-learning materials and students' performance. Case study approach is that the researcher systematically gathers in-depth information on a single entity such as an individual, a group, an organization or a community using a variety of data gathering methods [5]. A case study approach is considered the most appropriate methodology to answer the **what**, **how** and **why** research questions. This research method allows the researchers to study the central phenomenon in depth [6]. Triangulation may improve the reliability of a single method [7]. There are at least four methods, for example, research to respondents, with other sources, using other data collection methods and using two researchers to analyze the data separately [5].

The study was conducted between January and May 2009. The case being studied was an elementary Japanese language course. In total there were four classes and the case being examined included ninety-five undergraduate students aged around twenty years old. Most students studied the course on elective basis. Students were from different disciplines such as languages (26.3%), business (18.9%), social sciences (29.5%), engineering/computer (11.6%) and creative media/law (13.7%). Amongst the sample, most of them were in first (52%) and second (29%) year study.

4 A Blended Model of Japanese Language Study

The well-known Japanese Language Proficiency Test (JLPT) [8] was used as a benchmark to generate the ideas. In particular, we try to sketch the full picture by referring to four vital dimensions in language studies: writing-vocabulary, listening skills, reading-grammar and oral skills. In the following, we demonstrate our proposed blended model of Japanese language for elementary learners.

4.1 Vocabulary

Let alone the tremendous time and effort required, study of Japanese vocabulary is especially difficult due to problems rooted from the linguistic features. The same kanji may contain two or more different pronunciations. Japanese is flooded with huge amount of homophones (sound-alike words). Japanese homophones are three times more numerous than those found in Chinese [9]. As the mental database of vocabularies grows, memory tends to "interfere with each other" [10]. From the learner's point of view, there is a need of automatic instrument which helps vocabulary management and self-assessment. It is expected that the e-technology will create synergy by speeding up the wordlist compilation and classification process for students' self-learning. The "huge information volume" and "high searching speed" properties of e-resources match perfectly to the demanding wordlist compilation task. Students can store the words in an electronic form instead of hand-written text on small paper cards. It allows students update the personalized wordlists and review them at anytime and anywhere. Students could also share or exchange wordlists in VLE platforms, forums, blogs or even personal wiki solutions [11] with their fellows.

In this case study, Blackboard [2] system was set up for an elementary Japanese language course. Like other web-assisted courses, lecture handouts are released online. Yet instead of using Internet as merely a data-release medium, we intend to treat it as a learning platform. Hyperlinks to interesting resources are also posted in VLE in order to stimulate students' interest. For instance, one of the subjects in the elementary course is "counting" with Japanese numerals. Instead of merely listing the complete list of numerals as in paperback books, we redirect students to selected YouTube[12] (Fig. 1) clip with Japanese talents counting with numerals (as part of the score-counting event in a singing contest). Real-life resources of these kinds not only stimulate curiosity and attention, but also in terms of relevance, which are important to learning motivation according to Keller and Suzuki [13]. In addition, as

can be seen in Figure 2, well-organized wordlists were also provided to students for revision.

Fig. 1. YouTube clip: Counting numbers in Japanese

Fig. 2. Organized wordlist for revision

4.2 Listening

Given that the contact-hours are limited, most of the times have been spent on vocabulary and grammatical explanations. Nowadays, standard teaching aids used are those companion tapes or CDs included in textbook. Considering that time needed for students to write down the answers and for instructors to reveal the correct answer together with vocabulary and grammatical explanations, one could easily draw a conclusion that instructors are simply not able to afford playing the tape many times in classroom. The outcome of all those is that the listening abililty among students in class could be highly asynchronus, which in turn, affects the progress of class. It is especially problematic that a considerable number of Japanese courses are taught in Japanese itself by native teachers. In our opinion, switching from tape to digital media is inevitable. Of course, the media itself is inherently superior, in the sense that it supports random access and bookmarking. However, the real significance come from the fact that electronic recordings make information dispersal easy and it promotes self-learning. Recorded Japanese passages and dialogs in mp3 format are available to students via Blackboard (Fig. 3).

Fig. 3. mp3 format dialogs with pictures

Students in need could listen to the recordings as many times as they want after the scheduled listening lab session. This helps alleviating the pressure of limited time. Apart from mechanical examples included with textbook, students where also given chances to be exposed to interesting real-life materials. For instance, short animation clips by using the YouTube video. Those films are targeted to juvenile audience in Japan and hence the language used, as well as the speed is appropriate to elementary level students. Students were given the Japanese transcript of the films beforehand and they could try to follow during animation playback. This serves a trio advantage: First of all, students could practice their listening skill, with dialog (and dialect) by native speakers. Also, students were exposed to the "everyday language" used among local Japanese people. More importantly, it stimulates students' interest and encourages them to be active learners.

4.3 Grammar

Despite the fact that Japanese vocabularies are affected by Chinese language, Japanese grammar itself did not significantly change [14]. Some scholars [15] urge that, in particular, the Japanese particle system is a major hurdle for second-language learners in college-level Japanese courses, due to its complexity and its absence from the learners' first language. As a result, Japanese teachers usually found themselves spending most of the times in teaching grammatical concepts to students. The use of a blend of e-technology and traditional tutoring is prooved useful in levelling the learning curve and improving students' writing and grammar skills. The computer's metalinguistic feedback program can lead learners to develop general grammatical competence in the use of particles [15]. In addition, we try to help stuents learning grammar by posting managed articles and summaries on the Blackboard environment. Apart from listing articles in a time-oriented manner (from week 1 onward), we also try to summarize the knownledge taught in different weeks and semesters to formulate grammar-oriented summaries. For instance, as shown in Fig. 4, learning materials related to Japanese grammar have been uploaded to the Blackboard (i.e. exercises and explanatory notes for outside benchmark language tests or summary of particular patterns). By uploading the revision exercises and linguistic summaries, instructors can save time from performing mechanical routine jobs. They can concentrate to spend more time for areas which require face-to-face instruction and interaction with students, such as oral training.

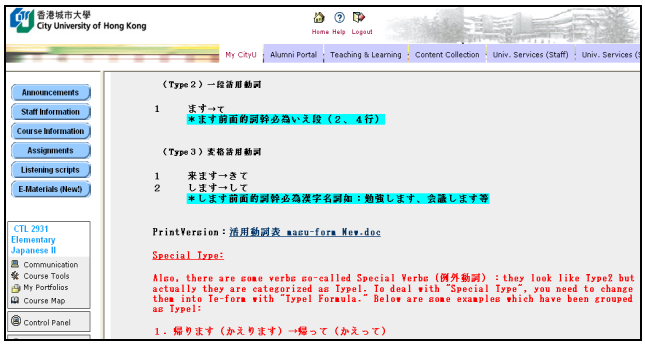

Fig. 4. Grammar explanation

4.4 Oral

Like most languages, the accent and intonation of spoken Japanese may be the most difficult parts to learn. In Japanese language, there are many words with same pronunciations. However, a change in the accent would change the meaning of the word. For instance, *hashi* can be 'chopsticks' *(hāshī)* or 'bridge' *(hāshi)*. Unlike English which has stress accent, Japanese has pitch accent which means that after an accented syllable, the pitch falls. Another distinct feature of Japanese language is the honorific expressions. Japan is well-known as a hierarchical society. Japanese has an extensive system to express politeness and formality. The position of a person is determined by a variety of factors including job, age, experience, or even psychological state [16]. This makes Japanese expressions difficult for overseas learners [17]. It is believed that the best way to enhance oral ability may be to maintain face-to-face interactions between tutors and learners. As Yamazaki [18] suggests, ideal speech translating systems are far from mature and considerable future work is needed on resolving various acoustic and linguistic phenomena such as colloquial idioms, occasional omission of words and inversion of word order. Nevertheless, in reality, it is infeasible to have intensive training between teachers and students. Hence, net resources, offline assessment and feedback mechanism via VLE are suggested to supplement normal face-to-face tutorial sessions. The use of online Text-to-Speech (TTS) system was recommended to our students. For instance, the NeoSpeech system (Fig. 5) available online supports pronunciation of vocabularies or even short phases.

Fig. 5. Pentax NeoSpeech [19] – Online Japanese Text-to-Speech (TTS) system

Students can use the system to input simple vocabularies or sentences to practice the pronunciation. Further, according to our rudimentary experiments, it was found that the system is rather intelligent because it can handle complex Japanese pronunciation rules well. For instance, the system can distinguish the pronunciations even the vocabularies are written the same but with different meanings. Students were also encouraged to use the provided link (i.e. the NeoSpeech) or software (i.e. mp3 recording) to enhance the quality of their reading and oral assignments. Students could make good use of this advanced system so as to improve their pronunciation and intonation. However, it is suggested that the interaction in the classroom between peers is one of the most significant factors for successful learning of the second language acquisition (SLA) [6].

5 Result: e-learning and performance

In this section, we report the result of the effects of e-learning on students' performance. Students' access records throughout the semester were collected using blackboard's built-in summary function. At the end of the semester, we matched students' access records with their academic results. We identified students' access records by using 5-point Likert scale from 5 (active users) to 1 (inactive users). The data were then analyzed with the classical ANOVA (Analysis of Variance) test using SPSS version 15. The statistical test aims to estimate how likely the differences observed in academic results (dependent variable) are caused by the independent variable (*e-material access frequency* in our case). In a word, we attempted to test the impact of frequency on academic performance. In order to protect participants' confidentiality, each student was given a code and their name was removed from the data with only the code used when the data was analyzed.

Table 1 presents the result using the regression analysis for the entire sample (N=95). Experiment result suggests that the frequency of e-material access has significant impact on academic performance. Positive correlation was found between students' academic performance and the frequency of using the e-learning materials (β=0.272, $p<0.01$, statistically significant). The result suggests that students who used the e-materials more frequently tended to receive better grade in the course.

Table 1. Regression analysis (N=95)

Model Summary

Model	R	R^2	Adjusted R^2	Std. Error of the Estimate
1	.272*	.074	.064	.92427

ANOVA - *Dependent Variable: Performance (grading)*

Model		Sum of Squares	df	Mean Square	F	*p*
1	Regression	6.341	1	6.341	7.423	0.008*
	Residual	79.448	93	.854		
	Total	85.789	94			

Coefficients - *Dependent Variable: Performance (grading)*

Model		Unstandardized Coefficients		Standardized Coefficients	t	*p*
		B	Std. Error	β		
1	(Constant)	3.347	.188		17.788	.000
	Frequency of using E-materials	.168	.062	**.272**	2.724	.008

* *Predictors: (Constant), Frequency of using E-materials*

Note: p=0.008 (p<0.01) indicates the result is significant.

6 Conclusion

In our previous research [20, 21, 22, 23], we discussed and proposed how facilitators can enhance the teaching activities effectively by four dimensions of Japanese language learning. In the present research, we continue to explore how educators and learners can be benefited from blended learning with proposed activities in relation to vocabulary, listening, grammar and oral skills. We also empirically tested the model by looking at the relationship between the frequency of using e-materials and students' performance. Blended learning focuses on optimizing achievement of learning objectives by applying the "right" learning technologies to match the "right" personal learning style to transfer the "right" skills to the "right" person at the "right" time" [1]. In addition, effectiveness of blended learning also depends on whether an instructor or facilitator can match the appropriate delivery media to existing teaching activities and to catch up with the e-learning paradigm. This case study demonstrated that instructors can use different levels of "blend" in different learning areas to improve students' performance, and thus also enhance the effectiveness of teaching and learning as a whole. Despite the research suggests that e-material bring about solid advantage on academic performance, the advantage contributes to nowhere if the students shows zero enthusiasm on accessing the e-material. Therefore, when designing the e-material, instructors should also take students' motivation into

consideration, rather than concentrating only on academic contents. For instance, the instructors could put effort on relating the material to daily life as much as possible. Instead of simply *replacing* paperback information with electronic form, one should actually *compensate* existing content with the help of modern media such as digital audio and movie clips. Feedback from students, whether in direct form (email/forum) or indirect form (system access count) should be cherished and taken into account. If the blended paradigm is put to good use, both the instructors and students could enjoy the synergy between motivation and performance.

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An Outcome-based Approach for Building Portfolio

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Abstract. A portfolio records achievements in a learning process. In this paper, we propose the construction of a portfolio using outcome-based approach. A prototype of an Outcome-based e-Portfolio System was developed which helps students in setting up the intended learning outcomes, recording learning activities and achievements, and linking learning achievements to intended learning outcomes.

Keywords: e-Portfolio Systems, outcome-based learning

1 Introduction

Portfolio has been used in some disciplines, including education, to organize and present works; to provide a context for discussion, review and feedback from teachers, mentors, colleagues and friends; and to demonstrate progress and accomplishments over time [1].

Portfolio, in its simplest meaning, is merely a collection of a student's work stored in a folder [2, 3]. The use of portfolio in education is to organise learning materials and to demonstrate achievements around some pre-defined learning goals. Traditional portfolio includes items like learning goals and work samples, art work and written reports to support the achievements to the learning goals. However, as quoted in Barrett's White Paper [4], the Northwest Evaluation Association thinks that "The collection must include: student participation in selecting contents, the criteria for selection, the criteria for judging merit, and evidence of student self-reflection." The evidence of achievements may be extended to include items like academic results, awards, copies of certificates, transcripts, letter of recommendations, etc., which may then be used to develop into some forms of resume.

Traditional paper-based portfolio is bulky and cannot be accessible easily for communication and discussion. The use of information technology (IT) in supporting the collection of learning evidence in diverse formats and media seems to be a natural outcome. Thus, the term "portfolio", in this paper, is used interchangeably with the term "electronic portfolio".

Outcome-based learning is a learning paradigm which defines the learning goals or outcomes at the beginning of a leaning process, design the curriculum with learning activities, links learning activities to the defined outcomes, and evaluate student achievements according to the defined learning outcomes. Although outcome-based

learning is largely applied to courses with a set of definite goals, it provides a structured approach for learning outside the classroom. The challenge of such a process does not only lie on the provision of a structured approach, but also a structured template with great flexibility to organise work of learners at different time and place, for reflection and assessment.

This paper proposes a structured approach of constructing a portfolio for outcome-based learning; discusses the challenges of such an approach; and describes a design of an outcome-based portfolio system.

2 Outcome-based Learning – A Structured Approach

2.1 Electronic Portfolio Systems

The portfolio can serve for a diverse set of purposes, as a tool from documenting the learning process and its achievements, assessing the learning outcomes, to self-marketing. The purpose of its usage may determine the content of the portfolio, which is the evidence collected in the learning process. There are many successful cases of using electronic portfolio systems in learning and assessment [5, 6, 7].

A student-centred portfolio allows sufficient freedom for a student to determine what should be collected and included in the portfolio. On the other hand, a teacher may want to look for learning evidence according to a pre-defined checklist and to come up with an overall idea on assessing how well a student has achieved based upon data collectively in that portfolio. These conflicting paradigms impose challenges in designing an electronic portfolio system to serve these different purposes [4].

2.2 The OBE Approach

There has been a lasting development over the past four decades that outcome-based education (OBE) has come to its current form. OBE can be characterized by [8]:

- development of clearly defined and published learning outcomes that must be achieved before further progression;
- design of a curriculum and learning to ensure the achievement of the learning outcomes;
- design of an assessment process matched to the learning outcomes for individual students to ensure that they achieve the outcomes;
- provision of remediation and enrichment for students as appropriate.

Despite the confusion on the meaning of terms like outcomes, goals and standards in OBE, we all use some kinds of assessment in learning to check whether some pre-defined learning goals have been achieved.

2.3 The Challenges

There are many challenges in building e-portfolio systems for OBE. Specifying outcomes clearly is a difficult task. A program of study, a specific course, a well-designed learning activity or even a competition, may have a series of goals or outcomes for a learner to achieve. The outcomes have to be specific before they can be measured. In addition, these courses or learning activities may have similar or even a small set of common attributes contributing to the learning outcomes. A learner may want to achieve different sets of learning outcomes at different stages.

There are a lot of achievements or accomplishments of a learner at different stages, especially in terms of whole person development. A learner may not realize what specific attributes are contributing to the achievements or learning outcomes. The ignorance in understanding learning attributes may lead to lack of reflection during the learning process and lead to difficulties in linking evidence of achievements to the learning goals.

3 The Design of an Electronic Portfolio System

The design of the proposed electronic portfolio system intends to support a systematic but flexible information structure facilitating a continuous development process of a portfolio. The dynamic process of constructing a portfolio does not only show the static evidences of achievements of a student but also exhibit the reflection and growth of the student. To facilitate such a portfolio development process to becoming learning experience, this design framework mainly consists of two parts: the *information structure* and the *dynamic process of constructing a portfolio*.

3.1 The Information Structure

The information structure is defined to guide students to organise their learning objectives and evidences of their achievements and competence. There are several major entities in the information structure: *learning outcomes, activities and achievements, reflections,* and *abstracts*.

Intended learning outcomes
Based on the outcome-based approach, students start from specifying their short-term and long-term goals for career development with which the intended learning outcomes are to be defined and refined. The specification of intended outcomes makes students relate what they would like to become with their personal goals. It also provides a platform for students to think about how to demonstrate their knowledge, skills and personal qualities. Hence, students need to take the initiation to

create evidences of their accomplishments. To devise a list of focused and achievable intended learning outcomes is thus, essential to the success of creating the portfolio. This portfolio is then to be perfected through a dynamic process.

Activities and achievements

A substantial amount of information depicted in the portfolio focuses on the participation of activities by students. Obviously, an activity is a visible act that is indispensable in a portfolio. However, the actual evidence relevant to accomplishing a specific learning outcome is the achievements induced from that activity. Students should distinguish an achievement from an activity that the latter just provides an opportunity for development of valuable attributes and perceptible contributions. This helps to avoid students spending times in a lot of activities aimlessly without making any significant achievement relevant to the intended learning outcomes. Achievements could be quantifiable performance of discipline specific knowledge and skills, and generic skills.

In the information structure, each of the intended learning outcomes should be connected to multiple instances of activities. Similarly, students can benefit from an activity in more than one aspect. Consequently, an activity usually links to multiple achievements thus, forming a network path echoing back to individual learning outcome.

Reflections

Reflection is the key to learning. A list of activities and achievements alone could give only a superficial account of efforts made by the students. In the reflective process, students integrate their experiences in various activities and achievements to match with their learning objectives and search for the direction for improvements. This is the link to closing the learning cycle.

Abstracts

The information structure should support partial sharing of portfolio and compilation of resumes of different orientations. The internal organization of the portfolio should support different parts of the portfolio content to be extracted and polished to generate abstracts for different purposes.

3.2 Dynamic Process of Constructing a Portfolio

A portfolio should not only systematically present a collection of students' work but more importantly make the progress of student learning available be recorded and viewed. The portfolio should not only be summative but also formative. Thus, the framework should incorporate the dynamic aspect of a portfolio reflecting the student learning process. Through iterations of action planning, activities participation, affirmation of achievements, self-reflection and refining the intended learning

outcomes, students assume responsibility for improving themselves. The process enhances their critical thinking and meta-cognitive capacity - they know what they know. Most importantly, their self-esteem could be enhanced through seeing their own growth. The dynamic portfolio process consists of four functions: planning the goals, recording the activities, linking the achievements to learning outcomes, and reflection.

Planning the learning outcomes

Once the learning objectives are defined, there should be an action plan to achieving the learning outcomes. The action plan involves defining a series of activities relevant to achieving the learning outcomes.

Recording the activities

Details of students participating in activities are recorded. The time dimension of the portfolio is maintained to demonstrate the development history of the students. Very often, as the portfolio is updated constantly, the information about the impact of incidences to students may be lost. These incidences could be an experience gain from an activity or feedback from peers and teachers. The reflection details in the process could also be ignored. The history of the formative evaluation can help students to know how they learn which is extremely useful in planning their further development.

Linking achievement to learning outcomes

An additional dimension is to allow students mappings the *achievements* to *activities* and then to *learning outcomes*. There is a time-line guiding the participations of activities and the accomplishments.

Reflection

Besides portfolio content organization and the process audit, the framework should enable external comments to be taken. To stimulate the reflective process, it is a standard facility for portfolio sharing and commenting. Affirmations and comments from teachers and peers would boost students' momentum for advancement.

4 Developing the Portfolio System

4.1 Implementation

A prototype of the outcome-based electronic portfolio system was developed using Java following the information and functional requirements as discussed in last section. The system provides functions to allow students to create a portfolio; to maintain the *intended learning outcomes, activities* and *achievements;* to link learning *achievements* to *intended learning outcomes*; and to view evidence of achievements according to intended learning outcomes, with interface as shown in Figure 1.

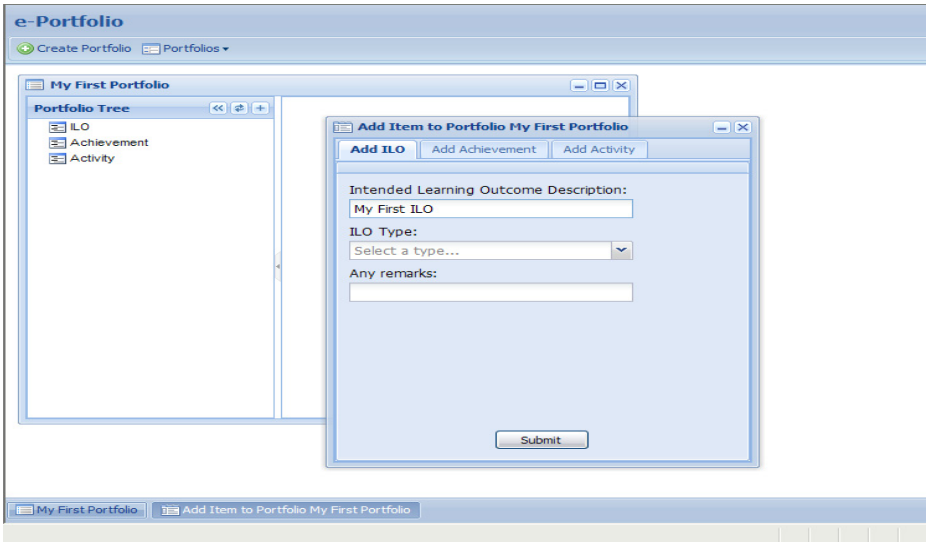

Fig. 1. The User Interface of the Outcome-based e-Portfolio System

The system records basic data for an activity entry and provides a metadata template for a student to describe a piece of achievement evidence, which may be in the forms of a certificate of merit, a transcript, or even a certificate of attendance to certain activities. In order to provide students with an easy guide to set up the intended learning outcomes and then link a piece of evidence to specific intended learning outcomes, the system also provide a structured list of these attributes for selection. The intended outcomes were organized into 8 categories including analytic and problem solving, IT literacy, interpersonal skill, language proficiency, management skill, numerical competency, technical skill and work attitude.

A portfolio ontology model was created to represent a portfolio and its data elements including *intended learning outcomes, activity, achievement* and their relationship. A portion of the portfolio ontology is shown in Figure 2. Protégé [9] was used as the ontology editor for the initial creation of the portfolio ontology. Semantic web application is one of the underlying technologies for ontology. The use of

metadata for description and representation of taxonomy of a subject domain and its relationship in ontology provides human-defined semantics and computer-understandable information to the underlying data. By employing ontology in this prototype, rooms are left for [i] adjusting the Intended Learning Outcome, Activity, and Achievement taxonomy and their relationships; and [ii] generating abstract views for different purposes by inferring from the portfolio ontology network path.

With the help of the portfolio data relationship, when one wants to check what has been achieved in terms of a specific intended learning outcome, one could easily find a list of activities and achievements with evidence.

Fig. 2. Portfolio Data Ontology

4.2 The Experience

Since it is a first attempt in building such an electronic portfolio system, we only focused on providing functions for maintaining portfolio data in simplest forms, describing achievements or evidence of learning and linking evidence to intended learning outcomes. For example, we have only recorded the activities in terms of name, date and time, place etc. A student needs to link the intended learning outcomes, activities and achievements together manually. The construction of a portfolio is a process of collecting learning achievements. When linking the learning activity and achievement to intended learning outcomes, reflection can be realized by asking the question of what I have achieved from taking this learning activity. The history and reflection component in taking a learning activity has not been recorded in this prototype.

When linking the portfolio data together, we discovered that there were a lot of common attributes or intended learning outcomes for some specific activities. Creating the linkages or relationship between these activities and learning outcomes are repetitious and cumbersome but with a possibility of neglecting some of the

important intended learning outcomes. It would be a great help to students if the system could provide a well-defined and well-designed activity template in the portfolio construction process. In other words, it is desirable to consider a more rigorous learning design approach in planning the activity.

5 Conclusion

The proposed outcome-based e-Portfolio construction is focused on defining the intended learning outcomes, recording the learning activities, collecting learning achievements and linking them to intended learning outcomes. A prototype was developed to demonstrate the viability of the concept and to uncover practical issues of taking this approach in constructing a portfolio. The current prototype can provide a simple mechanism to link up different categories of portfolio data together but fails to include details such as history and reflection in taking an activity. There are also issues when linking activity to intended learning outcomes. The next step will be adopting a learning design approach when planning an activity.

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Effective Mentoring of Undergraduate Final Year Projects: Using a Wiki-Based Environment

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Abstract. In this paper, we present a novel team-based project mentoring method with a wiki-based system, named "TikiWiki", for the final year project courses offered at the undergraduate level. With the powerful groupware features provided by the TikiWiki, the instructor is able to establish a community-centered mentoring environment that capitalizes on local expertise to create a sense of online collaborative learning among students. The TikiWiki can help the instructor effectively organize and coordinate final year projects, and the groupware features may support the interactive activities, such as interpersonal communications and data sharing. The groupware features also provide the web-based system with a wide range of additional ways of organizing collaboratively developed materials, which makes it an effective tool for online active learning. The student is able to learn the ability to work effectively in a team, with an improvement of project management, design collaboration, and technical writing skills. With the fruitful outcomes in recent years, we positively think that the collaborative learning environment with the TikiWiki can perform an excellent shift away from the conventional instructor-centered teaching to community-centered collaborative learning for the final year courses.

1. Introduction

The traditional instructional model for college courses is usually characterized by presentation of lectures, and provides an environment that is instructor-centered classroom teaching [22]. The knowledge-based lectures tended to cover the materials in the same sequence as they appeared in the textbook, but with little attention to learner-centered activities, or community involvement. In most final year courses of

recent years, however, the emphasis is usually placed on solving large-scale, open-ended, complex, and sometimes ill-defined real-world problems [10], [19], rather than just learning new materials. Students are often provided opportunities to produce their coursework with the system-wide synthesis and analysis, verbal project reports and written deliverable documents, and their solutions of an open-ended, real-world problem [13], [18]. Hence, the typical syllabus only contains fairly a few lectures, and concentrates on student problem-solving performance and teamwork collaborations outside the classroom, with the aim of helping prepare the senior student with the system-design, analytical, project management, communication, and interpersonal skills [9], [14], [25], [26]. Nowadays, the advances of learning science and development of web-based technologies [1], [7], [17], enable the instructors to effectively implement and maintain the interactive mentoring models [5], [7], [15]. The web-based learning technologies can provide both the learners and instructors with convenient access, at any time and from anywhere [3], [8]. In addition, many web-based learning environments are able to support online collaborations [20], [23], [24], and their utility of powerful features enables the instructors to timely assess the learners' learning activities and performance [14], [16]. This paper describes the wiki-based content management system that was used in the final year project courses offered at Beijing University of Posts and Telecommunications (BUPT), China. We also present the advantages of the wiki-based collaborative learning environment for mentoring undergraduate students.

2. Overview of the BUPT Final Year Project Mentoring

Compliant with the engineering education program requirements of the Accreditation Board of Engineering and Technology, Inc., [11], the primary objective of our final year mentoring is to help prepare undergraduate students enrolled in electrical engineering, computer engineering, and bioengineering programs with the skills of teamwork, project concept generation, management, technical writing, and interpersonal skills.

Teamwork performance is considered to be a pivotal part in our mentoring for the final year project courses. Normally, the class is divided into a few small teams, each of which comprises no more than three students. Interdisciplinary teaming is recommended, as the combination of students from diverse background is conducive to collaborative and constructive learning [4], [6]. Regarding the teamwork styles, all the teams would be categorized as field-independent and field-dependent groups according to the concept of Enderle et al. [10]. Field-independent team members should be excellent problem solvers, and they typically need private time to clarify ideas and solutions. Field-dependent learners, on the other hand, should be excellent communicators and need the interaction of the team to clarify ideas and solutions. On a team-based final year project, each student has some individual tasks to accomplish, and a team success depends upon its members' contributions to the task completion as a whole.

Efficient teamwork collaboration calls for an effective supporting system. Recent research in learning science, as summarized in the Bransfored's book [2], reports that

most effective learning environments are knowledge centered, assessment centered, learner centered, and community centered [3], [5]. With the motivation of fostering collaborative learning skills of students involved in the final year projects, we utilize a powerful and multilingual wiki-based system, named "TikiWiki". Through the TikiWiki, we make our effort to establish an effective community-centered learning environment for mentoring, and to place the student as the main actor of the teaching-learning process by increasing his interactivity and participation. The following sections provide a description of the TikiWiki system that supports our final year projects, and then present our mentoring style under such a wiki-based environment.

3. Collaborative Learning with the TikiWiki system

3.1 Description of the TikiWiki system

The TikiWiki system is an open source software package[1] that includes the Content Management System (CMS) and rich features of groupware, e.g. the Calendar, File Gallery, Notepad, Task, and Wiki, and it can be used to establish a community-centered learning environment for final year projects. The details of the key features of the TikiWiki system are listed in Table 1, and an illustration of the File Gallery feature is shown in Figure 1. The TikiWiki system also provides the feature-rich software packages. Unlike other open source platforms that ship only a small set of features and encourage third party add-ons, the TikiWiki system incorporates a sufficient number of features in the main code base, which helps ensure that all these features will not get broken when the system is upgraded. It also permits tight integration of the various features and makes it easier for content usage. A predominant characteristic of the TikiWiki is that the wiki syntax works throughout the application. In addition, the wiki-based features provide the TikiWiki system with a wide range of additional methods for organizing and monitoring collaboratively developed data (including forums, articles, and blogs), which makes the TikiWiki become one of the most effective tools yet created for online teamwork and collaborations.

[1] The TikiWiki documentation online available: http://doc.tikiwiki.org/

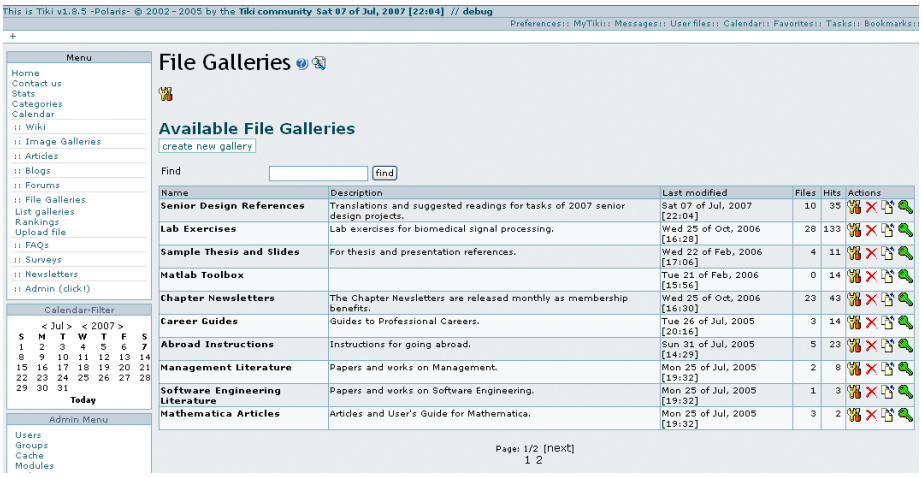

Fig. 1. The File Gallery feature of the TikiWiki system: a screen shot

Table 1. Descriptions of the TikiWiki features

Feature names	Descriptions
Articles	Fast-breaking news, announcements
Blog	Online diaries or journals
Calendar	Events calendar with public, private and group channels
Chat	Real-time group text chatting
File Gallery	Computer files, videos or software for downloading
Forum	Online discussions on a variety of topics with file attachments
Image Gallery	Collections of graphic images for viewing or downloading
Newsletters	Content mailed to registered users
Notepad	Users can write, upload, download and read notes. Notes can be read as raw text files or as wiki pages interpreting the wiki markup syntax.
Quiz	Timed questionnaire with recorded scores
Survey	Questionnaire with multiple choice or open ended question
Task	To do list. Users can send tasks to others. Teams share group tasks.
Wiki	Collaboratively authored documents with history of changes

3.2 Collaborative Learning in Final year Projects

When mentoring of final year projects under the TikiWiki environment, the instructor can first post a few open-ended problems for students' choice. In this phase, the balance between theory and practice should be carefully considered. Too much "real world" practice would make the learning become simply job training, yet, too little practical experience leaves the students with naive problem-solving skills [10]. The problems selected in our final year and related courses can easily tap into students' interests and fall on a "reality" scale, which were not so trivial that they could be solved in only a few steps. Figure 2 gives an example of the candidate problems. The objective, background, and the details of the tasks are listed in the Forum feature page of the TikiWiki system.

Later, a series of lectures that present the details of the team-based projects and the desired outcomes will be scheduled. Students can self-assess the project proposals, and also exchange their interests and ideas in the form of in-class brainstorming sessions or via web chatting with the TikiWiki system. At this stage, the instructor coordinates the teams based on the interests, capabilities, and backgrounds of students. According to our experience of final year project mentoring since 2002, the optimal team pattern often turns to be an interdisciplinary combination of students with assorted backgrounds, and usually, the team leader should be a sophisticated person who is good at interpersonal communications. The teamwork collaborations would be emphasized again, because the face-to-face talking and cyber-interactions among students are vital for the successful completion of their projects.

At the next step, the instructor can deploy the project assignments according to the conclusions of previous discussions (see Figure 3 for an illustration of project assignments via the TikiWiki Forum feature), and help coordinate the roles of the members in their teams. The instructor will assist the student in focusing on the important aspects of the projects, along with guidance on research, technologies, methodologies, and testing. A research project may include reviewing current literature on the subject, examination of current patents to see what has been done previously and what could be done without infringing on the work of others [16]. The supporting materials such as bibliography and technical notes are downloadable in the File Gallery of the TikiWiki, and some illustrations and running project examples are visible on the wiki pages. The groupware features of the TikiWiki provide much convenience for community-centered interactive activities by means of interpersonal communications and data sharing.

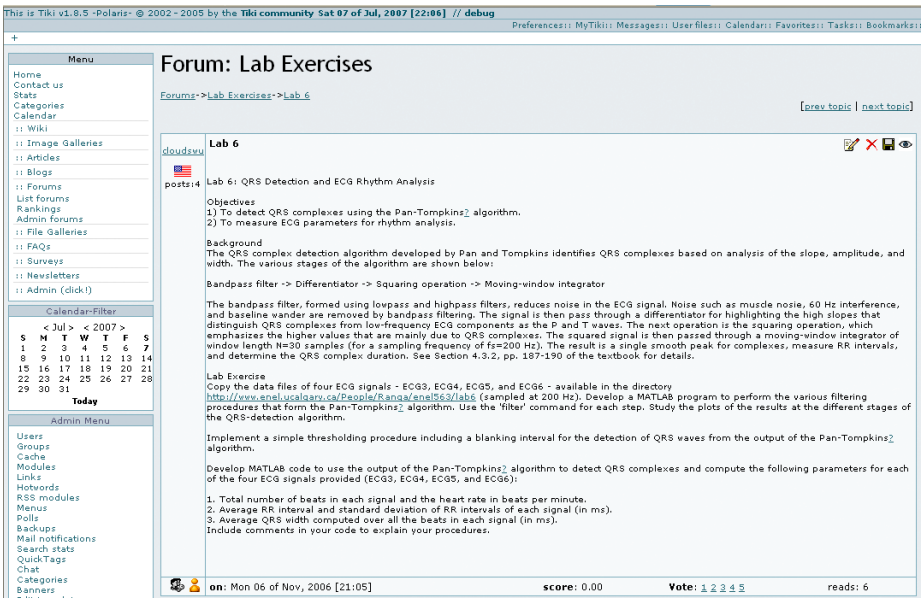

Fig. 2. An electrocardiographic (ECG) signal processing problem for students' choice

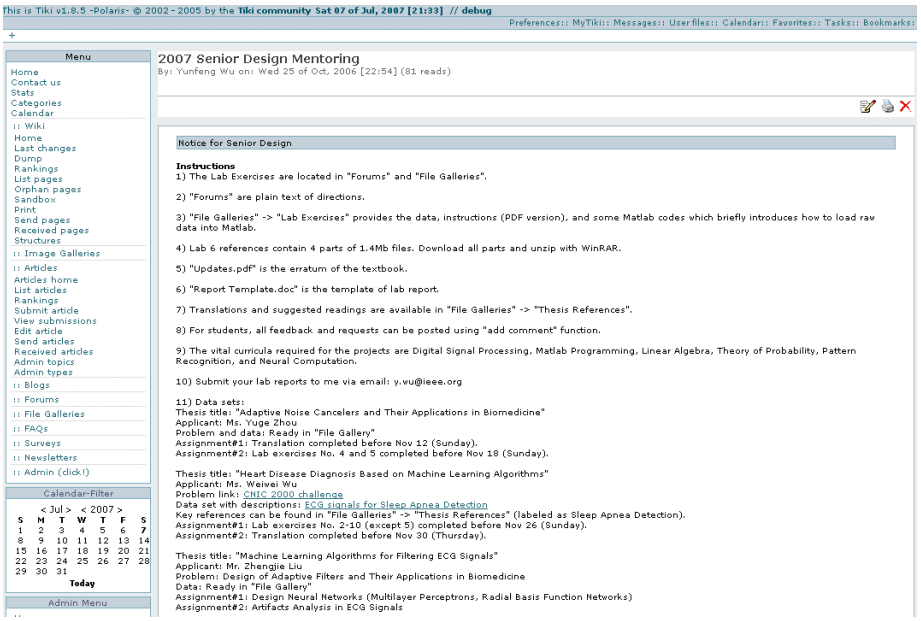

Fig. 3. Illustration of the project assignments deployed to students

It is quite common that one or more students in a team are less industrious than others, which may result in an unsatisfactory project in the end. The timeline development, therefore, becomes important and necessary for a success of the project [21]. The TikiWiki system contains the Task feature which can help the instructor monitor the different stages of each ongoing project by reviewing the progress reports submitted by student teams via web browser. Students are required to make oral presentations about project implementation in class, and then submit written reports through the Article groupware feature. The instructor will make comments on the task implementation and the interim reports, and might adjust the roles of some members within an unsatisfactory team if necessary.

Finally, students will be required to upload their final reports via the stated web site, which are comprised of team project deliverable documents and the individual contributions to their teams, in accordance with the deadlines indicated in the Calendar feature. Those project documents evaluated as an excellence will be posted on the web page, and a post-project meeting will be scheduled for students to present the strength and weakness of their projects. During the interactive sessions, students can share their experience of project practice with the audience, and the instructor will summarize each project with some informed advice. The session memos will then be recorded by teaching assistants, and later archived in the course repertory of the TikiWiki system for future references.

4. Outcomes

The outcomes of our final year project mentoring using the powerful TikiWiki system were fruitful. Our program received very positive feedback from the students involved in the project courses, and the satisfaction ratio retains over 93% for the past three years. One of our pioneering students won the second place prize of the *Myron Zuker* student design contest sponsored by the IEEE Industry Applications Society in 2002. With the encouraging achievement, our students started efficient teamwork and online collaborations with the TikiWiki system from 2003. As a result, a group of students with interdisciplinary backgrounds developed an excellent wireless solution of language translation, and successfully won the first place prize of the *Myron Zucker* student design contest in 2005. In addition, the students' achievement received the 2005 Outstanding Performance Award granted by the IEEE Engineering in Medicine and Biology Society.

5. Concluding Remarks

It has been widely accepted that the collaborative learning activities can provide a unique opportunity to foster individualized learning and teamwork experience. Our web-based environment using the TikiWiki system performs a great shift away from the conventional instructor-driven mentoring to community-centered collaborative learning environment for final year courses. Students are able to learn how to work effectively in teams, with a superb improvement of problem-solving skills, such as project management, design collaboration, conflict resolution, verbal presentation, and technical writing. It is believed that the knowledge-centered, learner-centered, and community-centered collaborative learning environment based on wiki or other web-based systems will play an important role in the pilot college programs, and provide students with good preparations for their future careers in engineering.

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Machine Learning - Handwritten Signature Verification on Tablet Applied in an Attendance Sign-in System[1]

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Abstract. Handwritten Signature Verification (HSV) has been changed in the last decade as graphics tablets have come into widespread uses. A tablet can be used to capture a handwritten signature as samples of coordinate pairs. We propose a HSV in a two-phase methodology. The first phase includes procedures with machine learning. We capture a set of initial HSV figures from the user who can be identified according to the nine HSV features. They are Number of Strokes, X coordinate sequence, Y coordinate sequence, Average pressure, Speed of Strokes, Angle of first two strokes, Number of cross points, Proportion of Width and Length of signature, and Elapsed Time. In the second phase, we compute the mean and the ranked weighting factors of the nine features of HSV. The higher value of the weighting factor is represented the better similarity.

Keywords: Handwritten Signature Verification HSV, Machine Learning, Weighting Factor, tablet

1. Introduction

The Handwritten Signature Verification (HSV) is a common behavioral biometric to identity human beings for different purposes such as establishing their authority to complete an automated transaction, gaining control of a computer, gaining physical entry to a protected area, and so on. Signatures are particularly useful for identifications because each person's signature is highly unique, especially if the dynamic properties of the signature are considered in addition to the static shape of the signature. Even though skilled forgers can accurately reproduce the shape of signatures, it is unlikely that they can simultaneously reproduce the dynamic properties including pressure, speed, and time as well.

Most early work in automatic HSV, in the early 1970's or before, focused on static (or off-line) HSV. Static HSV systems are those that require only an image of the signature. The advantage of these systems is that they do not need specialized hardware to capture signature information at the point of sign. However, static techniques don't take advantage of the signature dynamics. Thus the results generally

[1] The work described in this paper was substantially supported by a grant from City University of Hong Kong (Project No.: 9667023)

aren't as good as for dynamic techniques. Early dynamics HSV was based on using specially instrumented pens since no suitable equipment for capturing signatures was available. Recall that this has changed in the last decade as graphics tablets have come into widespread uses. A typical modern on-line HSV system therefore is likely to be based on a dynamic technique which uses a signature input device like a tablet.

2. Literature review

Early HSV work were described by Herbst and Liu [1], Plamondon and Lorette [2], Leclerc and Plamondon [3], Gupta and McCabe [4]. Two different approaches to signature verification are common. The first approach is called the functional approach. The second approach is called the parametric approach. Feng and Wah [5] presented a technique called extreme points warping (EPW), which used dynamic time warping of selected important points (the peaks and valleys) of a signature. Chang, Wang and Suen [6] presented a technique based on Bayesian Neural Network for dynamic HSV of Chinese signatures. Kashi, Hu, Nelson and Turin [7] described a method for the automatic verification of online handwritten signatures using both global and local features.

3. Methodology of ML-HSV

Signature normalization is an important preprocessing step in signature verification. Depending on writing conditions, people modify their signatures. If the space for a signature on a document is small, people tend to scale down their signatures. If there is no clear indication of the writing direction, signature verification must not be sensitive to signature rotation. There are two possible solutions for reducing dependence of signature verification on these transformations: select features that are invariant to the transformations or perform signature normalization. We use a scheme based on Fourier transforms to normalize tablet signatures [8], that is, sign one' signature by using a tablet on a computer.

3.1 Definitions

It is convenient to use complex notations to represent planar curves (x_0, y_0), (x_1, y_1), …(x_{N-1}, y_{N-1}) using complex vector notations. An ordered sequence of complex vectors with the linear operations defined in a usual way is called a linear space $\mathbf{C}^N$. Thus each vector $\mathbf{z} \in \mathbf{C}^N$ can be expressed as

$$\mathbf{z} = \mathbf{x} + j\mathbf{y} \tag{1}$$

where $\mathbf{x} = (x_0, x_1, \ldots, x_{N-1})$ and $\mathbf{y} = (y_0, y_1, \ldots, y_{N-1})$.

The space of complex vectors with the dot product defined as

$$\mathrm{z}_1 \cdot \mathrm{z}_2 = \sum_{i=0}^{N-1} z_{1,i} \cdot z_{2,i}^{*} = \sum_{i=0}^{N-1} (x_{1,i} + jy_{1,i}) \cdot (x_{2,i} - jy_{2,i}) \tag{2}$$

Where z^{*} denotes complex conjugate of z, is called a unitary space U^{N}.

Vector norm (length) is defined as

$$|\mathrm{z}| = \sqrt{(\mathrm{z} \cdot \mathrm{z})} = \sqrt{(\mathrm{x} \cdot \mathrm{x} + \mathrm{y} \cdot \mathrm{y})} \tag{3}$$

Vectors are called orthogonal if their dot product is equal to zero. The absolute value of the dot product is invariant with respect to a curve rotation witch can be seen from the following equation:

$$|(\exp[j\theta]\mathrm{z}_1) \cdot \mathrm{z}_2| = |\exp[j\theta]|\,|\mathrm{z}_1 \cdot \mathrm{z}_2| \tag{4}$$

The magnitude of the dot product can be further normalized for scale invariance and its

$$D = \frac{|\mathrm{z}_1 \cdot \mathrm{z}_2|}{|\mathrm{z}_1| \cdot |\mathrm{z}_2|} \tag{5}$$

value is one of many distance metrics between two curves and can be used as a measure of curve similarity. Using vector notations, the combined affined transformation of a curve can be expressed as

$$\mathrm{z}' = A\mathrm{z} + B \tag{6}$$

Where $A = K\exp[j\theta]$, $K = |A|$ is related to scale, $\theta = \arg(A)$ is related to angle of rotation, and *B* is a complex quantity related to the displacement.

3.2 Fourier normalization

Fourier transform of a planar curve **z** is defined as a mapping

$$\mathrm{Z} = \mathrm{Fz} \tag{7}$$

where F is the Fourier matrix. The entry in row *j* and column *k* of F is defined as $F_{jk} = w^{jk}$ where w is the primitive N^{th} root of unity and is defined as $w = \exp[2\pi i / N]$. Since this mapping is invertible:

$$\mathrm{z} = \mathrm{F}^{-1}\mathrm{Z} \tag{8}$$

and since the Fourier matrix is both symmetric and orthogonal

$$\mathrm{F}^{-1} = \frac{1}{N}\mathrm{F}^{*} \tag{9}$$

The sequence Z can be represented as an alternative representation of a curve in the "spatial frequency" domain. This and similar transforms are very popular in image processing, because often many coefficients of Z are small and can be neglected thus giving a more compact and smoothed curve representation. In our implementation, we obtained the Fourier transform of the first difference of the coordinates, instead of the actual coordinates as shown in equation (7). This was done to reduce the end-point distortions in the reconstructed signature obtained by using the inverse Fourier transform.

The objective of signature normalization is to transform a signature to some canonical form which is then processed by the signature verification algorithm. Our approach to signature normalization is based on the normalization of its Fourier coefficients. First we set $Z_0 = 0$ which according to equation (6) is equivalent to translating the coordinate system origin to the curve centroid

$$Z_0 = \frac{1}{N}\sum_{k=0}^{N-1} z_k \tag{10}$$

Next, we divide the rest of the Fourier coefficients by Z_1. Since the Fourier transform is linear, each coordinate of the translated signature is divided by Z_1 which according to equation (6) is equivalent to scaling by $K = 1/|Z_1|$ and rotating by $\theta = \arg Z_1$. The normalized signature is obtained by the inverse transformation of the normalized Fourier coefficients and is used for the computation of the features.

3.3 Method to measure the similarity

A method is proposed to measure the similarity of the reference signature and the test signature. In our performance evaluation, we compute Euclidean distance between two signatures. Quantifying the similarity among features is shown in the following nine steps.

Nine features are selected for HSV:

1. Number of strokes

$N_s = N_{pu}$

N_{pu} means the number the pen is lifted when writing the signature.

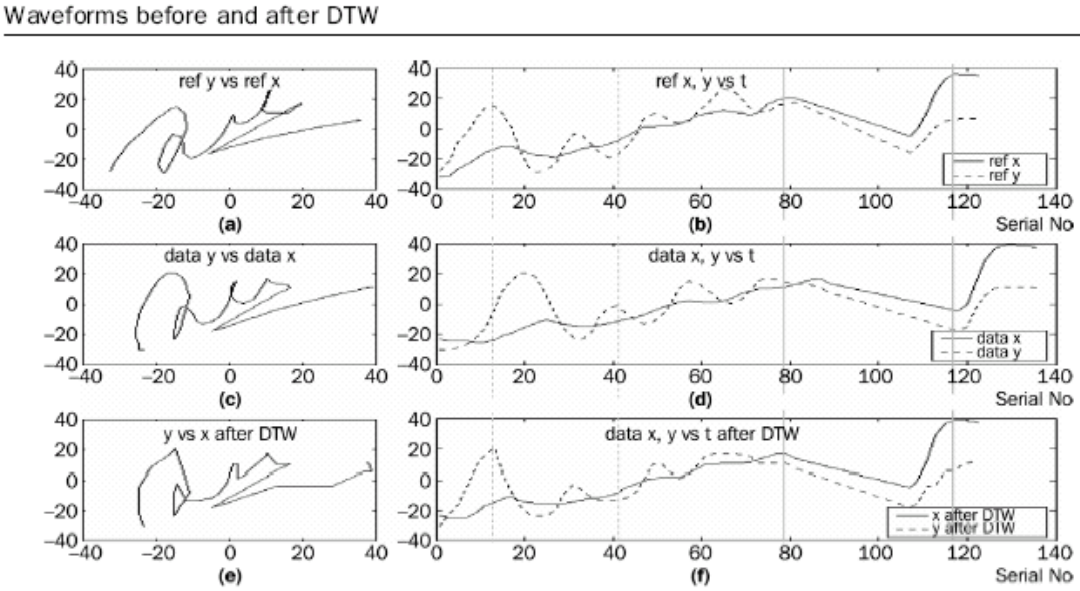
2. Sequence of strokes

Transform the spatial coordinate of the signature into time series waveforms. x and y waveforms are both needed. Dynamic time warping (DTW) [9] is to align the shapes of x, y waveforms from a test sample with the reference ones.

$X = [x_1, x_2, x_3, ..., x_k]$

$Y = [y_1, y_2, y_3, ..., y_k]$

k is the number of samples in the signature



3. Pressure of strokes

$P = [p_1, p_2, p_3, ..., p_k]$

k is the number of samples in the signature

The signature device can detect the pressure and record it.

4. Speed of strokes

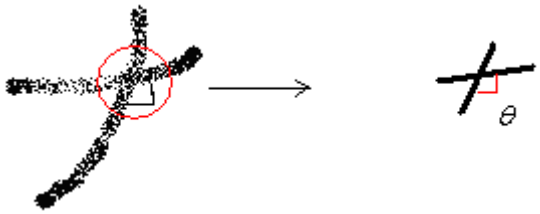
$$V = \frac{L_{st}}{T}$$

L_{st} is the whole length of the signature track

T is the whole time finishing the signature

5. Angle of strokes

The angle between the first two successive strokes is used as a feature.



θ can be calculated as the angle between the two straight line

6. Continuity of strokes

We check whether two first two successive strokes have intersection point.

If yes, $C = 1$

If no, $C = 0$

7. Number of intersection point

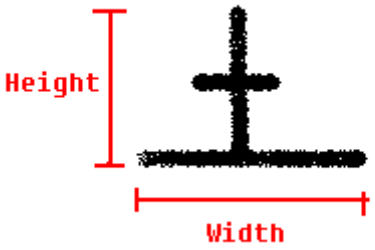
N_i = the number of intersection points between different strokes

8. Proportion of Width and Length of signature

$$R = \frac{W}{H}$$

W represents the width of the signature

H represents the height of the signature



9. Time in contact

T_{con} = the accumulated time when the pen contacts with the paper in the whole signature time

Let's assume the every feature has the same weighting factor, that is:

$$w_1 = w_2 = w_3 = w_4 = w_5 = w_6 = w_7 = w_8 = w_9 = \frac{1}{9}$$

Then the total similarity between two signatures is:

$$TS = \sum_{i=1}^{9} S_i \times w_i = S_1 \times w_1 + S_2 \times w_2 + \ldots + S_9 \times w_9$$

4 Case study and evaluation

The HSV system can actually be applied in many areas such as banking corporation, legal process, or Government. In order to implement and evaluate the proposed methodology, we just apply it into a case named an attendance sign-in system. In the City Universities, students may need to take attendances to meet the lecturer's requirement of their enrolled courses. Lecturers have no control whether or not the signatures signed on attendance sheet are the corresponding students. One of the solutions is to implement the machine learning HSV system for resolving the problem and evaluating the findings of the proposed system. The case is a web-based application. We shall use the Apache with Tomcat server. The program will be developed by using Java Servlet Face (JSF) and MySQL database. The first step is to collect an initial signature. The second step is to collect an attendant signature. The third step is to verify the similarity of two signatures. Eventually, an accepted signature or a rejected signature can finally be proved.

The aim of the study is to implement the proposed HSV system into a real situation. Although the machine learning process can be accumulated and iterated to tune up for the verification, we shall not apply the multi-signature learning into the case. The machine will only learn the first signature in this case which is called the single-signature learning. Therefore, the nine features will be weighted in a different proportion for one signature learning according to a pre-defined distribution. If we use several signatures for the learning process, the weighted ranking of the features will not be equal according to the trend of a user's signature.

In the case, all signed students' attendant tablet signatures in each lecture will be compared with their initial tablet signature that was signed by the student at the beginning of the course. At the end of the course, according to these handwriting signatures including the initial and attendant signatures, we can sum up with a conclusion regarding the HSV system and student attendance. The following Fig. 1 is the work flow for the attendance sign-in system.

The ER-diagram of the system is also developed and shown in Fig. 2. In Fig. 3, the login page of the attendance sign-in system is created and students will select their numbers in order to enter to the signature collection form as shown in Fig. 4.

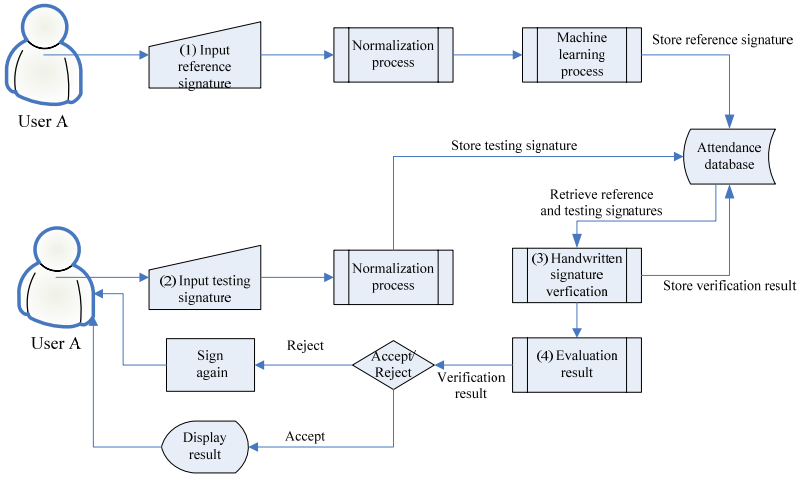


Fig. 1 – The work flow of the attendance sing-in system

4.1 Collecting an initial signature

In the application, a signature collection form is designed for collecting an initial signature. In this step, the signature will be normalized and stored in a data source. Therefore, the signature normalization is implemented in this step. In the attendance sign-in system, it must collect the first signature as an initial one for each student. Students may sign in their first signature in the first lecture or the first attendance in subsequence lectures. Once the data of the initial signature is obtained as shown in Fig. 4, it is used for comparing all attendant signatures.

Since the HSV system is proposed to be implemented a learning feature for each user, the Machine Learning (ML) process in this application occurs for the initial signature only. The system selects all nine features as major user characteristics. These nine major characteristics must reliably be included in each comparison with attendant signatures. The dynamic features including pressure, speed, and time must be counted in a single signature learning since these are important for an online HSV. The other two static features are number of strokes and number of cross points. The number of strokes factor is important because more or less one stroke must be treated for two different words, especially in Chinese characters. As for the number of cross points, it is important as well. The similarity of two tablet signatures should be in a same number of cross points.

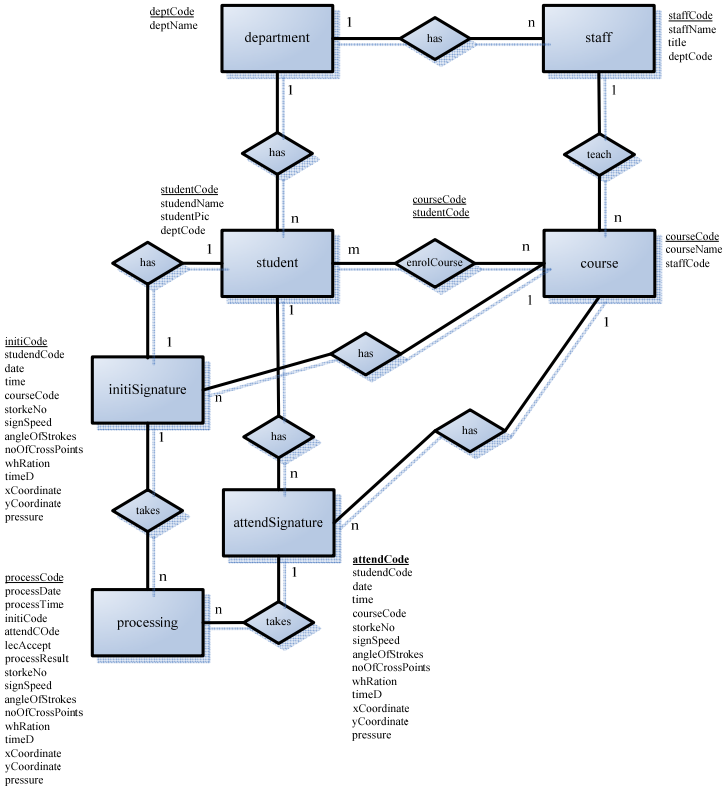


Fig. 2 – The ER-diagram of the system

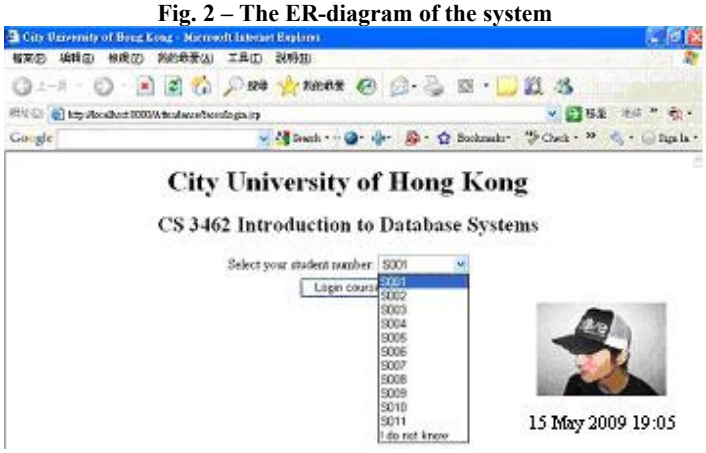


Fig. 3 – The login page of the attendance sign-in system

Each student has an initial signature kept in the system so that in the MySQL database, we have to create an initiSignature table for recording necessary data. Besides, a course table and a student table will also be created at the same time.

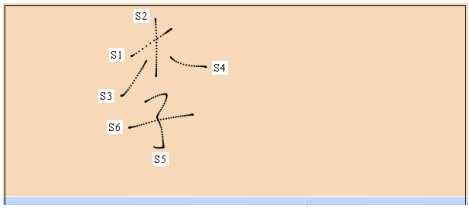


Fig. 4 – Capturing the initial signature

4.2 Collecting an attendant signature

We re-load the signature collection form for collecting an attendant signature. After capturing the attendant signature, it must be normalized in order to proceed the verification in step three. The learning technology is not involved in the attendant signature so that the processing time is quick. In this study, machine learning (ML) is occurred in the initial signature only. In the application, a student must provide his/her student number in order to record his/her signature into the data source. After signing in his/her signature, the static data including stroke numbers, angle, X & Y coordinates, cross points, and proportion as well as the dynamic data including pressure, speed, and time are captured. Therefore, a student's password can be replaced by a student's signature. Subsequently, two sets of signatures that are the initial and attendant signatures are evaluated in the HSV process.

The system will keep the data of the attendant signature in using MySQL database system. In addition, it will also record the student name and some relevant data such as date, time, and course information. Therefore, we shall develop and design several tables for attendant signatures in the database system. We have an attendSignature table that consists of attendCode, studentCode, date, time, courseCode, and nine feature columns. In order to connect the course table and the student table, we create an enrolCourse table. We create a department table that consists of deptCode and deptName. A staff table that consists of staffCode, staffName, title, and deptCode is also created. The data of the attendant signature will be recorded on the system before comparing with the initial data. The following Fig. 5 and 6 are interfaces for capturing two different attendance signatures for comparisons with the initial signature.

Fig. 5 – Capturing attendance signature 1

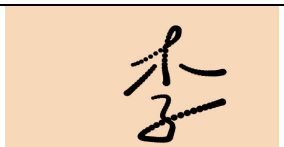
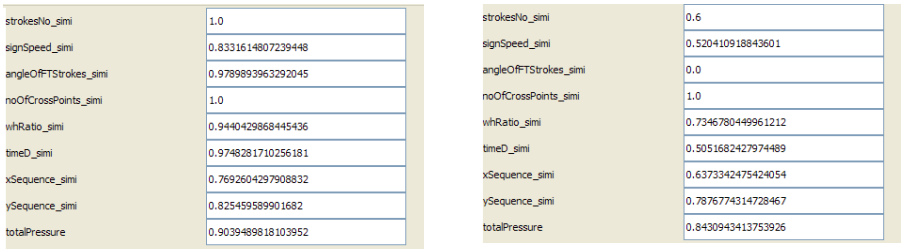


Fig. 6 – Capturing attendance signature 2

4.3 The HSV process

In this step, two signatures with different nine features are verified through the proposed HSV process. Different weightings of features must be obtained. Then, we have two important figures. The first one is concerned as static data which consists of stroke number, angle, cross point, X coordinate, Y coordinate, and proportion. The second one is concerned of dynamic data which consists of pressure, speed, and time. The HSV process focuses on a similarity indication based on the static and dynamic data between the initial signature and the attendant signature extracted from the data source. Therefore, in the MySQL database, we can find two tables which are initiSignature and attendSignature. Besides, the system will record every HSV process so that an hsvProcess table is created. In Fig. 7, the data obtained from two different attendance signatures is weighted.



strokesNo_simi	1.0
signSpeed_simi	0.8331614807239448
angleOfFTStrokes_simi	0.9789893963292045
noOfCrossPoints_simi	1.0
whRatio_simi	0.9440429868445436
timeD_simi	0.9748281710256181
xSequence_simi	0.7692604297908832
ySequence_simi	0.825459589901682
totalPressure	0.9039489818103952

strokesNo_simi	0.6
signSpeed_simi	0.520410918843601
angleOfFTStrokes_simi	0.0
noOfCrossPoints_simi	1.0
whRatio_simi	0.7346780449961212
timeD_simi	0.5051682427974489
xSequence_simi	0.6373342475424054
ySequence_simi	0.7876774314728467
totalPressure	0.8430943413753926

Fig. 7 – Data obtained from the HSV process for the signatures 1 and 2

4.4 The evaluation result

According to a pre-defined acceptance score, a verification result is justified through the whole process. The system displays a rejected data on the screen as shown in Fig. 9 if the attendant signature is not matched with the initial signature in terms of static and dynamic data. Otherwise, it displays an accepted data on the screen as shown in Fig. 8. The acceptance rule is at least 80% similarity between attendance tablet signature and the initial tablet signature.

Actually, the processResult column of the hsvProcess table is used for generating the similarity indication which is evaluated as a rejected or accepted result. This indication is varied every time when using the multi-signature HSV model since the weighted factors of nine features are adjusted frequently. In the single-signature HSV model, this is fixed. Each feature can sum up with a readable figure. Depending upon the weighting distribution, the result of the evaluation can be calculated and displayed on the application screen. If the evaluation grading is in a full mark, the score is equal to 1. Therefore, we must define an acceptable score for the similarity indicator before running the HSV process. In this case, we will set the score in a high level which is equal to or more than the score at 0.8.

If a student signs attendant signatures with rejected results several times, the system will record and stop the iteration process with a notification. Sometimes, students hold several own signatures. He/She may not remember his/her initial signature that has already been recorded by the attendance sign-in system. Therefore,

lecturer will have a right to accept the attendant signature by viewing the student picture from the login page. Otherwise, the signature will be counted as a forgery. The ML-HSV process in the attendance sign-in system is used for identifying the correct students. At the end of the course, lecturer can view an attendance statistic report (Fig. 10) and individual student report (Fig. 11) to weight each student's learning attitude. This is the main function of the system.

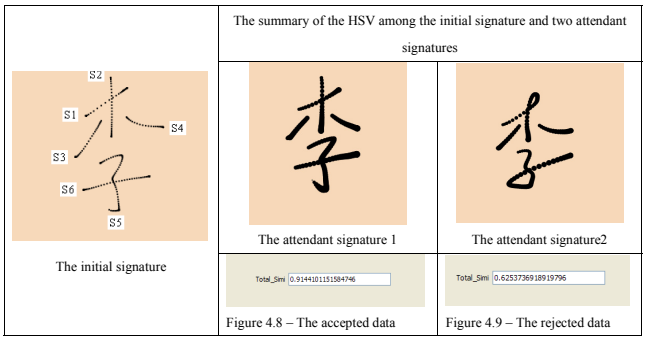


Fig. 8 – The accepted tablet signature **Fig. 9 – The rejected tablet signature**

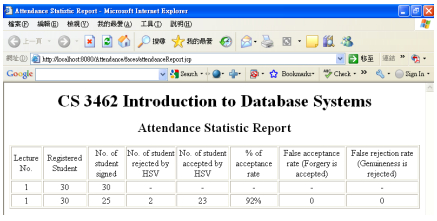


Fig. 10 – Attendance statistic report

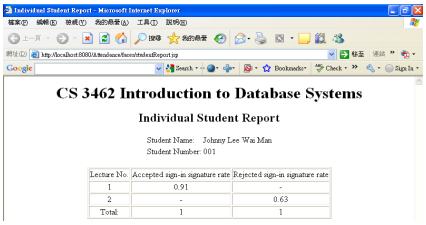


Fig. 11 – Individual student report

5 Conclusion and future work

We add an extra feature which is the machine learning process on top of the concurrent Handwriting Signature Verification (i.e. a static and dynamic verification) for the attendance sign-up system. The case is used to implement and to evaluate the feasibility of using the ML-HSV. The attendance statistic report as shown in Fig. 10 can be used to summarize the result of the system. Although we only implement a single-signature learning process, the whole application can function well. In addition, there is still room for improvement. For instance, we can implement a multiple-signature learning process in the future. We apply the attendance sign-in system in the university course which has been registered by several students. After implementing the system, we can conclude whether or not the ML-HSV can be used to identify the forgers who have assisted other students to sign in the lectures. The final result can be summarized as show in Fig. 11.

The future work of the ML-HSV is for developing a multi-signature learning process. Many people have their own styles in writing signatures so that these cannot

be consistent. As a result, it is important to capture the trend of signatures in order to perform accurate HSV on tablet by adding weighting factors to each feature using the multi-signature learning process.

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A Study of Effectiveness of E-learning in Hong Kong

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Abstract. Recent advances in information technology enable the development of e-learning, which becomes a global trend in education. However, the effectiveness of the e-learning program has not yet been thoroughly studied. Initial methodology has been proposed to measure the effectiveness of e-learning program. This study examines the effectiveness of e-learning in Hong Kong. Kirkpatrick's Four Levels Model is the most widely used model for measurement of effectiveness for training program. We have implemented Kirkpatrick's model to measure the effectiveness of e-learning in a university. Experimental results have shown that students are satisfied with e-learning programs. The e-learning programs are more effective in courses at the fundamental level. Students' academic results are significantly improved in these courses. However, the current e-learning programs fail to achieve some overall objectives of the schools. This study provides baseline data for schools in Hong Kong to set their strategic direction of e-learning.

1. Introduction

The traditional instruction takes place in face-to-face meetings between an instructor and students in a classroom. The instructional interactivity is important in conventional method of teaching. The instructor-led classroom education has been proven to be an effective way for delivery of knowledge. However, it is luxurious to implement classroom education in terms of resources. Sometimes, classroom education is infeasible due to some constraints such as time and space.

Recent advances in information technology enable the development of e-learning, which becomes a global trend in education. E-learning has a number of advantages over traditional classroom education (Obringer, 2008). Many educational institutes are now exploring the uses of e-learning courses. A large number of e-learning courses have been offered. To develop a training program, a lot of resources are required. Resources are also required to deliver the training program. To ensure better utilization of resources, it is important to measure the effectiveness of individual e-learning program.

Unfortunately, the effectiveness of the e-learning program has not yet been thoroughly studied in Hong Kong. Initial methodology has been proposed to measure

the effectiveness of e-learning (Leung, 2003). Leung proposed to measure the effectiveness of e-learning by using Kirkpatrick's Four Levels Model (Kirkpatrick, 1994). However, Leung implemented only the first two levels in the four levels model. Besides, there are a number of shortcomings.

This study fully implements the Kirkpatrick's model in evaluation of e-learning programs. We examine the effectiveness of e-learning in Hong Kong according to the Kirkpatrick's model. The quantitative measurements in the study shall provide baseline data for schools in Hong Kong to set their strategic direction of e-learning.

2. Kirkpatrick's Four Levels Model

Many training program fail to achieve the objectives of the organizations due to different reasons. It is very important to develop a model to evaluate the effectives of the training program. Evaluation is a systematic approach to measure the effectiveness of a training program (Russ-Eft & Preskill, 2001).

A number of models have been proposed for evaluation of training programs (Stokking, 1990). Kirkpatrick's Four Levels Model is currently the most well-known and most widely-used model for measurement of effectiveness of training programs. It is first proposed by Donald Kirkpatrick in 1959 (Kirkpatrick, 1959).

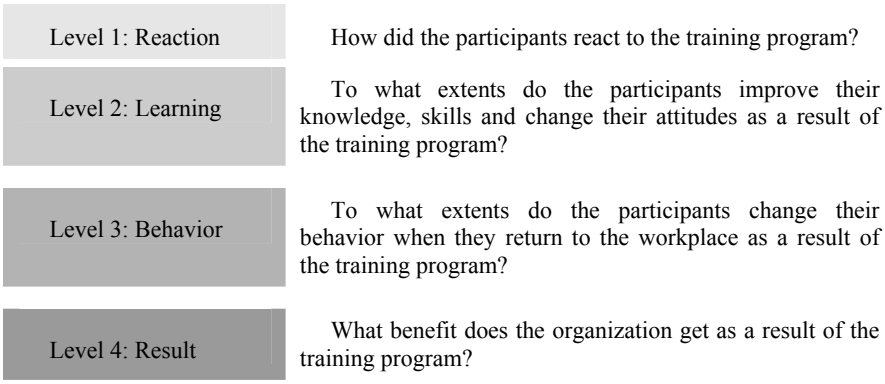

Fig. 1. Kirkpatrick's Four Levels Model

The Kirkpatrick's model contains 4 levels (Fig. 1), which are disjoint from each other. The four levels of Kirkpatrick's model are defined as (Kirkpatrick, 1959; Kirkpatrick, 1994):

Level 1 Evaluation – Reactions

Level 1 evaluation measures how participants in a training program react to the training program. Typically, participants evaluate the training program in different aspects, such as trainer, training environment, and training contents, etc. It provides some feedbacks for improvement of the program. According to Kirkpatrick (1994), every training program must at least be evaluated at this level.

Level 2 Evaluation – Learning
Level 2 evaluation measures the extent trainees have advanced in their skills, knowledge, or attitudes. Nowadays, the level two evaluation often involves conducting a test before the training (pre-training-test / pre-test) and a test after the training (post-training-test / post-test). The evaluation method can be formal or informal. The knowledge gained can be measured by comparing the results in the two tests.

Level 3 Evaluation – Transfer
Level 3 evaluation measures how the trainee's behavior is changed by the training program. It attempts to study how the knowledge gained can be applied to the daily operations. Level 3 measurement is more difficult, as the behavior is intangible.

Level 4 Evaluation- Results
Level 4 evaluation measures the overall effectiveness of the training program to the business objectives of the organization. In the commercial case, we can measure the change in sales volume or profit gained, etc. Level 4 measures the value added to the organization by a training program.

According to the model, evaluation must start with level one. If resource allows, the evaluation can be further extended to other levels sequentially. Information collected from prior levels will serve as a base for next level. The individual level provides a checkpoint in a training problem. For example, if a trainee is unsatisfied (which is measured in Level 1), he will slow down his learning process (which is measured in Level 2). If a trainee learns slowly, it will be a barrier for him to apply knowledge in his daily operations (which is measured in Level 3). Hence the overall business objectives cannot be achieved (which is measured in Level 4). They are equally important in the model.

Nowadays, Kirkpatrick's Four Levels Model has been widely used in evaluation of effectiveness for a wide range of training programs in the industry. Kirkpatrick's model has been implemented by a number of multinational organizations (Kirkpatrick & Kirkpatrick, 2006), including, Caterpillar, IBM, Microsoft, Nextel, and Toyota, etc. Though the Kirkpatrick's Model remains as an industry standard for evaluation of training programs, the literature delineating the implementation of Kirkpatrick's model in evaluation of learning programs in academic few and far between.

As in any modern city, schools in Hong Kong follow the global trend of e-learning. E-learning is first introduced to Hong Kong by universities and they naturally participate more actively in e-learning. This study focuses on e-learning in universities. Despite that e-learning was developed in 1990s (Cyrs, 1997; Wegner et. al., 1999), Leung (2003) first proposed to measure the e-learning program one decade later. Leung proposed to measure the effectiveness of e-learning by Kirkpatrick's model. However, Leung implemented the only first two levels. Besides, there are a lot of shortcomings:

- Leung conducted a small scale experiment. Only one course was evaluated in the study, while 38 students participated in e-learning and 45 students participated in traditional teaching model.

- The course selected was a course for postgraduate students. Usually, postgraduate students are more mature and self-disciplined. The results cannot be applied to undergraduate students.
- Leung evaluated the effectiveness of e-learning programs by comparing the assessment results of two batches of students. However, two batches of students had different academic background, different work experience, and different score in their undergraduate studies. Therefore, their academic results cannot be compared directly.
- Leung evaluated student's reaction by summarizing the feedback of students. However, there is not quantitative measurement about the student's satisfactions about the learning programs.
- The level 3 and level 4 of Kirkpatrick's model has not yet been implemented in Leung's study.

It is important to measure the effectiveness of e-learning program. There are a number of reasons to support evaluation. First, the evaluation provides data to show the effectiveness of the e-learning program. Schools want to ensure that the students gain knowledge in the e-learning programs. Second, the evaluation determines whether the e-learning program is aligned with the objectives of the school. Third, the evaluation identifies the weakness of the program for further improvement.

As there is no a complete study conducted in Hong Kong, this study investigates the effectiveness of e-learning in Hong Kong by using Kirkpatrick's model (Kirkpatrick, 1994). The formative evaluation of a training program is to conduct the evaluation during the development and implantation of a program with intentions for improvement of the program (Scriven, 1991).

This study evaluates the effectiveness of e-learning in Hong Kong. In addition, we also try to identify critical factors for success of an e-learning program. The study shall provide some useful information for schools in Hong Kong to set their strategic direction of e-learning. The management can determine whether it is cost effective to implement e-learning programs. The study provides some guidelines for schools to implement e-learning programs, and feedbacks to the school for enhancement of their e-learning programs. Finally, we hope that some more effective e-learning programs can be developed based on this study.

3. Implementation of Kirkpatrick's Four Levels

We have followed the Kirkpatrick's Four Levels Model to design the evaluation of e-learning programs. It is believed that differentiation of evaluation occurs between programs (Stokking, 1999). The evaluations must be designed to align with the objectives of the training programs (McCurry, 1999). The e-learning programs in academic field are very different from training programs in commercial. As a result, the four levels will be modified to fit the e-learning model in academics. Experiments have been designed for each level to measure a specific dimension of the program. Instructors and students from the Department of Computer Science in City University of Hong Kong have been invited to participate in the study. We have conducted questionnaire survey and interviews.

Level 1 Evaluation – Reactions

Level 1 evaluation measures the participants' reaction towards e-learning programs. Level 1 is probably the most frequently used measurement, because it is the easiest to be implemented. Questionnaire is the most common data collection tool for level 1 measurement. In our study, we investigate the students' satisfaction to e-learning. We measured students' satisfactions by questionnaires. Students are asked to evaluate the programs in multiple dimensions, i.e., ease of operation in the e-learning system, appropriateness of workload, adequacy of materials, satisfaction of program, etc. A large scale questionnaire survey has been conducted to collect data. 200 students from City University of Hong Kong are selected to participate in the level 1 evaluation.

Level 2 Evaluation - Learning

Level 2 evaluation measures the effectiveness of learning. Usually, tests are conducted before and after the course to determine the knowledge gained in the course. However, it is not feasible to conduct a test for a course before delivery of the course. Therefore, we adopt an alternative approach in this study. Two groups of students with similar academic backgrounds are selected to join the evaluations. The first group of student is educated in traditional mode and another group is educated in hybrid mode. The assessment results of these two groups of students in some selected common courses are analyzed.

Level 3 Evaluation - Behavior

Level 3 evaluation measures the transfer of students' behavior due to the program. We focus on how students' attitude been changed by e-learning programs. Pre-course questionnaire survey and post-course questionnaire survey have been conducted. We mainly want to investigate if the e-learning program can stimulate students' learning interests, i.e., the students are more self-motivated to their studies. As the learning interest is intangible, we measure some more subjective measurements, such as time spent for courses and the attendance rates. Moreover, we are also interested if the program improves the students' time management skills.

Level 4 Evaluation - Results

Level 4 evaluation attempts to assess training in terms of business results. This level measures the success of the training program by some common indicators, such as, market shares increase, sales increase, cost reduced, quality improved, etc. Education in Hong Kong is regulated by Government. The government has the absolute control on education policy, for example, number of students to be admitted by a school, the rate of school fee etc. Therefore, these figures cannot reflect the success of a school in Hong Kong. On the other hand, we cannot get some sensitive figures of the schools, for example, the admission score, cost, etc. Summing up the above, the level 4 evaluation is extremely difficult to be implemented, because of insufficiency of data.

We can also measure the success of e-learning programs by purely comparing of their academic results. The academic result for individual course has been studied in Level 2. The overall academic results for the school are difficult to be measured. We can also measure the success of the alumni of the universities. However, it takes a long time to complete. Owing to the time constraint, we cannot conduct this study in

the current study. At last, we decide to measure the success of the e-learning program from another view. We will interview the instructors to understand the effectiveness of the e-learning, i.e., what is the impact of e-learning to overall education program. As the number of instructors is small, we can afford to conduct an in-depth interview.

4. Data Analysis and discussion

We have conducted pre-course questionnaire survey in September 2007 and post-course questionnaire survey in January 2008. The instructors are also interviewed in January 2008 to collect their feedbacks on the e-learning programs. Five courses were involved in this project. Table 1 shows the difficulty level of the course.

Table 1. Difficulty Level Courses

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

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

4.1 Level 1 Evaluation – Reactions

The students are asked to rate individual items in their learning programs (including traditional mode and hybrid mode). The scores are indicated in a 0 to 5 scale, where a score of 0 means strongly dissatisfied and a score of 5 means strongly satisfied.

As shown in the Table 2, the students receiving hybrid mode education get an average satisfaction score of 4.0, while the students receiving traditional mode education only get an average satisfaction score of 3.7.

Table 2. Students' Satisfaction of Courses

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

The paired one-tailed t-test shows that students receiving hybrid mode education demonstrate greater satisfactions than students receiving traditional mode education (p-value = 0.036 at 0.05 significance level). Table 3 gives more details about students' satisfaction with e-learning program. Students are most unsatisfied with the course scheduling and support in learning. The schools need to address these issues in order to improve the overall satisfaction.

Table 3. Satisfactions of Courses for Students in Courses (Classroom + E-learning mode)

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

4.2 Level 2 Evaluation - Learning

To evaluate the effectiveness of e-learning programs, we compare academic results of students who are taught in different modes in same course. The academic results of students in five courses were recorded. Table 4 shows the number of students who get "A" Grade.

Table 4. Number of A-Grade Students

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

As shown in the Table 4, average 16.75% students in courses with hybrid mode get A-grade, while only 11.32% students in courses with traditional mode get A-grade. However, paired one-tailed t-test suggest that there is no strong evidence to show that the students in courses with hybrid mode get a better result in the student in courses with traditional mode education (p-value = 0.06, rejected at 0.05 significance level). There is only weak statistical evidence to show that e-learning programs can improve students' academic results (p-value = 0.06, accepted at 0.10 significance level).

Taking the difficult level of courses (Table 1) into consideration, it is found that the effectiveness of the e-learning is affected by the difficult level of the courses. The students in courses with hybrid mode have advantages in the courses at fundamental levels, i.e., Course 1 and Course 3 (Table 1). However, the students in courses with hybrid mode have no advantage in the courses at advanced level, i.e., Course 5 (Table 1). They may even get poorer results than students in course with traditional mode. The improvement in the courses at intermediate levels are not significant, i.e., Course 2 and Course 4 (Table 1). This is an important observation. However, a larger scaled experiment is required to confirm this observation.

4.3 Level 3 Evaluation - Behavior

Level 3 evaluation investigates if the e-learning programs can stimulate students' learning interests. To investigate how students' attitudes have been changed by the e-learning programs, pre-course questionnaire survey and post-course questionnaire survey has been conducted.

Table 5. Time Spent in the Courses for Students in Courses

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

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

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

Kirkpatrick's model (Kirkpatrick, 1996) suggests we should conduct evaluation based on the results of prior levels. The results in level 2 suggest that the behaviors of students in the courses at different difficulty levels are different. We compare the students' time spent in courses at different difficulty levels. We find that the students in the courses at fundamental level tend to increase their time spent significantly. However, the increase for students in the courses in intermediate level and advanced level are less significant.

As shown in Table 5, there is a strong correlation of time spent in the courses with traditional mode and time spent in the courses in hybrid mode. In other words, the students' time spent on individual course depends on the nature of the course. Similar to the students in courses with traditional mode, the students in course 3 also spend significantly more time in course 3 with hybrid learning mode. To investigate the

rationale behind, we have conducted an interview with students. The students in course 3 generally found that this course was difficult to them. Therefore, they spent more time in the course.

Moreover, the students in the courses at fundamental level found that the e-learning tools could help them a lot in studying. Therefore, they spent more time on e-learning courses. In particular, they found the instant feedback system is most useful in their studying of computer programming. However, the student in the courses at other levels found that the e-learning tools were less useful. Therefore, they paid minimal effort to the e-learning activities to satisfy the requirement set by the instructors.

Table 6. Students' Attendance Rates in Courses

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

We also compared the students' attendance rates in the courses (Table 6). The average student's attendance rate to traditional courses is 61.5%, while their attendance rates to courses with e-learning is 62.3%. There is no significant difference. Paired two-tailed t-test (p-value = 0.42) cannot find any evidence to show e-learning programs can improve students' attendance rates at any reasonable significance level. Similar to the result in level 2 evaluations, the students' behaviors vary a lot in different courses. We have setup some focus groups with students to analyze students' attendance rates in different courses.

We find that the attendance rate to Course 1 (54.2%) is relatively much lower than other courses in hybrid mode (Table 6). However, the student spent much more time in course 1 with hybrid mode (Table 6). The Course 1 is Computer Programming, which teaches the students to write computer programs. The students found that the e-learning tools were very effective to their learning. They believed that computer programming was best learnt by practices. As a result, some students decided to attend less lectures, they preferred to work on their own with the e-learning systems.

For the other courses except Course 5, the students found that the e-learning tools were less effective to their learning. Therefore, their attendance rate was not much affected (change from -1.6% to 2.2%). However, Course 5 is an advanced level course. The students found the course materials were very difficult. They believed that teacher's lecturing was most effective to their learning. Therefore, their attendance rate of Course 5 was significantly higher than the others (75.2%).

From the focus group study, we find that students enjoy a large degree of freedom. They choose what to attend based on their needs. If they believe that e-learning activities is helpful, some of them would rather attend less classroom instruction sections and involve more on e-learning systems. However, if they believe that instructors' lecturing is effective to them, they will attend more classroom instruction sections. Their attendance rates of individual course are affected by many factors. The e-learning system fails to improve the attendance rates. There is no evidence to show that the e-learning programs can improve students' attendance rates.

Finally, we would like to investigate students' learning interests in different courses. We asked the students to rate their interests about the courses before and after the courses (Table 7).

Table 7. Students' Learning Interests for Courses

	Course	1	2	3	4	5	Mean
Traditionl Mode	Pre-course	3.7	3.4	3.8	3.3	2.7	3.38
	Post-couse	3.8	3.2	3.7	3.2	2.6	3.30
	Change	0.1	-0.2	-0.1	-0.1	-0.1	-0.08
Hybrid Mode	Pre-course	3.8	3.4	3.7	3.3	2.6	3.36
	Post-course	4.2	3.3	4.1	3.4	2.5	3.50
	Change	0.4	-0.1	0.4	0.1	-0.1	0.14

As shown in Table 7, the e-learning program fails to stimulate students' learning interest. For the students in courses with traditional mode, the students' learning interests decrease in most courses, while the students' learning interests increase slight in course 1 only. For the students in the course with hybrid mode, the learning interests increase significantly in Course 1 and Course 3. As Course 1 and Course 3 are courses at the fundamental level. The e-learning activities are most effective in this type of courses (Anderson & Skwarecki, 1986). Therefore, students' learning interests increase. However, the e-learning activities fail to stimulate student's learning interests in the courses at other levels. Sometimes, the students' learning interests drop after the courses.

In the focus group study, the students tell us that the course materials are not exactly the same as what they expected at the beginning. As a result, their learning interests decrease. To improve the students' learning interests, it is important to keep the students well informed about the course design and contents.

4.4 Level 4 Evaluation - Results

The level four evaluation is the most difficult one to be implemented. As it is difficult to measure the overall objectives of a school, we measure the success of the e-learning programs from the view of instructors. We have interviewed the instructors. The results are summarized in Table 8. Unfortunately, the number of observation is too low to conduct any statistical analysis. Nevertheless, the questionnaire can tell us some preliminary results.

As shown in Table 8, the instructors considered that the e-learning is not flexible enough. The systems were unable to be customized for their courses. On the other hand, the e-learning programs increased the workload of instructors. The instructor needs to spend time to prepare e-learning activities. However, the instructors do not observe significant improvement in some indicators, such as, students' attitudes, time management skill, learning interests and academic results.

Therefore, the utilization of e-learning in the courses is still low, and students are not actively involved in e-learning. However, the instructors are less satisfied with the effectiveness of e-learning programs in their courses on the whole. As the sample size

is small, we hesitate to draw any conclusion at current stage. We will leave it as an open-ended question for future studies.

Table 8. Responses from Instructors

Question	Score	
	With e-learning	Without e-learning
1. Rate students' attitudes to the course.	3.2	3.1
2. Rate students' time management skill in the course.	2.5	2.6
3. Rate students' learning interests in the course.	3.6	3.5
4. Rate students' academic results in the course.	3.7	3.9
5. Rate your workload in the course.	4.3	3.5
6. Rate the utilization of e-learning in the course.	1.4	/
7. Rate the operation of the e-learning system.	3.2	/
8. Rate the flexibility of the e-learning system.	1.7	/
9. Rate students' involvement in e-learning in the course.	1.3	/
10. Rate effectiveness of e-learning in the course.	1.6	/

5. Conclusion

Kirkpatrick's Four Levels Model has been widely employed for measurement of effectiveness of training programs. In this study, we have implemented the Kirkpatrick model to measure the effectiveness of the e-learning programs in all four levels. We have made a number of findings which may be very useful in the future for the design and implementation of e-learning programs:

1. Students receiving e-learning together with classroom education demonstrate greater satisfaction than students receiving classroom education only.
2. Students who received e-learning together with classroom education in a course at fundamental level achieve a better academic result than students receiving classroom education only. However, there is no significant improvement in the academic results for courses at other levels.
3. The current e-learning programs fail to change students' attitudes towards learning, i.e., time management and attendance rates. They also fail to stimulate student's learning interests.

In our study, we found that the e-learning programs are more effective in courses at fundamental level. The e-learning tools attempt to provide instant feedback, which is important in students' learning. The students don't need to wait for the instructor to grade their exercise. The materials in courses at fundamental level are highly structured. It is easier to implement highly structured e-learning exercise with instant feedback (Targett, 2002, unit 10). However, the materials in courses at intermediate and advanced level are less structured. It is hard to implement e-learning exercise with instant feedback. The e-learning is most successful in courses at fundamental level, which can be used for benchmark of future design of e-learning programs.

As it is widely known that one critical factor for the success of a learning program is whether it can stimulate students' learning interests. However, it is difficult to

increase the students' learning interests. If a student like the course and decide to study the course, his learning interest will remain high in the course. We have confirmed this in our study.

In the current stage, e-learning is used to supplement the traditional education in Hong Kong. However, e-learning is unable to replace traditional teaching in the foreseeable future. Therefore, the students' choice of course is still limited by the offering of traditional courses. We fully expect some day e-learning may be an option all by itself, i.e. some e-learning course could take the place of traditional face-to-face classroom learning. By that time, the students will enjoy more flexibility in the course selection. We expect the students' learning interests may be increased by e-learning, as e-learning has great potential to provide more choices to the students at any time in any place. Although the effectiveness of e-learning programs is very limited in current stage, we expect this can be improved in the future.

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eLearning XML Data Modeling Made Easy with Computer Aided Instruction

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Abstract. As XML becomes a data standard on the Internet, there is a need for technology transfer of XML data modeling techniques into the industry for e-commerce and e-Government. However, it is a challenge to build a satisfactory Computer Aided Instruction (CAI) on Internet for a standard XML conceptual schema design. This paper aims to solve the problem by providing an eLearning tool to teach users how to specify data requirements through online end-user supervised interaction, capturing requested data semantics into metadata, presenting the data relationships of cardinality, is-a, participation, generalization, aggregation and categorization into a DTD graph, and mapping the DTD graph into a DTD (Document Type Definition) in backward engineering. The resultant methodology applies DTD graph as the XML conceptual schema, and DTD as the XML logical schema. An easy-to-use HCI (human computer interface) design is used to let user specify their requirements in questions and answers mode on the screens.

Keywords: eLearning, XML data modeling, Computer Aided Instruction, HCI, DTD Graph, metadata, data semantics, Expert System

1 Introduction

XML technology will become everyday's life. The purpose of XML database design is to utilize an accepted methodology to perform data modeling technique. The methods of designing an XML database system can help system developer to visualize their own design in a DTD graph diagram. *KA (knowledge acquisition) in Database Design,* aims to facilitate online database design by asking users for supervising their own XML database.

Due to the fact that database design has many data interactions between user and engine, just a question answer approach is not suitable for all cases. The *KA in Database Design* approach is similar to concepts of ruled-based algorithm and forward or backward chaining. A function (program) is defined, the function returns a value of success or failure (solved or not solved). If it returns with a success value, then the function also returns the sequence of selected steps that solved the problem. If the solution seems hopeless, the value is returned as failure. In other words, it's doing things over and over, a program for alphabetizing, compare until you get to an end - solve or fail.

CAI Architecture The main function of the system is to provide step-by-step instruction and examples for users to recognize XML data requirements and to provide guidance for users to generate each data semantic. Dynamic interaction, graphic user interface (GUI), and stepwise guidance are the system characteristics to attract the users in inputting their data requirements. To physically store the database, each data semantic needs user input to confirm their requirements. These data requirement can then be stored into a metadata[1].

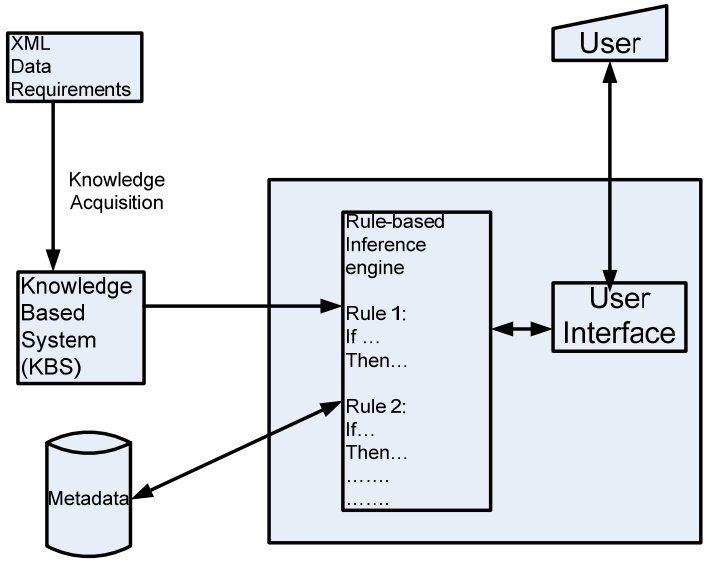


Fig. 1 Architecture of the CAI for XML data modeling

Data Type Definition (DTD) Graph XML started in 1998 as a new data standard on the Internet[2]. XML documents can be stored in a native XML database or an XML enabled database. The former is an XML oriented database management system. The latter is relational database with an XML Application Program Interface(API).

Facilities are available to link elements together with an Identifier (ID) and Identifier Reference (IDREF). An element with IDREF refers to an element with ID. Each ID must have a unique address. Nodes can refer to each other by using ID and IDREF such that nodes with IDREF referring to nodes with ID.

An XML document is in a hierarchical tree structure. Every XML document must have one root element. The root element is in the highest hierarchical level. The root element contains all the other elements and attributes inside of it. Other elements are in hierarchical order such that they are in relative parent or child node. The relative higher level is the parent node and the relative lower level is the child node.

An element is the basic building block of an XML document. An element name must start with a letter or underscore character. An element can have sub-element under it. An empty element does not have a sub-element. Between element and sub-element, there are declarations that control the occurrences of sub-elements. For

example, one can define element instances in a DTD with an Occurrence indicator of "*" operator to identify "set" sub-elements that can occur from zero to many times under a parent element. The "+" occurrence indicator specifies one to many times occurrence under a parent element. The "?" occurrence indicator specifies zero to one time occurrence under a parent element.

2 Related Work

Whereas the XML field has received substantial attention over the past years, the vast majority of XML-related research has been concerned with technical details of applying XML. Very little work to date has addressed the problem of how to design XML-based data structures, i.e. the upfront schema modeling work before XML can be applied.

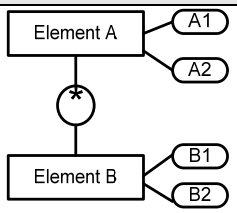
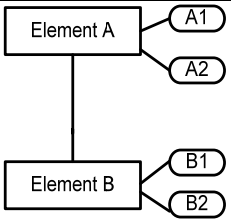
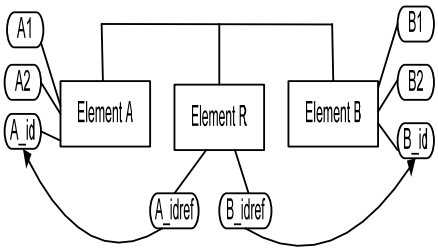
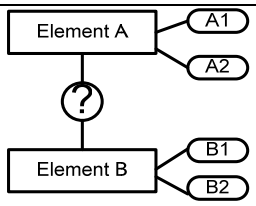
One of the earliest works in this area has been that of Feng et al. [3]. They propose a two-level design methodology that separates abstract semantic design concerns from detailed schema design. The former models the entities of a XML data collection, their relationships (of various types) and constraints that govern the relationships of entities. The latter is concerned with transforming a semantic model into a corresponding XML schema consisting of elements, attributes, and simple and complex types. However, the entire modeling process remains quite complex and is thus not accessible to end-users. Conversely, the XML data modeling approach proposed in this paper differs by guiding the user through the design process and hiding many of the complexities involved in XML schema design.

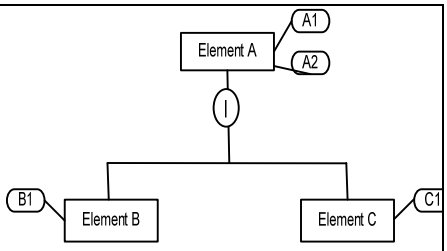
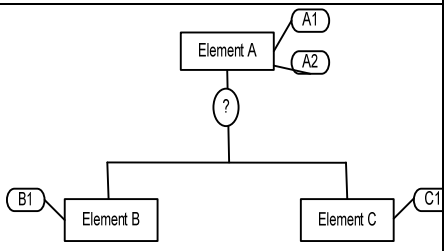
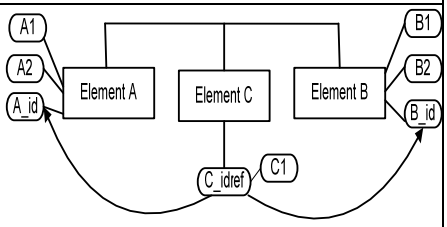
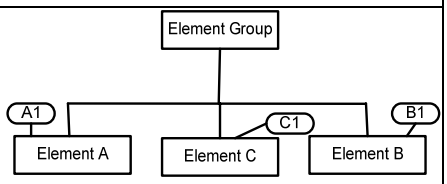
Another approach to ease the creation of XML data models is based on using UML (the Unified Modeling Language) to express data semantics, and then to translate these into an actual XML Schema. In [4], which follows this approach, a three-level design approach is proposed, beginning with conceptual level design, followed by logical design and finally physical design. At the first two of these levels, UML class diagrams are used to represent the designs graphically, whereas the design at the third level consists of actual XML schema code. However, compared to the work presented in this paper, the approach of [4] only considers more simple types of object relationships.

Also, other work has been concerned with devising richer representational forms for XML schema, such as the X-Entity notation proposed in [5].

Again, work has been done on schema translation from relational to XML. As a result of their work, various data semantics of weak entity, cardinality, isa, participation, generalization, categorization and aggregation relationship can be represented in a DTD. An alternative is to design a DTD Graph from scratch using our proposed KA. Besides weak entity not existing in DTD, we can capture other data semantics as shown below[6]:

Table 1 Data semantics representation for DTD and DTD Graph

Data semantic	DTD	DTD Graph
1:n Cardinality (data between two elements are in one-to-many association)	<!ELEMENT A(B)*> <!ATTLIST A A1 CDATA #REQUIRED> <!ATTLIST A A2 CDATA #REQUIRED> <!ELEMENT B EMPTY> <!ATTLIST B B1 CDATA #REQUIRED> <!ATTLIST B B2 CDATA #REQUIRED>	
1:1 Cardinality (data between two elements are in one-to-one association)	<!ELEMENT A(B)> <!ATTLIST A A1 CDATA #REQUIRED> <!ATTLIST A A2 CDATA #REQUIRED> <!ELEMENT B EMPTY> <!ATTLIST B B1 CDATA #REQUIRED> <!ATTLIST B B2 CDATA #REQUIRED>	
m:n cardinality (data between two elements are in many-to-many association)	<!ELEMENT A EMPTY> <!ATTLIST A A1 CDATA #REQUIRED> <!ATTLIST A A2 CDATA #REQUIRED> <!ATTLIST A A_id ID #REQUIRED> <!ELEMENT B EMPTY> <!ATTLIST B B1 CDATA #REQUIRED> <!ATTLIST B B2 CDATA #REQUIRED> <!ATTLIST B B_id ID #REQUIRED> <!ELEMENT R EMPTY> <!ATTLIST R A_idref IDREF #REQUIRED> <!ATTLIST R B_idref IDREF #REQUIRED>	
Isa relationship (data between two elements are in superclass and subclass relationship)	<!ELEMENT A(B)?> <!ATTLIST A A1 CDATA #REQUIRED> <!ATTLIST A A2 CDATA #REQUIRED> <!ELEMENT B EMPTY> <!ATTLIST B B1 CDATA #REQUIRED> <!ATTLIST B B2 CDATA #REQUIRED>	

Disjoint generalization (data between elements are in superclass and disjoint subclasses relationship)	<!ELEMENT A(B|C)> <!ATTLIST A A1 CDATA #REQUIRED> <!ATTLIST A A2 CDATA #REQUIRED> <!ELEMENT B EMPTY> <!ATTLIST B B1 CDATA #REQUIRED> <!ELEMENT C EMPTY> <!ATTLIST C C1 CDATA #REQUIRED>	
Overlap generalization (data between Elements are in superclass and overlap subclasses relationship)	<!ELEMENT A(B?, C?)> <!ATTLIST A A1 CDATA #REQUIRED> <!ATTLIST A A2 CDATA #REQUIRED> <!ELEMENT B EMPTY> <!ATTLIST B B1 CDATA #REQUIRED> <!ELEMENT C EMPTY> <!ATTLIST C C1 CDATA #REQUIRED>	
Categorization (data between elements are in subclass and one of superclasses relationship)	<!ELEMENT A EMPTY> <!ATTLIST A A1 CDATA #REQUIRED> <!ATTLIST A A_id ID #REQUIRED> <!ELEMENT B EMPTY> <!ATTLIST B B1 CDATA #REQUIRED> <!ATTLIST B B_id ID #REQUIRED> <!ELEMENT C EMPTY> <!ATTLIST C C1 CDATA #REQUIRED> <!ATTLIST C C_idref IDREF #REQUIRED>	
Aggregation (data between elements are in a group of component classes)	<!ELEMENT Group(A, B, C)> <!ELEMENT A EMPTY> <!ATTLIST A A1 CDATA #REQUIRED> <!ELEMENT B EMPTY> <!ATTLIST B B1 CDATA #REQUIRED> <!ELEMENT C EMPTY> <!ATTLIST C C1 CDATA #REQUIRED>	

3 Database Design CAI for user supervision and validation of DTD graph

A free format allows users to design an XML database system on their own decisions. It is a test of the user knowledge on database design by capturing the users' input data and validating the input data against the designing rules. The steps of performing this data modeling technique with sample input data, and the system validation and responses are as follows:

Step 1 – eLearning user input of XML data semantics
The first step is to define the scope of the XML document. Root element is the main object and the focus in an XML document. The relevant and associated elements are sub-elements under the root element. Attributes represent properties of elements. Once the scope is clearly defined, the relevant data and their relationships should be identified in the later steps. An association represents a structural constraint between two elements. For example, one-to-one, one-to-many and many-to-many between two elements. An is-a relationship is between a subclass element and a superclass element with a zero to one occurrence indicator between them. Multiple is-a associations between subclass elements and a superclass element can be generalized to form a superclass element. If the objects of the subclass elements are mutually exclusive, they form a disjoint generalization. If the objects of the subclass elements are mutually inclusive, they form an overlap generalization. Multiple is-a associations between a subclass element and multiple superclass elements can be categorized to form a subclass element. Aggregation is a method to form a group element from its component elements. The existence of a group element depends on its component elements. We let user specify each data semantic of cardinality, is-a, generalization, aggregation and categorization. Once entered, the KA will automatically generate the corresponding DTD Graph and DTD.

The expert system consists of an inference engine which makes use of a list of rules. In the process of conversion, the following backward rule transforms the input data into elements and "E" represents variables to be instantiated:

Algorithm for Inference Engine backward chaining:
Begin
Rule: "E" is an element
IF
"E" is an input record

Rule: Introduce one-to-one cardinality
IF
"E1" is a parent element
"E2" is a child element
One-to-one occurrence indicator between E1 and E2

Rule: Introduce one-to-many cardinality
IF

"E1" is a parent element
"E2" is a child element
One-to-many occurrence indicator between E1 and E2

Rule: Introduce many-to-many cardinality
IF
"E1" is a sibling element with ID
"E2" is a sibling element with ID
"E3" is a sibling element with pair of IDREFs referring to IDs

Rule: Introduce isa relationship
IF
"E1" is a parent element
"E2" is a child element
Zero-to-one occurrence indicator between E1 and E2

Rule: Introduce overlap generalization
IF
"E1" is a parent element
"E2" and "E3" are child elements
sequence occurrence indicator between E1 and (E2, E3)

Rule: Introduce categorization
IF
"E1" and "E2" are parent elements with IDs
"E3" is a child element with IDREF
IDREF in E3 refers to one of IDs in E1 or E2

Rule: Introduce aggregation
IF
"E1" is a group element
"E2" and "E3" are component elements
One-to-one occurrence indicator between E1 and (E2, E3)

A DTD Graph specification can be represented in a relation style metadata as follows:

DTD Graph metadata:
Element (Element_Name)
Attribute (Element_Name, Attribute_Name, Require, ID)
Domain (Domain_Name, Domain_Type, [Value1, Value2, …])
IDREF(Element_Name, IDREF_Name, [ID1, ID2, …])
Root (Element_Name)
Association (Sibling_Element_Name1, Sibling_Element_Name2,
Minimum_occurrence, Maximum_occurrence)
Isa (Parenet_Element_Name, Child_Element_Name)
OverlapGeneralization (Parent_Element_Name, [Child_Element_Name1,
Child_Element_Name2, …])

DisjointGeneralization (Parent_Element_Name, [Child_Element_Name1, Child_Element_Name2, …])
Aggregation (Group_Element_Name, Parent_Element_Name, [Child_Element_Name1, Child_Element_Name2, …])
Categorization (Common_Element_Name, [Sibling_Element_Name1, Sibling_Element_Name2, …])

Step 2 Knowledge validation of User entered XML schema design

Data semantic validation rules are implemented that validate the user entries and determine the conflicts among the specified data semantics in real time, so that the user can design the schema interactively. The validation algorithms are generic that can be implemented in any programming language. As a proof of concept, the algorithms are implemented in the Java programming language. The following is a list of data semantic validation rules.

The element verification rules, which verify that: (a) all elements may have unique identifiers, and (b) names of element classes are unique.

The association verification rules, which include the rules to verify that: (a) each association has at least two participants and all of the participants are defined. (b) all elements that are listed in generalization are defined.

The attribute and domain verification rules, which verify that: (a) attributes are not repeated, (b) identifying attributes cannot assume the Null value, and (c) attribute domains are properly defined.

The is-a association rules, which verify that: (a) each isa subclass element has a superclass element and a property defined isa condition, (b) no two subclasses are specialized by the same condition, and (c) subclasses have either their own attributes or are in a association with other element classes and/or association.

The class aggregation verification rules, which verify definitions of classification and aggregation groupings of element classes. Among other aspects, these rules verify that: (a) all members of groupings are properly defined as classes, and (b) group descriptions are not repeated.

For each data semantic, there is a corresponding template of the DTD for the involved entities, and the result obtained by applying a template to a data semantic can be represented in a DTD graph. As such, applying the templates to all specified data semantics can obtain a set of DTD sub-graphs. In order to obtain a consolidated DTD graph from which a DTD can be derived, it is necessary to merge the set of DTD sub-graphs by using the following algorithm:

Algorithm for merging DTD sub-Graphs from each step
Begin
Let $Set_{DTDGraph}$ be the set of specified DTD sub-graphs
Select and remove a DTD sub-graph with a root element that is to be root element of the XML document from $Set_{DTDGraph}$ and set it to G_{final}
While there is a DTD sub-graph, G, in $Set_{DTDGraph}$
    Remove G from $Set_{DTDGraph}$
    Add all elements in G that are not in G_{final} to G_{final} by matching element names
    Add all edges in G to G_{final}
end

After completing the algorithm, the $Set_{DTDGraph}$ should be an empty set and the G_{final} will be the merged DTD graph. If G_{final} is partitioned, some elements are not the sub-elements of the root element, and the schema is invalid.

Step 3 Display validated User designed DTD Graph
It is possible to use software libraries that generate a graphical representation of a DTD graph, such as the JUNG[9]. Basically, elements and occurrence indicators in the DTD graph are the vertices in rectangles and circles respectively, and the linkages (or simply links) among them are the edges. By specifying the vertices and the edges with JUNG, the image of the DTD graph can be derived. Given a DTD graph obtained from the above algorithm, it is possible to derive the DTD accordingly with the following algorithm:

Algorithm for generating DTD from DTD Graph
begin
For each element in the DTD graph
    If the element has sub-elements,
generate ELEMENT declaration based on sub-elements with corresponding occurrence indicators
Else
    generate an EMPTY ELEMENT declaration for the element
end;

The DTD Graph verification rules are logical clauses that must be satisfied by any DTD Graph specification. The rules are classified according to the DTD Graph primitives and structures that they examine. The following verification rules are discriminated:

4 eLearning tool exercise case study

To illustrate the usages of the algorithms proposed in this paper, a user-friendly eLearning tool is developed and its user interface is shown below:

The eLearning tool contains a tabbed pane at the top that shows an elements/attribute diagram, XML tree diagram and the resultant schema document, and three panes at the bottom that shows the existing elements, attributes and relations specified. The user interface provides a usual graphical menu system for the user operations.

Among all features, a guide approach is provided by selecting the **Data semantic wizard** from **Edit** menu, which shows a dialog that prompts the user for the desired user entries. To design a DTD graph, we can extract meaning from the user input by identifying the data semantics among the front end captured elements and attributes. The entered data can be validated before transforming them into a DTD graph.

For example, the following is a set of elements of Loan Contract, Loan Drawdown, Fixed Interest Rate, Index Interest Rate, Loan Repayment, Loan Balance, Customer, Loan History, Index Rate Type and Index Interest Rate for a loan application.

The user keys in the element names and specify one of them as the root element. For each element, subsequently the user can keys in its attributes. Being an interactive

software application, the eLearning tool verifies the element names and attribute names to make sure that they adhere to the validity specified in the XML specification. Once the user feels comfortable with the elements and their attributes, the user can click **Next** button to proceed to the next step as shown in Figure 1 and Figure 2.

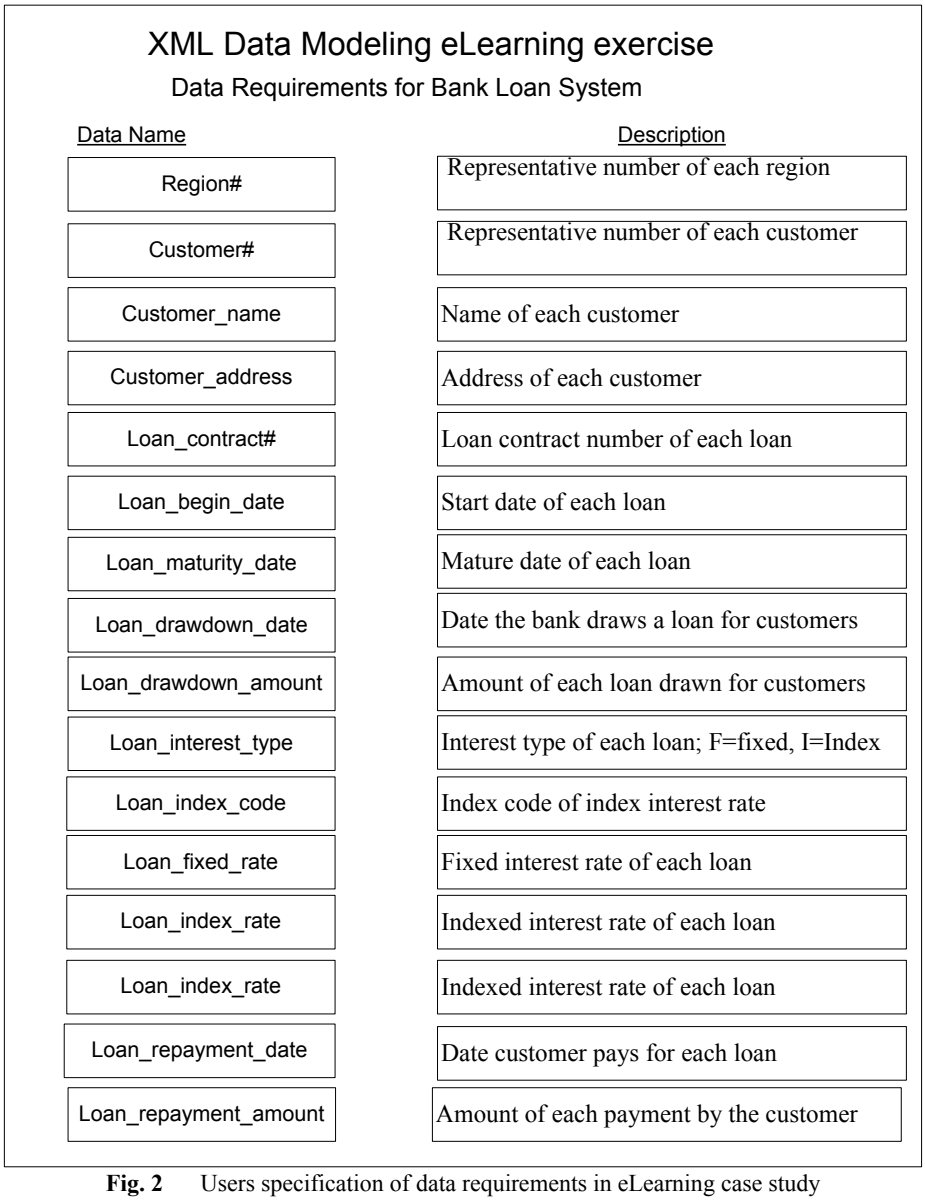


Fig. 2 Users specification of data requirements in eLearning case study

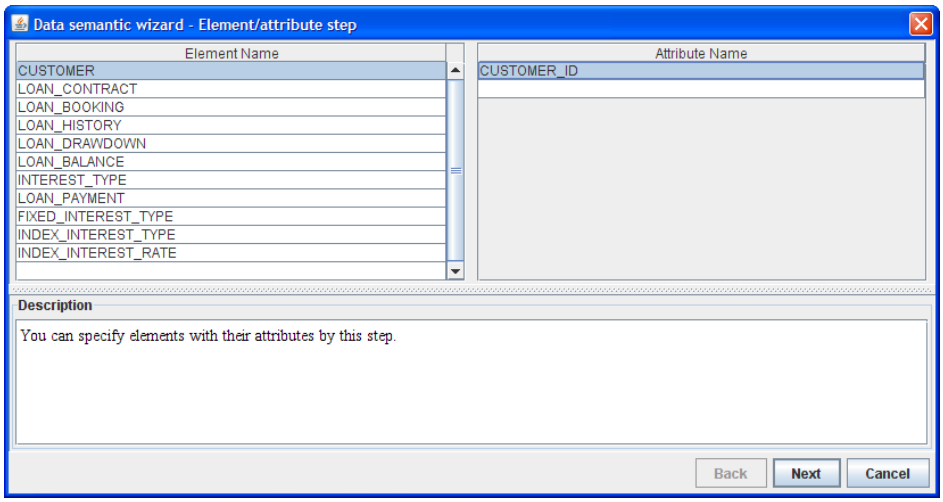


Fig 3. Online capture elements specification

Based on the elements specified in the previous step, the eLearning tool enables the user to specify pairs of parent element and child element that are in one-to-one cardinality. After the user has specified all one-to-one cardinality relations, the user can click the Next button and the eLearning tool will verify all the relations.

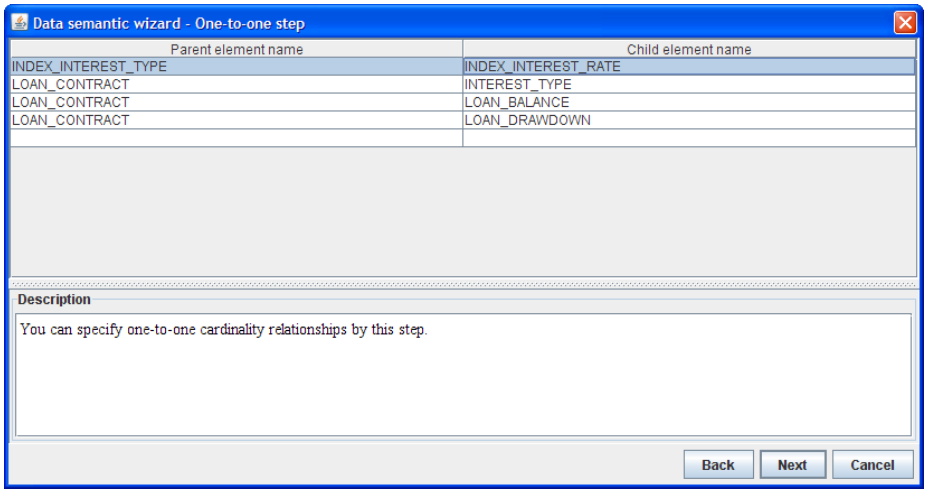


Fig. 4 Online capture one-to-one cardinality data semantic

Similar to the case of one-to-one cardinality relations, the step enables the user to specify the pairs of parent element and child element that are in one-to-many cardinality relationships. After all the one-to-many cardinality relations have been specified, click Next and all existing relations, including one-to-one and one-to-many cardinalities, are verified and proceed to the next step if all of them are valid.

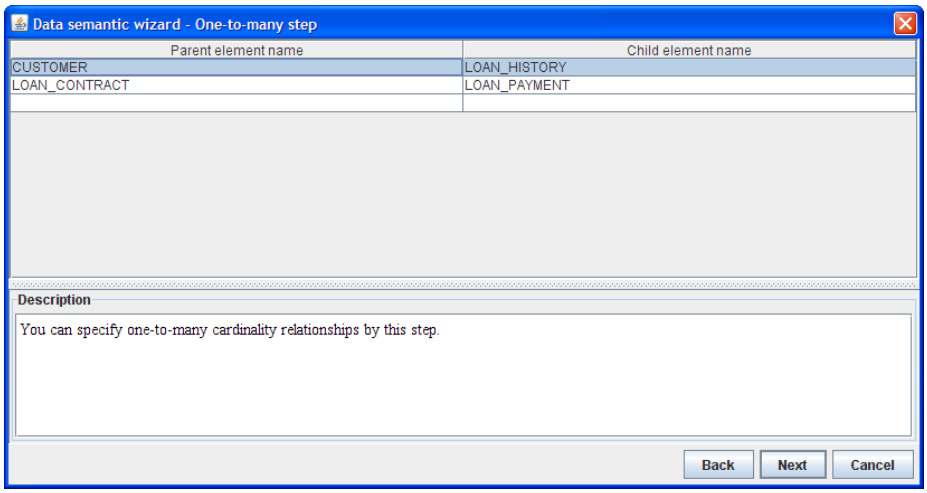


Fig. 5 Online capture one-to-many data semantic

To specify a many-to-many cardinality relation, a new relation element is introduced that associates with the two elements via two IDREF attributes. Therefore, after specifying the two elements in many-to-many cardinality, the user has to enter a relation element name. Afterwards, click the Next button to proceed to the subsequent steps.

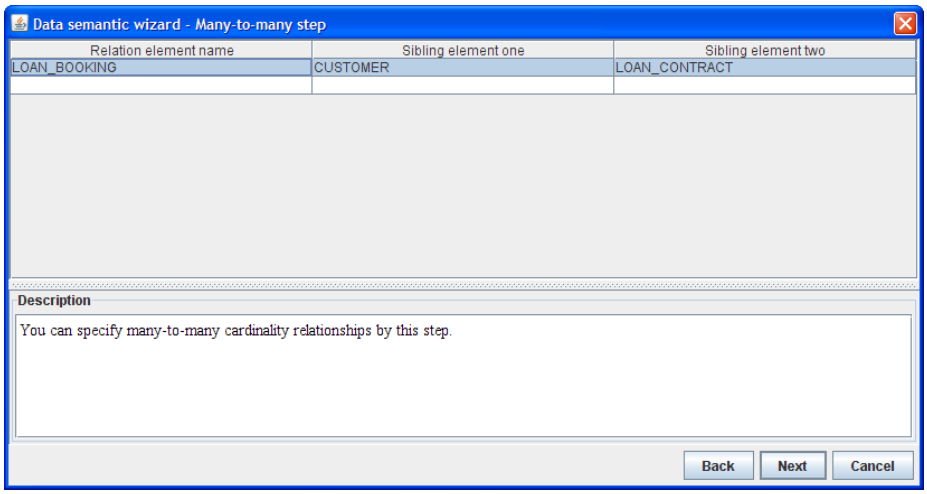


Fig. 6 Online capture many-to-many data semantic

Similarly, the eLearning tool enables the user to specify the is-a, disjointed generalization, overlap generalization, categorization and aggregation relations. As usual, when the Next button is clicked, all existing relations are verified so that it is not necessary for the user to find the steps for corrections. Furthermore, the eLearning tool provides the user the elements for selection to prevent keying in incorrect element names.

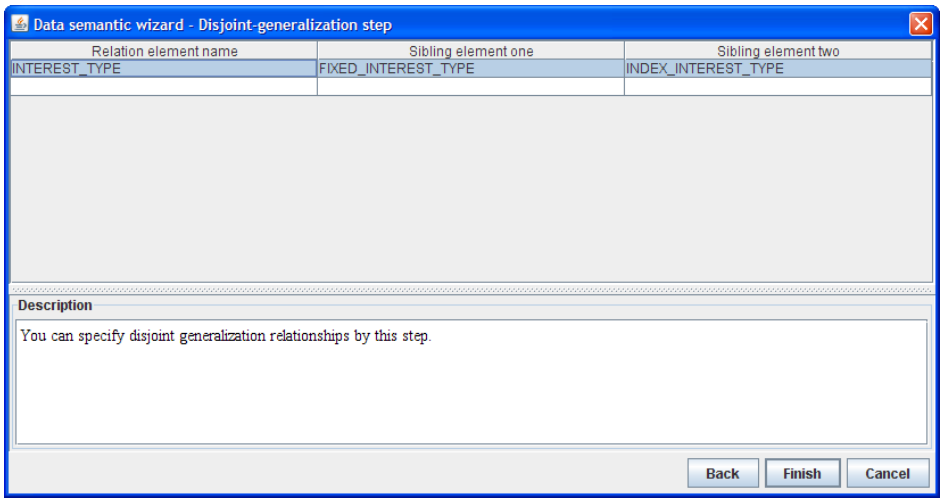


Fig. 7 Online capture disjoint generalization data semantic

After completing the steps with the eLearning tool, all relations are verified and a DTD tree is created for each of them. Then, the eLearning tool can visualize the relationships among the elements as shown in the following:

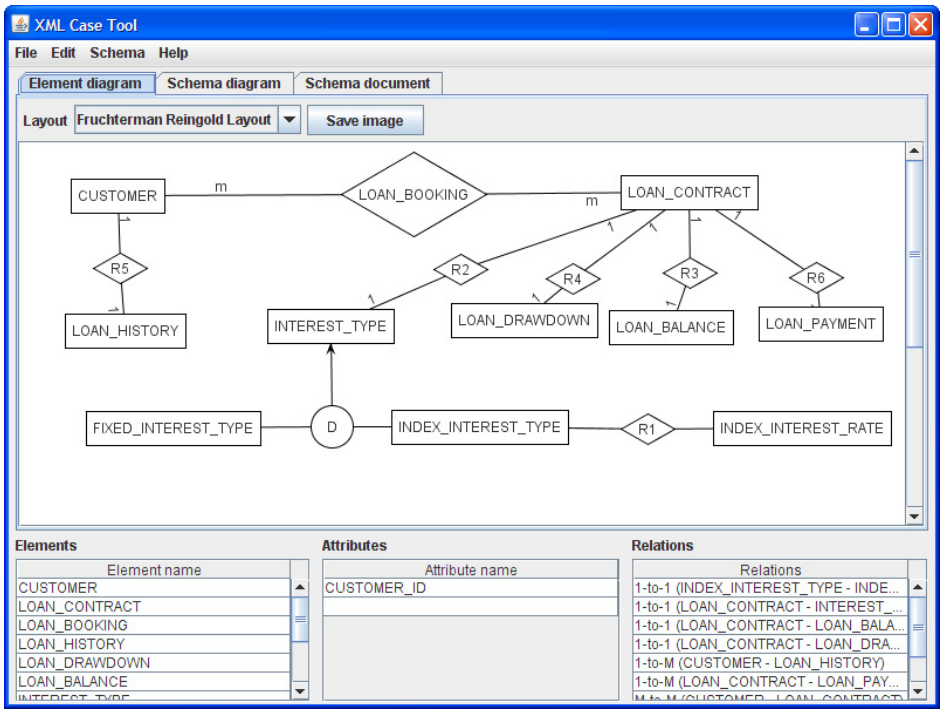


Fig. 8 Derived DTD Graph from knowledge acquisition with user input

The user can keep on modify the elements/attributes and relationships and verify the candidate DTD tree, finally, the user can select Schema and then Generate DTD document or Generate XSD document to generate the schema document by converting the DTD tree into DTD, such as the one as shown in Fig. 4:

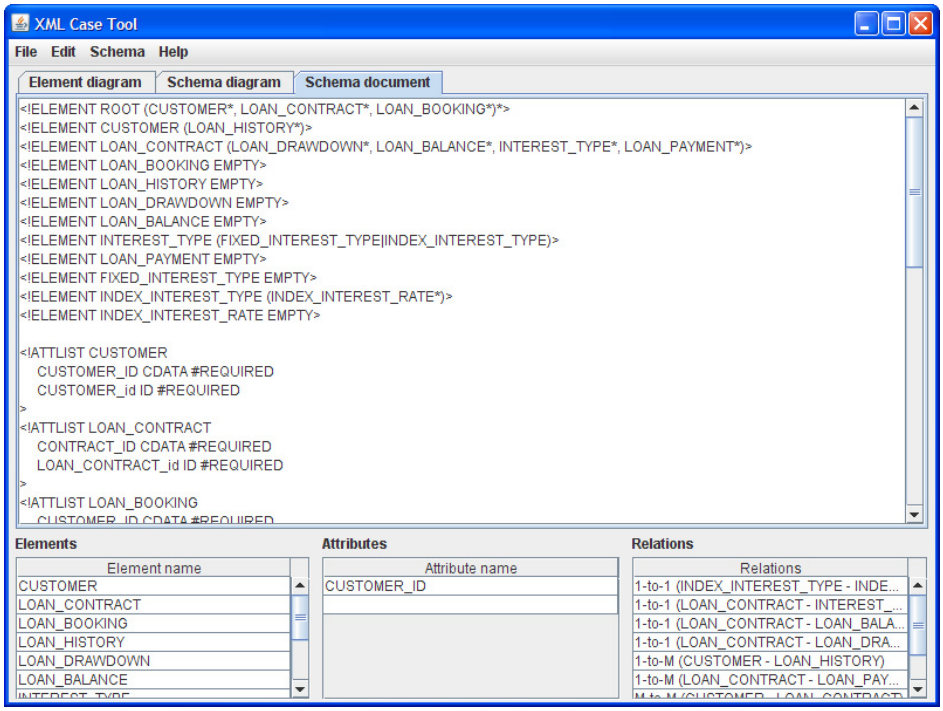


Fig. 9 Generated DTD from DTD Graph

6 Conclusion

An eLearning CAI system has been constructed to capture user input for designing a DTD Graph. This paper presents a methodology of generating an XML conceptual schema DTD graph with validation and also its XML logical schema DTD. The derived data semantics of association, isa, generalization, categorization, aggregation, and cardinality can be input by the users, and validated by a metadata. Its main contribution is to teach students how to design a valid XML schema in the form of DTD Graph with user supervision. The future research direction of this paper is to include XSD (XML Schema Definition) in the computerization forward engineering of XML data modeling technique[11] in this eLearning tool.

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