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지능을 이용한 스마트 이러닝

Smart E-Learning using Intelligence

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요 약 가상대학은 언제 어디서나 컴퓨터만 소지하고 있다면 단순히 마우스나 키보드를 몇 번 클릭함으로써 강의를 쉽게 학습할 수 있다. 많은 사람들이 가상대학이 시간을 절약할 수 있고 학습을 향상시킬 수 있다고 믿고 있다. 가상 대학 강의를 선택한 학생이 얼마나 학습했는지를 점검하기 위해서 강사는 얼마나 많은 학생이 이해했으며 학생들의 어려운 문제점이 무엇인지 반드시 알아야 한다. 이러한 조건들이 점검되지 못한다면, 가상대학 강제는 매우 어렵고 지루하게 느껴질 것이다. 본 논문에서는 이해한 학생과 이해하지 못한 학생을 가르치는 쌍방향 지능형 강의 시스템을 소개한다. 컴퓨터 모의 실험결과 쌍방향 가상 수업 시스템이 이해하지 못한 학생을 고려하지 않은 기존의 단방향 가상 수업시스템보다 훨씬 효과적인 것을 입증했다.

Abstract Cyber university can easily study the lecture only press the couple of mouse click or keyboard button anywhere and anytime, if you have a computer. Many people believe that virtual university can save time and improve learning. To check How many students learn which selected some of the virtual university courses, instructor must know how to the understanding students and find out their difficult problems. Without checking this condition, it will be a very difficult and boring virtual university course. In this paper, we introduce the intelligent learning system. It has a full duplex direction that teaches understanding students and not understanding students. The computer simulation results confirmed that a full duplex virtual learning system has been proven to be much more efficient than one way direction which unfortunately does not consider to understanding problems.

Key words : Fuzzy rules ,Full Duplex, E-learning

1. Introduction

Now we can know what the name of disease by one drop of blood. Also, it's different prescriptions up to every single patient by age, sex, weight and height even though it's same disease. For example, if they have same disease, an old person and a kid have to take 1 pill one time per a day, but for 20's healthy

person has to take 1 to 2 pills 2times per a day. As the same way, if students who get over 60 points, let them success in an examination and other who can't get over 60 points make them not success in an examination then it will be satisfied to study up levels. However, it causes another problem for students who get much more than 60points need to control the degree of difficulty. However, it's different of understanding lecture for students who get over 85 points.

Therefore, students who get 60points get class more low level of class for next lessons and students who get more than 80points should take higher level class.

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There are two reasons need to Full Duplex Method study: First, there are students who can understand 80% of lecture and also students who can understand 30% of lecture together in the existing school. However, it's not helpful and waste of time each other. To solve this problem, middle school and high schools run level study instead of superiority and inferiority class. Level study means students study up to their level in class. In this article, we improved the method of evaluation algorithm and test based on student's scores for his level study in virtual university. Second, it causes serious problem gap between examination relative and the degree of difficulty. For example, when student-A choose Germany and B choose French as a second language for entering university. If Germany examination is very easy to success in an examination that average score is 80points, however French examination is hard that average score is 60 points. In this case, it would be a disadvantage for B. In order to this problem, there is a lot of research materials produced all over the world; however there is not satisfied result related this problem.

In this paper, we will study about novel score system, and implement e-learning system for systematic evaluation system for cyber student. This paper is organized as follows: Section 2 we briefly explain the problem of conventional classes. Section 3 presents the blend e learning study. Section 4 we describe full duplex e learning solution. Finally, section 5 will give conclusions.

2. Related Work

The expansions of distance education and recent innovations in technology have allowed for increasing interaction between and amongst learners and instructors. Multiple studies have concluded that increased levels of interaction result in increased motivation, positive attitudes toward learning, higher satisfaction with instruction, deeper, more meaningful

learning, and higher achievement (Entwistle & Entwistle, 1991[1]; Garrison, 1990[2]; Hackman & Walker, 1990[3]; Ramsden, 1988[4]; Ritchie & Newbury, 1989[5]; Schell & Branch, 1993[6]; Wagner, 1994[7]). Distance educators have identified four types of interaction: learner-content, learner-instructor, learner-learner, and learner-interface (Hillman, Willis, & Gunawardena, 1994[8]; Moore, 1989[9]). The interaction that takes place between the learner and the content is probably the most basic of the four types of interaction. The change we call learning takes place when the learner interacts with the content. The content can be in the form a text, radio, television, audiotape, videotape, and computer software. Sometimes a learner only interacts with the content of a course, never interacting with the instructor, other learners, or the interface. As many researchers mentioned above it, feedback and evaluation is of the highest importance for instructors to realize whether they are understanding or not. For this reason, we implements e-learning system which is composed of feedback and evaluation function for virtual university.

3. Smart e-Learning using fuzzy rules

Tele-education may provide a similar effect of face-to-face lecture in the classroom or reciprocal class employing virtual audio and video devices, which would mean that it could provide more effective learning than actual classroom.

In Fig.1 P1, P2 and P3 consider degree of difficulty. Each number of lines means the degree of questions difficulty and condition of students' learning. Therefore, although students gains same scores such as 90, if the degree of questions difficulty is high (0.8) or low (0.6), it can be changed at final score.

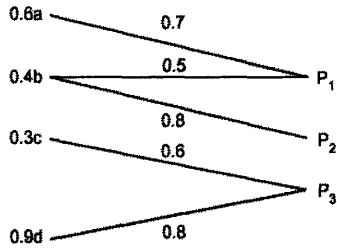


Fig. 1 Calculation of final score using Fuzzy rule

There are students who can understand 80% of lecture and also below 50% of lecture, even if they take same class. In the class, it's impossible how much students can understand lecture. If students who have different ability take same class, the lecture will run focus on students who understand most part of it. Accordingly, to overcome this problem, our nation run moving class up to level like developed countries. However, to run level learning, it's hard to expect high effect with same text books. Superiority class should use difficult text books and inferiority class should use easy text books, it will get good effect. Therefore, it's better to be taught by 2 expert teachers than same teacher teach both classes. In this article, to teach students next step of lecture in online school or university using full duplex learning after students answer 20 questions, and then it changes individual marks considering the degree of questions difficulty. Furthermore, if the student gets more than 60 points but each understanding of lecture is low then it will show what part is weak for students.

Table 1. Inputdata for smart virtual university

Student input condition		
1. Learner test score during past 1 month	small	Big
2. The incorrectness rate of exam	small	Big
3. The right answer rate of exam	Big	Small
4. Degree of difficulty of exam	Big	Small
5. Learner attitude/attendance during past 1 month	Small	Big

Table1 is saying an estimate procedure in 5 different conditions that serve to prediction. In this paper, we proposed analysis feedback for recently e-learning

environments. There are several proper feedbacks for instructors, students, and learning management systems. The feedback could provide proper teaching, learning resource delivering and learning progress suggestions. With this approach, assessment propels the learning effort in e-learning. Adaptive feedback algorithm aided in results elevation more than existent studying method. In the Fig.2 smart e-Learning system and experimented with IRT and intelligence algorithm to measure weak class of students and understanding.

STID	STID	ST	SG	SG	TR	AW	REF
1	51	100	80	10	170	57	X
2	42	X	X	X	X	X	X
3	55	90	100	100	290	97	HIGH
4	54	100	100	X	200	67	MED
5	38	X	X	X	X	X	X
6	46	X	X	X	X	X	X
7	41	X	X	X	X	X	X
8	44	X	X	X	X	X	X

Fig. 2 E-Learning simulation

As can be seen Fig.2, it presents a result of estimation in virtual university using a IRT concept and intelligence method. It shows the process of Judging the understanding level and final scores of students, transmitting the results to the professor's computer. Therefore, at the end of each lesson, the teacher will see the accurate level of student's mark and understanding level. Teacher can make slow students review the lesson individually and the advanced students can study a higher degree of lesson.

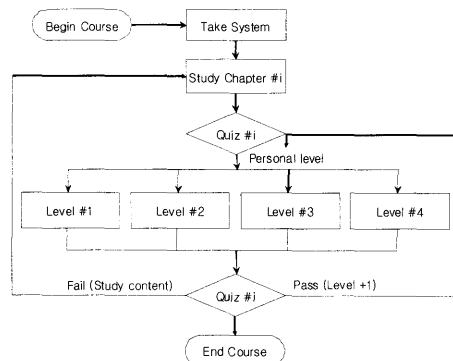


Fig. 3 Evaluation Flowchart of each Subject

<<The advantage of intelligent cyber university >>

- The advantage of the intelligent cyber university
1. Recent scores has been decreased over 10 point to the average (Once or more) ... Automatic .. First Disciplinary probation
 2. Recent scores has been decreased over 20 point to the average (Twice or more) ... Automatic.. Second Disciplinary probation
 3. Recent scores has been decreased over 20 point to the average (Third time or more) ... Automatic.. Third Disciplinary probation
 4. Down tendency of the scores than average... Automatic warning
 5. High rate of absence Automatic warning
 6. When failed problem repeatedly wrong again Automatic warning
 7. Increased tendency of the scores than average.. Automatic notice
 8. When degree of test difficulty is high ... Automatic adjustment of passing point(up)
 9. When degree of test difficulty is low.... Automatic adjustment of passing point(down)
 10. High rate of absence Automatic warning

As can be seen Fig.3, it presents a result of estimation in virtual university using an IRT concept and intelligence method. It shows the process the understanding level and final scores of students, and evaluation result can be transmitting to the professor's computer. Therefore, at the end of each lesson, the teacher can see the accurate level of student's scores and understanding level. Teacher can control e-learning systems as well as quiz system management. Instructors created a lot of quiz and lecture notes in lots of topics. Students solve the quiz via the computer system to increase his/her level in specific subject. In accordance with his/her score, they need a various feedback related his/her subject.

4. Simulation

To understand all of a student who selected some of e-learning course, teacher must realize that how many students to understand and what are the difficult problems. If tutors do not have comprehension of these considerations, it is impossible for them to affluent management to their students. In this paper, we introduce of intelligent learning contents of full duplex direction that teach understanding student and not understanding students. In this paper, we present level analyzing of each person using a neural network and a

fuzzy expert system. In addition to, demand estimate process that we use is as following. X shank is time and Y shaft is value (data value past) of variable.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \dots + \epsilon$$

Last point that consider degree of difficulty

Where:

X₁:Element1 that influence independent variable

X₂:Element2 that influence independent variable

X₃:Element3 that influence independent variable

X₄:Element4 that influence independent variable

X₅:Element5 that influence independent variable

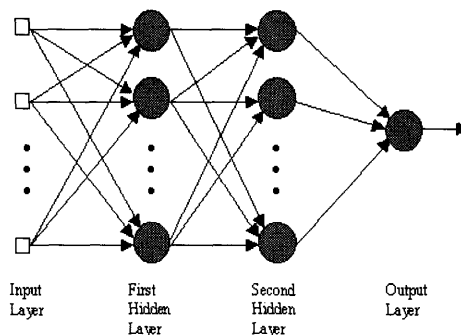


Fig. 4 Structure of neural network

It is an important problem that set up value of a neural network analyzing. It reduces analyzing error and accelerates analyzing a process that chooses value appropriately early.

Fig. 4 shows structure of neural network of smart e learning system.

Usually, neural network's studying begins in value specification early. The analyzing rate how we decide parameter value is decided. Therefore, we choose suitable parameter to data that wish to analyze. So, consider all cases according to each extent 0.1, 0.3, 0.5, 0.7, 0.9 with (kappa, theta, phi, mu) and tried an experiment in free case.

And, it is limited class by each 500 number of times.

- ① Study test data with 10 different condition using neural network.
- ② Calculate test data and error of estimate data

after predict about 10 test data.

Table 2. Calculation of score using item difficulty

AVG Score	number of students	Right Answer	Wrong Answer	Degree of difficulty	Regular Method	A.I. Method
80	150	High	Low	Low	Pass	Pass
55	150	Low	High	High	Fail	Pass
65	300	High	Low	Med	Pass	Pass
57	250	Med	Med	High	Fail	Pass
63	100	High	Low	High	Pass	Fail
70	100	Low	High	High	Pass	Pass
90	200	Low	High	Low	Pass	Pass

Table 2 finds out point distribution and ascertained head count by point distribution using a degree of difficulty. Because scorer's number of percentage is a ratio that dominates in degree of difficulty, degree of difficulty is decided according to scorer's number. The Identification problem about a person that takes an examination in on-line estimation is the most important point in estimation of a cyber education system. Finally, it will decide pass or fail using the item difficulty.

Table 3. Calculation of final score using full duplex learning

Number	Course	Degree of difficulty	Strong Point	Weak Point	Right Answer
Q1-Q3	O.S.	5	Low	High	0
Q4-Q6	O.S.	8	High	Low	3
Q7	D.B.	4	Med	Med	1
Q8-Q10	FILE	10	Med	Low	3
Q10-Q12	FILE	3	High	Med	3
Q13-Q15	O.S.	5	Med	Med	3
Q16-Q17	D.B.	6	Med	Med	2
Q18	D.B.	8	High	Med	1
Q19-Q21	N.T.	9	Med	Low	1
Q22-23	N.T.	4	High	Med	2
Q24-25	N.T.	5	High	Med	2

Table3 shows decides which course is strong point and weak point even though who got a same test score. In this paper, after finishing test, it is automatically tells the student which course is strong point depending on item difficulty. But, As you know, student level is different. that is why, in order to solve these problems, in this paper, it used fuzzy rules.

- (RULE 1) IF DPSV IS PB
AND USPC IS PB
THEN OPRG IS BIG
- (RULE 2) IF DPSV IS PB
AND USPC IS NS
THEN OPRG IS MEDIUM
- (RULE 3) IF DPSV IS NS
AND USPC IS NS
THEN OPRG IS SMALL

where

DPSV : Student level

USPC : Degree of difficulty of examination

OPRG : Results (10 grades) that consider degree of difficulty

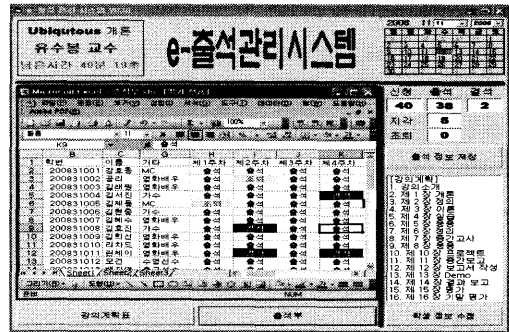


Fig. 5 E-learning system simulation 1

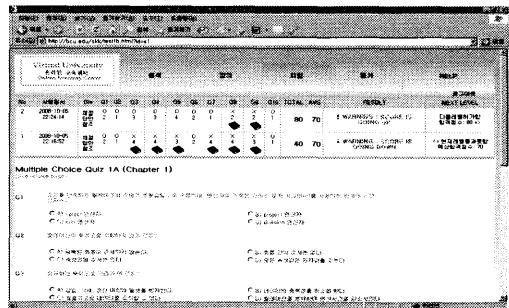


Fig. 6 E-learning system simulation 1

Fig.5 and Fig.6 are shown the test screen of proposed e-learning system. Especially, we developed automatically check attendance of students in cyber e-learning. In order to develop this function, we applied RFID tag in proposed system. In this paper, we develop new two-way learning simulation function that estimates student not only based on their grade but

also shows the weakness as well. If the two-way learning test is developed for each subject, it makes teacher analyze both of student's grade and weakened subject at the same time every end of class. Therefore, it could give intensive course for the top ranked students who understand the lesson, and some students who are lack of understanding can repeat the lesson; good learning model would be developed.

5. Conclusion

An e-learning system is not only with good teaching strategy and better learning resources but the also proper assessment model. In this paper, we proposed analysis feedback for recently e-learning environments. There are several appropriate feedbacks for instructors, students, and learning control systems. The feedback could provide suitable teaching, learning resource delivering and learning advance suggestions. With the approach, estimation propels the learning effort in e-learning. Adaptive feedback algorithm helped in results elevation more than existent learning system. The purpose of this paper is to discuss the ways in which we might use on-line assessment and feedback with students. 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 analysis feedback for recently e-learning environments. There are several proper feedbacks 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. Adaptive feedback algorithm aided in results elevation more than existent studying method.

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2) Who is the first president in the america?<br>
<INPUT TYPE="radio" NAME="Q2" VALUE=1>
  1. Kennedy. <br>
<INPUT TYPE="radio" NAME="Q2" VALUE=2>
  2. Bush. <br>
<INPUT TYPE="radio" NAME="Q2" VALUE=3>
  3. Washington.<P>

<input type value="Rewrite">
<input type=submit value="Submit">
</form>
</body>
</html>

<html>
<head>
  <title> Full duplex E - Learning </title>
</head>
<script>
function winper()
{
  var form = document.vote
  var total=0

  if (form.mun1[0].checked) total += 24
  if (form.mun1[1].checked) total += 20
  if (form.mun1[2].checked) total += 15
  if (form.mun1[3].checked) total += 10

  if (form.mun2[0].checked) total += 24
  if (form.mun2[1].checked) total += 20
  if (form.mun2[2].checked) total += 15
  if (form.mun2[3].checked) total += 10

  form.total.value = total
}
<form name="fo" target="new">
1) How many students in the america.? <br>
<INPUT TYPE="radio" NAME="Q1" VALUE=1>
  1. There are fifty states in the america.<br>
<INPUT TYPE="radio" NAME="Q1" VALUE=2>
  2. There are thirty states in the america. <br>
<INPUT TYPE="radio" NAME="Q1" VALUE=3>
  3. There are ten states in the america. <P>
    
```

References

- [1] Entwistle, N., & Entwistle, A. (1991). Contrasting forms of understanding for degree examinations. *Higher Education*, 22, 205-227.
- [2] Garrison, D. R. (1990). An Analysis and evaluation of audio teleconferencing to facilitate education at a distance. *The American Journal of Distance Education*, 4(3), 13-24.
- [3] Hackman, M. Z., & Walker, K. B. (1990).

Instructional communication in the televised classroom: The effects of system design and teacher immediacy on student learning and satisfaction. *Communication Education*, 39, 196-206.

[4] Ramsden, P. (Ed.), (1988). *Improving learning: New perspectives*. London: Kogan Page.

[5] Ritchie, H., & Newbury, T. J. (1989). Classroom lecture / discussions vs. live televised instruction: A comparison of effects on student performance, attitude, and interaction. *The American Journal of Distance Education*, 3, 36-45.

[6] Schell, N., & Branch, R. (1993). The role of conversation and culture in the systematic design of instruction. *Educational Technology*, 23(8), 7-18.

[7] Wagner, E. D. (1994). In support of a functional definition of interaction. *The American Journal of Distance Education*, 8(2), 6-29.

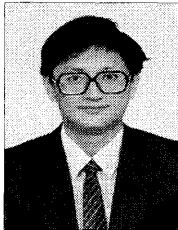
[8] Hillman, D. C., Willis, D. J., & Gunawardena, C. N. (1994). Learner-interface interaction in distance education: An extension of contemporary models and strategies for practitioners. *The American Journal of Distance Education*, 8(2), 30-42.

[9] Moore, M. (1989). Editorial: Three types of interaction. *The American Journal of Distance Education*, 3(2), 1-7.

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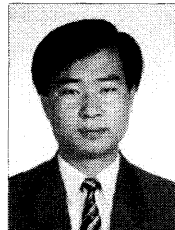
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