International Journal of Internet, Broadcasting and Communication Vol.12 No.3 108-115 (2020)
http://dx.doi.org/10.7236/IJIBC.2020.12.3.108

IJIBC 20-3-14

Realization of Online System Considering the Lecture Intelligibility of University Student

ChangPyoung Han* , YouSik Hong**

**Professor, Dept. of Automotive Engineering, Sangji University, Wonju-si, Kangwon-do, Korea*
***Professor, Dept. of Information and Communication SW Engineering, Sangji University, Wonju-si, Kangwon-do, Korea*
e-mail : yshong@sangji.ac.kr

Abstract

Blended learning is a teaching method utilizing all the advantages in 'on and off-line' learning circumstances in order to enhance the learning effect and efficiency, more than the simple use of online factors in the classroom education. In this paper, we present the realization and simulation of algorithm for the realtime evaluation of low-grade and high-grade subjects in order to implement smart e-learning system, considering a lecture intelligibility. In order to grasp the levels of student's intelligibility, we simulated a function that automatically summarizes the study contents of class given by a lecturer. Especially, in administrator mode of smart e-learning system, we suggested and simulated a system in order to help the lecturer to easily manage the student's grades, and we have provided software to tell the student's intelligibility of lecture, analyzed the rate of incorrect answers, automatic judgment of lecture intelligibility and judge the weakest subject

Keywords: *Automatic Analysis of Incorrect Answer Rates, Automatic Judgment of Lecture Intelligibility, Level-dependent Classes, Analysis of the Weak Subjects*

1. Introduction

During medical examination nowadays in a hospital, a drop of blood can help the diagnosis of patient's diseases. The same disease have different influences on the patients depending on the age, gender, weight, and height. Even the best lecturer cannot see the student's intelligibility of lecture and the weakest subject of the students during class. In order to solve these problems, we have set a goal to develop system softwares for the analysis of the class concentration, automatic analysis of the weakest subject, and automatic summary of study, during the blended learning(on and off-line study hours. A 'Minerva school', a school of the future, is noted for making a round of visits to 7-10 countries in order to offer an off-line internship in global IT industries (such as web-based Google, Apple, and Amazon) and performing a research for essential theories and practical works without university campuses. Minerva School, founded in 2010, accepted 28 freshmen in 2014. It is now big enough to accept 200 freshmen each year. Twenty-nine percent of the total students is Asian students, including 10 Koreans. The university is expected to turn out the first graduates this May [1-4]. In Korea,

Manuscript Received: June. 7, 2020 / Revised: June. 15, 2020 / Accepted: June. 20, 2020
Corresponding Author: yshong@sangji.ac.kr
Tel: +82-33-742-112, Fax: +82-33-730-0480
Professor, Dept. of Information and Communication SW Engineering, Sangji University, Wonju-si, Kangwon-do, Korea

Minerva School is known to have a higher competition rate for admissions, compared to Seoul National University and Harvard University. In order to increase the popularity of on-line classes from prestigious universities on the basis of WEB, the Ministry of Education offers, through Public Relations Officer, the master plans for educational information, digital textbooks, smart learning for students with disabilities, and KOCW lectures of universities. It also provides real experience of e-Learning. In a knowledge-based society, a method of self-directed learning is being developed, by overcoming the limitations of traditional classrooms and by developing textbook-based teaching method. However, the use of e-learning in class has not yet passed the basic level of finding information or offering educational content on a website. In reality, the bi-directionality, the biggest advantages of the web, is not yet fully utilized.

E-learning method cannot completely replace the existing teaching method [5-8]. In this paper, we propose a mixed form of learning method, the combination of online and offline classes, as an effective learning method for solving these problems. The blended e-learning, the most popular one recently, was developed in order to take advantages of online learning, by supplementing weakness of offline learning, which is mainly dependant on the students' voluntary participation and creative activities for the effective study. In order to optimize the management of student's grades based on the smart e-learning, we propose in this paper a software development such as the algorithm for the study summary, automatic judgment of lecture intelligibility, the algorithm for analyzing incorrect answer rate, and the algorithm for academic probation. This paper is organized as follows: Section 1 explains the basic concept of smart e-learning, Section 2 explains the study of the web-based SMART e-Learning, using intelligence, and Section 3 explains the results of computer simulation. Section 4 summarizes the algorithm and the concept of implementing the online system by considering the student's intelligibility of lecture. It also describes the future of smart education system.

2. Automatic Judgment of Weak Subjects

In this paper, we show an algorithm for automatic analysis of the weakest subjects, by utilizing cluster analysis based on various comparison patterns along with the educational evaluation results of students. In addition, in this paper, by applying the clustering analysis algorithm, we also propose an algorithm for automatic judgment of students' weakest subjects, automatic judgment of the incorrect answer rate, and automatic judgment function for each level-dependent learning. In addition, in administrator mode we propose and simulate a function to automatically judge a decline or rise of grades and absence of students in recent times. In hospitals, different prescriptions are issued to patients depending on the medical conditions; three tablets, one tablet, and one tablet, depending on the patient's medical conditions and the severity of the disease. In this paper, for the customized learning treatment, we implement a learning software based on the level of student test scores. We propose an algorithm that effectively monitors student's understanding of lectures in real time, in administrator mode. In particular, in order to implement score management system based on smart e-learning, we have developed a SW for automatic judgment of test scores in real time, automatic judgment of incorrect answer rate, and recent decline or rise of grades. In in administrator mode, we have proposed an algorithm and developed a software, in order to figure out recent situations of student in real time. Figure 1 shows the initial menu screen for smart e-learning. When the existing smart e-learning ID and password are entered, the student's attendance is automatically recognized. Clicking on the evaluation, the changing trend of student's grade can be checked. In addition, we have propose a software algorithm for web-based smart e-learning and automatic management grades. We have performed a computer simulation.

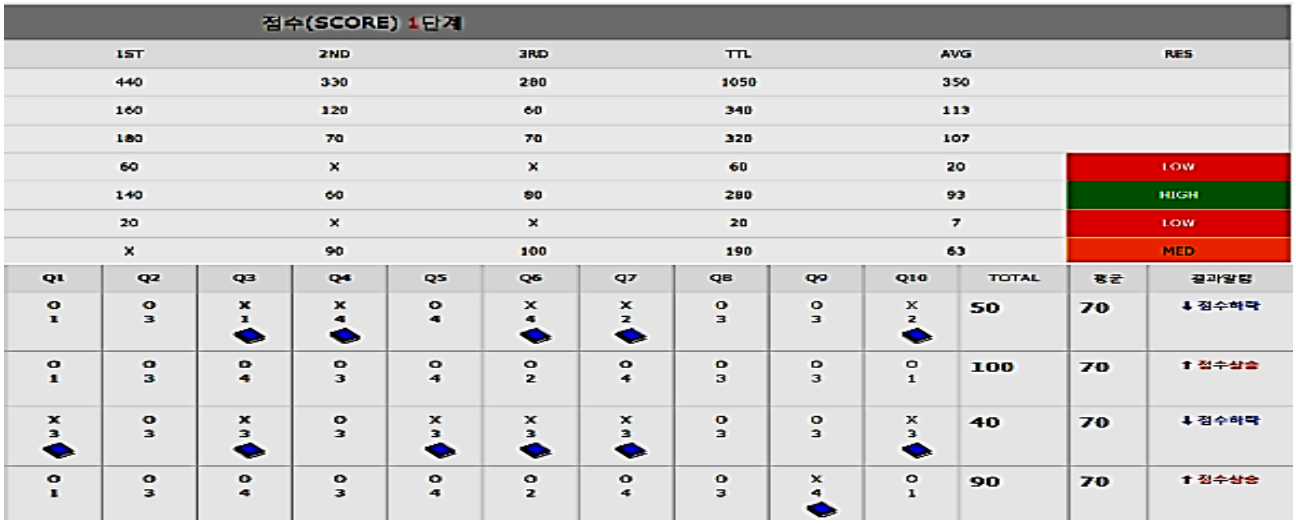

Figure 1. The result of smart e-learning simulation

Nowadays, many virtual universities of advanced education offer their courses on the internet so that people can study online anytime, anywhere. However, international or domestic students have sometimes difficulties in understanding lectures in real time, since there are too many courses they should take. Lecture speed can be fast or slow. In that case, since the percentages of students who understand the contents of lectures is not shown, it is not easy to adjust the level or speed of class. To solve this problem, we have developed an automatic analysis system for the weakest subjects of student, by applying analysis algorithms of artificial intelligence. Just as medical doctors issue different prescriptions to patients depending on the medical conditions (such as three tablets, two tablets, or one tablet per day), for the customized lecture, depending on the student's test score, we have developed level-based software and simulated on computer. Figure 1 shows the initial menu screen for smart e-learning. As shown in Figure 2, the computer simulation supplements the existing smart learning functions. When we enter IDs and passwords, student attendance is automatically recognized, and a trend of student's test scores is shown based on WEB.

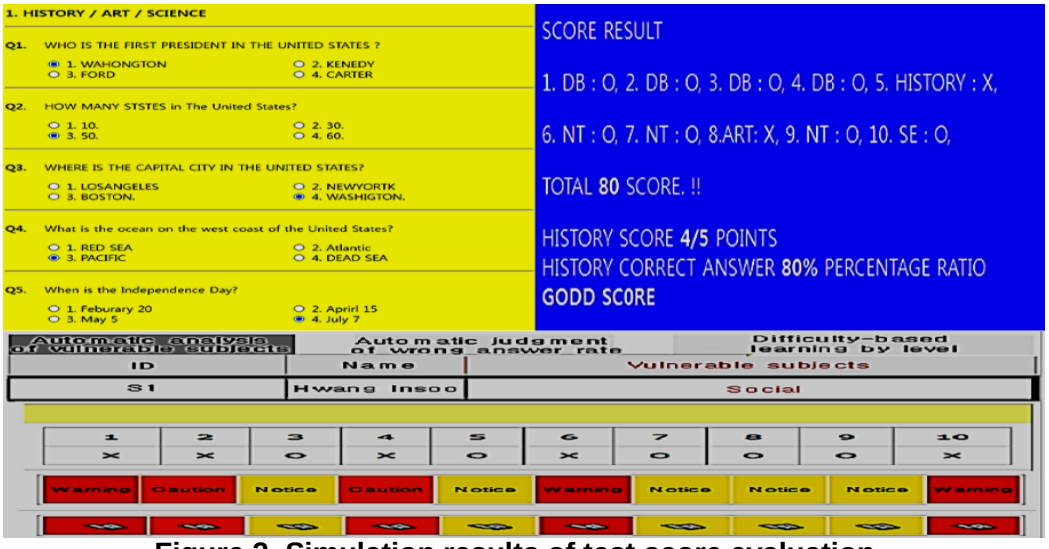

Figure 2. Simulation results of test score evaluation

Name	Math	Science	Sociology	Vulnerable subjects
황인수	10	30%	10	Science
손수지	60%	30%	30%	Math
간진구	70%	70%	90%	Sociology
박수연	80%	60%	20%	Math
정채연	10	30%	20%	Science
강수지	40%	70%	50%	Science
장하나	40%	60%	40%	Science
송영길	40%	30%	70%	Sociology
김지원	60%	80%	40%	Science
박혜자	70%	70%	90%	Sociology

Figure 3. Automatic analysis of subjects with the lowest grade

In Figure 3 shows the process of the online system, judging the subject with the lowest grade as the weakest one, after the test.

3. Computer Simulation

In order to realize a smart e-learning system considering lecture intelligibility, we have implemented and simulated an algorithm for real-time evaluation of subjects with low and high test scores. In addition, in order to find out the learning level, we judged automatically the lecture intelligibility and text summarization function. In particular, we have developed and simulated an algorithm for automatic analysis of the weakest subjects by using the cluster analysis, which is based on the educational evaluation results and various comparative patterns. In addition, by using the clustering analysis algorithm, we performed computer simulations to automatically analyze the weak subjects of student. Nowadays, we always can take web-based courses offered by many universities in developed countries and in Korea. However, when the students of foreign and domestic remote universities have different understanding, they have difficulties in grasping lectures in real time. When the lecture speed is fast or slow, or lecture level is too high, there arises a problem that their concentration falls down. In fact, since the students taking online learning classes have a lot of differences in their majors, it is hard to adjust the level of class for the students to easily understand the lectures. In order to solve these problems, self-directed learning is adopted. In the self-directed learning, students select and discuss lecture materials in small groups. To improve the understanding of lectures, they run the class in small group. Students can select creative subjects based on their background, and can maximize their academic effectiveness by doing upside down classes. However, even though there are many advantages in the self-directed learning, it is too difficult for an instructor to teach students who do not understand the basics. It is essential to offer helpers who can repeat the teaching, to develop software of automatic repeating contents, and automatic summary of difficult lectures. To solve the problem, we have proposed an algorithm for the automatic summarization of lecture, using open sources from internet, and performed a simulation experiment. Figure 2 shows the computer screen summarizing document algorithm. Document summarization is the

process of finding the sentences containing the most information, and of creating a summary to represent the entire document. Using the automatic document summary, the lecturer can teach the 70-90% of the lecture data in an hour, so many scientists are currently performing research and development. However, when a course has many analogies, metaphors, or irony, there might be a problem that the summarized result is inefficient. Using text rank algorithms and open source programs, we performed a computer simulation that automatically extracts lecture contents and keywords, with assigned weight values according to their relative importance. Figure 3 shows the results of 50% performance from original 100% lecture text that describes the radio frequency concept, using the document summary function. In this paper, we show our software to find out the keywords of lecture, when the students have difficulties in understanding the lecture. Adapting an open source algorithms taken from internet, we have proposed an algorithm function that provides an automatic lecture summary to students.

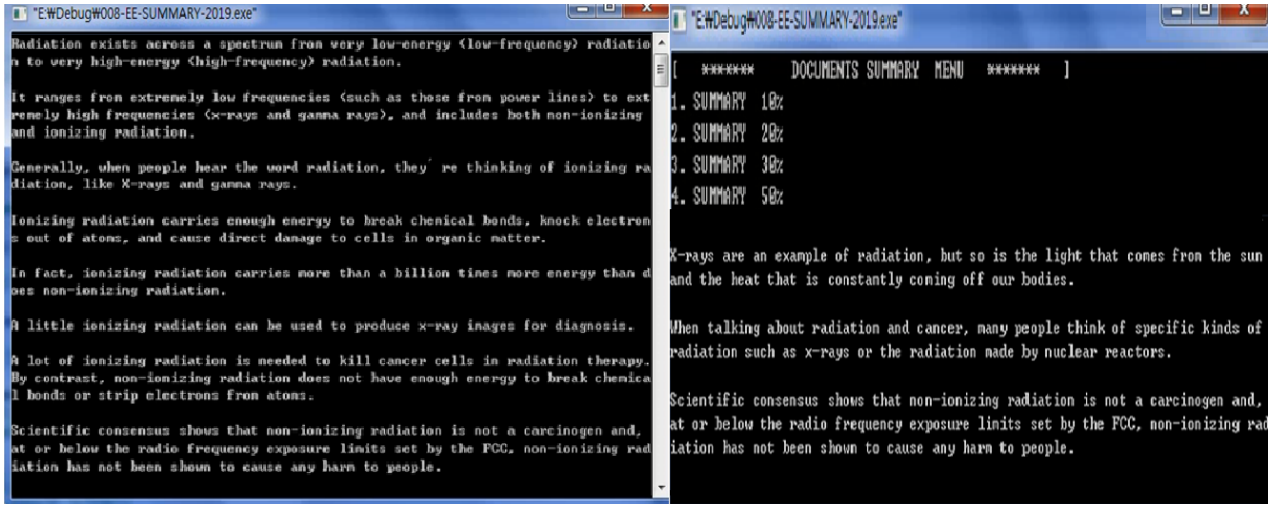

Figure 4. Automatic text summarization simulation

< Text rank algorithm adopting open source >

1. Analyze the entered text.
2. Extract the adverbs to determine the type.
3. If a paragraph has a connective adverb showing a result, then the paragraph is extracted.
4. If a paragraph does not have a connective adverb showing a result, the paragraph is extracted; when the category of the document has a double bracket structure such as news, only 25% of sentences is extracted, and when the category of the document has a sub-component such as editorial, only 25% of sentences is extracted
5. Generalize the sentence extracted from the previous step.
6. Calculation of the frequency for the generalized words
7. Calculate a weight number according to the frequency, to determine the word related to the title. Addition of case weight

8. Extract the only sentence that contains words with high weight value.

9. In the case of sentences with similar sentence structure in the extracted sentence, the extracted sentence is excluded.

10. Printing a summarized sentence

Value of TextLrank for sentences or word (V)i wj: weight value of sentences or word i and j TextLrank TR(Vi) calculation and higher-order TF(Term Frequency) Arrange: Word frequency, a measure of how often a specific word appears in a document IDF(document reverse frequency): reverse document frequency, reve rse document frequency: Document frequency Divide the total number of documents by the number of doc uments.The document containing the word TF-IDF formula: Wi,j=tfi,j×log(N/dfi).Using Scikit-learn, as a mac hine learning package of Python, calculate TF-IDF document summary or keyword summary using TextLran k class(sent_num=3): Basic 3 rows are for keywords (word_num=10): Output 10 keywords as a basic valu e # text lable lblText = QLabel('Text') lblText.setFont(fntLabel) vboxLayout.addWidget(lblText) # Setting of text editing self.edtText = QTextEdit()

```
lblText = QLabel(Text') lblText.setFont(fntLabel) vboxLayout.addWidget(lblText)
# set text textedit
self.edtText = QTextEdit()
self.edtText.setFont(fntEdit)
vboxLayout.addWidget(self.edtText)
# set result label
lblResult = QLabel('Result')
lblResult.setFont(fntLabel)
vboxLayout.addWidget(lblResult)
# set reslut textedit
self.edtResult = QTextEdit()
self.edtResult.setFont(fntEdit)
self.edtResult.setFixedHeight(120)
self.edtResult.setReadOnly(True)
vboxLayout.addWidget(self.edtResult)
# set QHBoxLayout for button
hboxLayout = QHBoxLayout()
vboxLayout.addLayout(hboxLayout)
self.clearButton = QPushButton('Clear')
self.clearButton.setFixedSize(100, 30)
self.summarizeButton = QPushButton('Summarize')
self.summarizeButton.setFixedSize(100, 30)
hboxLayout.addStretch(1)
hboxLayout.addWidget(self.clearButton)
hboxLayout.addWidget(self.summarizeButton)
hboxLayout.addStretch(1)
# init event
self.clearButton.clicked.connect(self.clearText)
self.summarizeButton.clicked.connect(self.summarize)
def clearText(self):
```

```
self.edtText.clear()
self.edtResult.clear()
def summarize(self):
text = self.edtText.toPlainText()
text = text.strip()
if not text:
return
textrank = Summarizer.TextRank(text)
strResult = ""
for row in textrank.summarize(3):
strResult += row
strResult += '\n'
self.edtResult.setText(strResult)
def center(self):
geometry = self.frameGeometry()
centerPoint = QDesktopWidget().availableGeometry().center()
```

<10 Characteristics of intelligence forms of learning system>

1. If an answer is repeatedly incorrect… SW for automatic warning system

2. When the score rises... Automatic notification warning

3. When the score declines... Automatic notification warning

4. SW for Automatic judgment of weak subjects

5. SW for Automatic judgment of incorrect answer rates

6. SW for Automatic judgment of weak subjects

7. SW for Automatic summary of lecture

8. SW function of music therapy for improving the concentration during a lecture

9. SW function of color therapy for improving the concentration during a lecture

10. SW for automatic setting of exam questions and SW function for lectures by each level

4. Conclusion

In blended learning technique nowadays, many algorithms have been developed to improve the understanding of online and offline lectures for students, professors, and assistants, by using videos, handouts, and internet discussion boards. However, the level of online Mook courses based on the web is so low that the graduation rate is less than 5-10%. In this paper, we have implemented and simulated an algorithm for real-time evaluation of low and high test scores of subjects in order to implement a smart e-learning system for lecture understanding. In addition, in order to grasp student's learning by level, we simulated the automatic text summary function that automatically summarizes the lecture given by the professor in class. Especially, In administrator mode of smart e-learning system, we suggested and simulated a system in order to help the lecturer to easily manage the student's grades. We have provided softwares to tell the student's intelligibility

of lecture, analyze the rate of incorrect answers, automatic judgment of lecture intelligibility and judge the weak subjects. In addition, in this paper, to solve these problems, we have proposed an automatic summary system and performed a computer simulation. In particular, in order to supplement the automatic recommendation system, we have developed a study SW for each level, proposed an SW algorithm to identify students weakness, and performed computer simulations.

Acknowledgement

This research was supported by Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education (grant number: 2018R1D1A1B07043)

References

[1]https://www.zdnet.co.kr/view/?no=20190225170917
[2] Janis Kapenieks, "User-friendly e-learning Environment for Educational Action Research," Procedia Computer Science, Vol.26, pp. 121–142, 2013
[3] Y.S Cho, “Introduction to Digital Textbook Utilization Pilot Project in Korea,” IMS Learning Impact 2009, IMS Global Learning Consoritum, 2009.
[4] Sarma Cakula, Maija Sedleniece, "Development of a Personalized e-learning Model Using Methods of Ontology," Procedia Computer Science, Vol 26, pp. 113– 120, 2013
[5] Toshiya Nakajimaa, Shun Shinoharab, Yasuhisa Tamura, "Typical Functions of e-Textbook, implementation, and Compatibility Verification with Use of ePub3 Materials," Procedia Computer Science, Vol.22, pp.1344–1353, 2013
[6] https://www.zdnet.co.kr/view/?no=20190225170917
[7] Hong You-Sik, Intelligent Education System, The Journal of Institute of Internet, Broadcasting and Communication, Vol.13, 2013
[8]http://www.eduinnews.co.kr
[9] S.E. Jung and E.S. Won, “Systematic Review of Research Trends in Robotics Education for Young Children,” Sustainability, Vol. 10, No. 4, pp. 1-24, March 2018. DOI: https://doi.org/10.3390/su10040905
[10]L, Xia and B, Zhong, “A Systematic Review on Teaching and Learning Robotics Content Knowledge in K-12,” Journal of Computers & Education, Vol, 127, pp. 267-282, December 2018.
DOI: https://doi.org/10.1016/j.compedu.2018.09.007
[11] D. Moher, A. Liberati, J. Tetzlaff, and D.G. Altman, “Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement,” Annals of Internal Medicine, Vol. 151, No. 4, 264-269, August 2009.
DOI: https://doi.org/10.7326/0003-4819-151-4-200908180-00135
[12]Jung, Sung Eun , Han, Jeonghye, “A Comprehensive Review on r-Learning: Authentic r-Learning Beyond the Fad of New Educational Technology “, International journal of advanced smart convergence v.9 no.2 ,pp. 28 - 37 , 2020
[13] Kim, Kenneth Chi Ho, “The Impact of Blockchain Technology on the Music Industry”,International journal of advanced smart convergence v.8 no.1 ,pp. 196 - 203 , 2019
[14]J. Johnson, “Children, Robotics, and Dducation,” Artificial Life and Robotics, Vol. 7, No.1-2, pp. 16-21. 2003.
DOI: https://doi.org/10.1007/bf02480880
[15] D. Alimisis, “Educational Robotics: Open Questions and New Challenges,” Themes in Science and Technology Education. Vol. 6, No. 1, pp. 63-71, June 2013. DOI: https://doi.org/10.1109/mipro.2015.7160399