Feedback and Analysis from Assessment Metadata in E-learning

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Abstract

With fast development in e-learning, assessment plays an important role between teaching and learning. A good e-learning system is not only with good teaching strategy and better learning resources but also proper assessment model. In this paper, we proposed an assessment meta-data and assessment analysis feedback for recently e-learning environments. There are several proper feedback for teachers, students, and learning management systems. The feedback could provide proper teaching, learning resource delivering and learning progress suggestions. With the approach, assessment prompts the learning effort in e-learning.

Keyword: *cognition level, Item Discrimination Index, Item Difficulty Index, questionnaire, Assessment Analysis Model*

1. Introduction

Today, distance learning is more and more popular all over the world. Especially in e-learning, people want to learn knowledge, skill, and training. But, how could the teacher realize the blind spot of learner, the weakness of learning and teaching. Assessment provides a very suitable method. Assessment response to the learners what is the major and important part in each subject and each course.

In e-learning environment, the assessment metadata could be reusable, interchangeable, and interoperable. With XML Schema and DTD, different environment and e-learning system could exchange their metadata information to achieve actual e-learning environment.

The first part in this paper, we introduce the assessment meta-dada. Then we also calculate and analysis of the test result. There are several analysis methods in second part. At last, we figure out our conclusion and future.

2. The MINE SCORM Meta-data

We defined an assessment metadata for e-learning. We reference SCORM as our e-learning standard. We call the assessment metadata MINE SCORM Meta-data Model. The whole MINE SCORM Meta-data is represented in a tree-like structure in Figure 1.

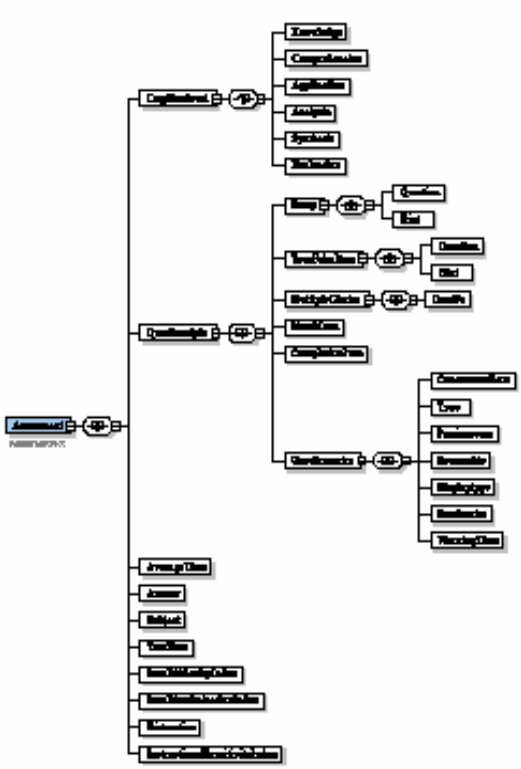

Figure 1: Assessment root and his child nodes. It is divided into ten sections. Cognition level and Questionnaire has six child nodes.

3. Analysis Model

A teacher use proper teaching strategy and good learning content to teach students. However, we don't know if students receive the information or not. The only way is hold a test. With the test result and analysis, teacher may know what the students need, how the students received, what the learning content should add or delete. A good assessment analysis model provides a blueprint for

Proceedings of the17 th International Conference on Advanced Information Networking and Applications (AINA'03)
0-7695-1906-7/03 $17.00 © 2003 **IEEE**

teaching.

Teacher Side:
- Each question statistic and analysis
- Total test Each statistic and analysis

Student Side:
- Receive auxiliary test for practice
- Hint and answer mechanism

System Side:
- Deliver auxiliary test for practice
- Deliver questionnaire to students and teachers

Each question statistic and analysis

- Number representation

  Teacher can see each question's status. Also it will provide some suggestions from the test question.

No	P_H	P_L	$D=P_H-P_L$	$P=(P_H+P_L)/2$	L	W	B	N
…	…	…	…	…	…	…	…	…

  No: The questions' Number

  P_H: the higher 25% of total student as the higher group

  P_L: the lower 25% of total student as the lower group

  $D=P_H-P_L$

  $P=(P_H+P_L)/2$

  - ✓ 1st step: according to score height arrange the examination paper
  - ✓ 2nd step: we define P_H the higher 25% of total student as the higher group and then P_L the lower 25% of total student as the lower group. (The reasonable range between 25%-33%)
  - ✓ 3rd step: calculate the people answer correct and his percentage in higher group and lower group in each question.
  - ✓ 4th step: Calculate each question Item Difficulty Index $P=(P_H+P_L)/2$
  - ✓ 5th step: Calculate each question Item Discrimination Index $D=P_H-P_L$

- Signal representation

  With signal presentation, the advice to teacher becomes more easy and simple. (See Table 1)

Table 1 : Some advice and different suggestions about questions.[1]

Status	Light signal	D	L	W	B	N
Good	Green	0.3-0.4				
Fix	Yellow	0.2-0.29	?	?	?	?
Eliminate or fix	Red	Lower 0.19				

L: No one choose the item, the choice becomes a useless item.

W: People in P_H choose but people in P_L didn't choose the item. But it is not the right answer. May be answer is wrong.

B: People in P_H have different choose. The different choice situation is balanced. It might have other correct answer in this question.

N: Students didn't answer the question. The question's meaning or description has some problems.

Total Test statistic and analysis

The assessment analysis should be presented in different aspects. A total test analysis result could show the whole status of students.

- Figure representation

  Time (cross axle) and Number of answered question (vertical axle) figure: The figure shows the test time is enough or not.

  Test score (cross axle) and degree of difficulty (vertical axle) figure: The figure shows the distribution of score and difficulty.

  Cognition level (cross axle) and learning content subject (vertical axle) figure shows the cognition level, question number and subject. (See Table 2)

Table 2 : Two-way specification table

	Concept 1	...	Concept i	
Knowledge	A1	...	Ai	SUM(A1-Ai)
Comprehension	B1	...	Bi	SUM(B1-Bi)
Application	C1	...	Ci	SUM(C1-Ci)
Analysis	D1	...	Di	SUM(D1-Di)
Synthesis	E1	...	Ei	SUM(E1-Ei)
Evaluation	F1	...	Fi	SUM(F1-Fi)
	SUM(A1-F1)	...	SUM(Ai-Fi)	

Definition

1.Cognition level divided into six level, each named from A to F. Assume X is universal set, X={A,B,C,D,E,F} Ex.

Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
A	B	C	D	E	F

2.Concept in the test would be named from 1 to i, initial i=1

ex. Concept 1

3.From concept 1, we write a question belongs to Knowledge cognition level. Then A1 is set [TRUE]. If over one question belong to Knowledge cognition level exist in concept 1. A1 is [TRUE] to represent there is a

question of knowledge level in concept 1 at least. If A1 is [FALSE], there is no question of knowledge level in concept 1 at least.

4.SUM(Xi) is the question's sum of cognition level X in concept i.

ex. SUM(F3)=3, there are 3 questions of evaluation level in concept

5.SUM(Ai-Fi) is the question's sum in concept i.

ex. SUM(A10-F10)=8, there are 8 questions (From Knowledge to Evaluation level) in concept 10.

6.SUM(B1-Bi) is the question's sum of Comprehension (From Concept 1 to Concept i).

ex.SUM(C1-C7)=7, there are 8 questions (From Concept 1 to Concept 7).

4. Assessment metadata and analysis Architecture

We proposed a architecture with analysis model. (See Figure 2) Microsoft .NET provides a Web Service in this environment. We use .NET [2] to construct our LMS, and use XML Schema or DTD to implement MINE Assessment Metadata. In order to solve different operation or platform operation, we choose SOAP [3] (Simple Object Access Protocol) as the basis of transportation and Java Applet as the LMS API.

With the API, java script and API adapter communication, client could track students' learning behavior. Metadata also provide assessment raw data for analysis model to generate analysis result and feedback to teachers, students and learning management system. Figure 3 is the interface for reedit and fix improper question, this part belongs to question analysis. Figure 4 shows whole analysis feedback. Each question is classified according to Item Discrimination Index Green light means good quality of question, Yellow light means normal with little error and red light means poor quality of question with big problem.

In Figure 5, teacher can see the analysis result with number representation. In Figure 6, with the help of paint algorithm we can see the distribution of cognition level and question. The system will show the test belong to which type of improper tests.

5. Discussion

(See Table 3)

IMS LOM

Specifies the relative difficulty of the learning resource, on a scale of 0-4.

Value can be: **0** — very easy, **1** — easy, **2** — medium, **3** — difficult, **4** — very difficult

Represented by the IMS difficulty element. The difficulty level could refer to the result of the Item Difficulty Index calculation result.

Table 3.: MINE SCORM, SCORM and ULF Compared table

	MINE SCORM	SCORM	ULF	IMS Question & Test
Difficulty	*	+	+	*
Discrimination	*	-	-	-
Distraction	*	-	-	-
Instructional Sensitivity	*	-	-	+
Question Style	*	+	+	*
Cognition	*	-	-	-

*: completed +:partial -:empty

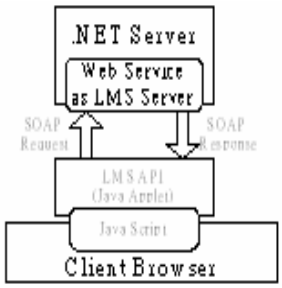

Figure 2 : Architecture with analysis model

ULF

Learning Content Format (LCF) is an interchange format for online learning content. Several standards related to online content and courses are currently in the process of being defined, including IMS Content Packaging Format [4], IMS Question & Test [5], and ADL Course Structure Format [6]. LCF adopts these standards and consolidates their best features into a stable and comprehensive format for describing online learning content. Assessments for a variety of purposes, including tests, evaluations, and surveys.

6. Conclusion and Future Work

In recent future, we can establish the learning knowledge map in each question to analysis students' realization. In addition to learning knowledge map, we can develop the assessment tools to question and change the question's style automatically. At last, we can focus on the interaction for assessment and multimedia assessment to prompt students' learning motivation.

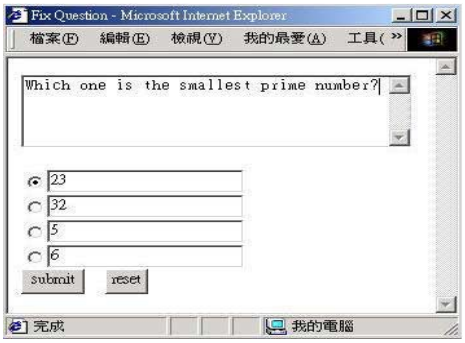

Figure 3 : Fix question interface

Figure 4 : Signal represent interface for whole test

Figure 5 : Item Discrimination Index and Item Difficulty Index number representation

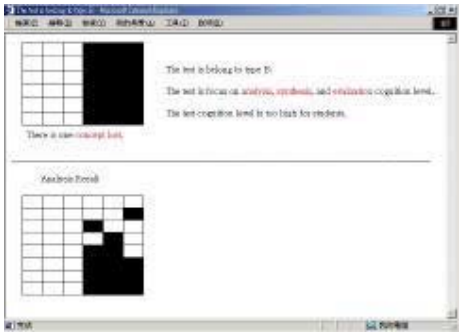

Figure 6 : Distribution of cognition level and question (paint algorithm)

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