The Effect of Feedback Types on Academic Achievement in Learning with Computerized Tests[1]

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ABSTRACT

The purpose of this study was to show the effect of back types (standardized type vs. differentiated type) on academic achievement in learning with computerized tests. For this study, two computerized learning programs with different feedback types were developed with HTML, PHP, and SQL computer languages, and a science achievement test was developed by two high school science teachers. The science achievement test's content and face validity were examined by 5 high school science teachers and its Cronbach's alpha coefficient was 0.82. The research subjects were 137 10th graders from 4 classrooms within 2 high schools in Korea. They were divided into two groups. One group took a 3-weeks learning program with computerized a test using standardized type feedbacks. The other group also took a 3-week learning program with a computerized test using differentiated type feedbacks. After learning with computerized tests was implemented, a science achievement test was administered to all students belonging to both groups. The result of data analysis with ANCOVA was that differentiated type feedback was more effective than the standardized

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1) An earlier version of this article was presented at the Pacific Rim Objective Measurement Symposium (PROMS 2006), The Hong Kong Institute of Education, Tai Po, Hong Kong, June 27th-29th, 2006
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type feedback for learning with computerized test (F=8.98, p<0.01).

Key words: learning with computerized test, feedback, standardized type feedback, differentiated type feedback, academic achievement

Ⅰ. Introduction

'Learning with a test' is defined as an academic exercise with test items and appropriate feedbacks. It is a very popular academic practice to prepare for both classroom achievement test and College Scholastic Ability Test (CSAT) in Korea. Therefore, it is very important to develop an effective educational program for a learning with test.

The purpose of this study is to develop a computer program for learning with computerized tests and to check its effectiveness for students' academic achievement. 'Learning with computerized tests' is defined as an academic practice with test items and appropriate feedbacks, which are provided by a computer program. Many comparative studies between paper-and-pencil tests and computerized tests were implemented. And those studies reported that students generally preferred computerized test to paper-and-pencil tests (Baek, 1993; O'Neil, & Kubiak, 1992; Power, & O'Neil, 1992; Vincino, & Moreno, 1988; Vispoel, et al., 1997). Based on those studies, it was assumed that learning with computerized tests was more effective than learning with paper-and-pencil tests.

In order to develop an effective computerized learning program, it is very important to investigate which feedback type is more effective for students' academic achievement. In order to investigate this issue, feedbacks are divided into two types: 'standardized type' and 'differentiated type' (Haddy, 2004; Smith, 1988; Wiberg, 2003). The standardized type feedback is defined as a unified feedback that is provided for all students at a time

after the test administration. Standardized type feedback is generally provided in learning with paper-and-pencil tests. On the other hand, the differentiated type feedback is defined as an individualized feedback that is provided to each student, if he/she wants, at any time during the test administration. Several studies have reported that differentiated feedback is more effectiveness than standardized feedback. They have also reported that self-directed feedback is more effective than compulsory feedback (Han, 2005; Kulhavy, 1977 Sassenrath, 1975).

Based on the literature review, it is assumed that the differentiated type feedback is more effective than the standardized type feedback for learning with computerized tests.

Ⅱ. Research Questions

It was hypothesized that there would be statistically significant difference in students' academic achievement depending on feedback types in learning with computerized tests. In order to investigate this hypothesis, the following research question was proposed and examined.

Is there statistically significant difference in students' science achievement between two groups, standardized type feedback group and differentiated type feedback group, within the context of learning with computerized tests? In other words, is the differentiated type feedback more effective than the standardized type feedback for learning with computerized tests?

Ⅲ. Methodology

A. Subjects
The subjects of this study were 137 10th graders from 4 classrooms within 2 high schools in Korea. They were divided

into two groups (Group I and Group II). Group I took a 3-week learning program with computerized tests using standardized type feedbacks. Group II also took 3-week learning program with computerized tests using differentiated type feedbacks (see Table 1).

Group	Feedback Types	Classes	Students
Group I	Standardized	2	68
Group II	Differentiated	2	69
Total		4	137

<Table 1> The Research Subjects

B. Instruments

1. Science Achievement Test

For this research, a science achievement test was developed by two high school science teachers. The content of the test was based on the Korean National Science Curriculum for 10th grade students. In order to develop the final science achievement test, the face and content validity were examined through a series of interviews and reviews with 5 high school science teachers. The final test consisted of 20 multiple-choice items and its maximum score was 100. The Cronbach's alpha coefficient of the test was 0.82, so the test's reliability was fairly satisfactory. For example, both item #11 and item #20 in the science achievement test are illustrated in Figure 1 and Figure 2.
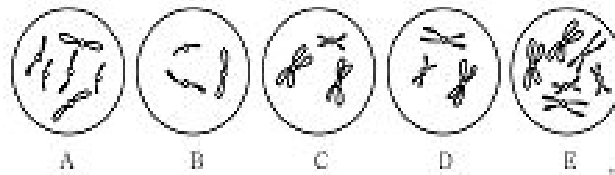
11. Which of the following are the factors that effect reaction velocity?

a. density	b. kind of reactant
c. temperature	d. volume of reactant
e. molecular weight	f. catalyzer

①a, b, c   ②a, c, d   ③a, b, c, f   ④b, c, d, f   ⑤c, d, e, f

<Figure 1> Item # 11 in the Science Achievement Test (An Example)

20. The below picture shows the meiosis process of an animal cell. Which is the chromosome of spermatid? (2n = 6)

① A   ② B   ③ C   ④ D   ⑤ E

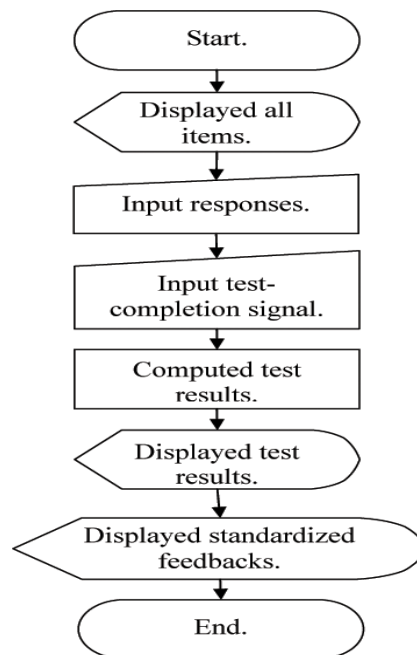<Figure 2> Item # 20 in the Science Achievement Test (An Example)

2. Computerized Learning Program

For this study, two computerized learning programs with different feedback types were developed. One was a learning program with standardized type feedbacks and the other was with differentiated type feedbacks. Each learning program was developed with HTML, PHP, and SQL computer languages.
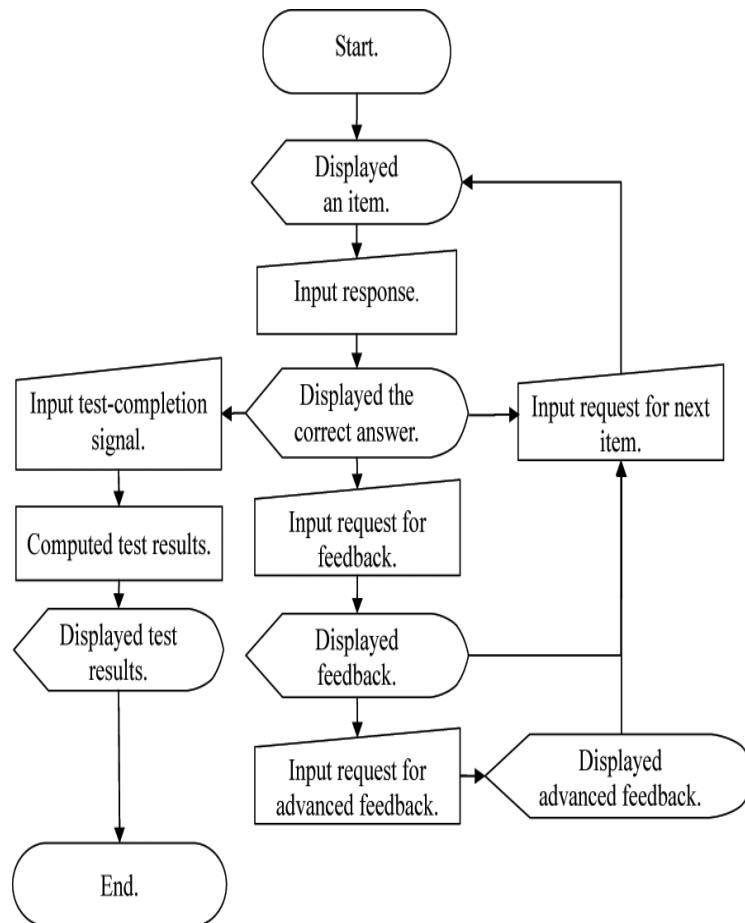
Figure 3 is the algorithm for the learning program with standardized type feedbacks. In this program, all test items were given to students at the beginning of the academic exercise. Students can practice with given items regardless of the items' order. When each student's responses for all items are finished, he/she can input a test-completion signal. When a test-completion signal is inputted, test results are displayed on the computer screen. The test results include individual student's test information (correct response number, test score, etc). After that, standardized feedbacks for all test items are given at a time.

Figure 4 is the algorithm for the computerized learning program with differentiated type feedbacks. In this program, one test item is given to each student at a time and the student responds to the given item. When the student's response for the

item is inputted, the correct answer for the item is given. After checking the correct answer, the student can choose either the feedback for that item or the next item itself. If the feedback is chosen, the detailed explanations about the item are displayed such as concepts, terms, theories, graphs, and etc. And if the next item is chosen, the next item is displayed on the computer screen. In addition, the more detailed feedback (so called advanced feedback) can be chosen by the student him/herself. When the student finished his/her learning, he/she can input a test-completion signal. When a test-completion signal is inputted, test results are displayed on the computer screen. The test results include individual student's test information (correct response number, test score, and etc).

<Figure 3> Flow Chart for Computerized Learning Program
with Standardized Type Feedbacks

<Figure 4> Flow Chart for Computerized Learning Program
with Differentiated Type Feedbacks

C. Data Collection and Research Procedures

The research procedures can be described as follows: First, learning with computerized tests was implemented for 3 weeks to the 10th grade students who were divided into two groups(Group I and Group II). Group I took learning with a computerized test of standardized type feedbacks, and Group II

took that of differentiated type feedbacks. After learning with computerized tests was implemented, the science achievement test was administered to all students of both groups.

In addition, the analysis of covariance (ANCOVA) technique was used for statistical test in order to statistically control the different science abilities between Group I and Group II at the initial stage (Baek, 2004; SPSS, 2000). Each student's score of science examination within the National Assessment of Educational Achievement (NAEA) was used as a covariate for ANCOVA. The science examination within NAEA was implemented at the beginning of this study by the Korea Institute of Curriculum and Evaluation. Its examination score was reported as standardized T-score (mean = 50, SD = 10).

IV. Results

A. Descriptive Statistics

Table 2 shows the summary of two groups' scores of science examination within NAEA (the covariate) at the initial stage. As shown in Table 2, the average scores of Group I and Group II in science examination within NAEA were 57.26 and 57.72.

Group	N	Mean	SD
Group I	68	57.26	13.31
Group II	69	57.72	14.56

<Table 2> Summary of Two Groups' Scores of

Science Exam within NAEA

Table 3 shows the summary of two groups' scores in science achievement test (the dependent variable) after learning with computerized tests for three weeks. As shown in Table 3, the mean score of Group I was 66.04 (SD=25.93) and that of Group II was 70.38 (SD=23.65).

Group	Feedback Types	N	Mean	SD
Group I	Standardized	68	66.04	25.93
Group II	Differentiated	69	70.38	23.65
Total		137	68.23	24.81

<Table 3> Summary of Two Groups' Scores in

Science Achievement Test

B. Statistical Test with ANCOVA

Table 4 shows the result of statistical test with ANCOVA. As shown in Table 4, there was statistically significant difference in student's science achievement between the two groups, standardized type feedback group and differentiated type feedback group (F=8.98, p<0.01). This result shows that feedback types have a significant effect on students' science achievement. In other words, the differentiated type feedback is more effective than the standardized type feedback for learning with computerized tests.

Source	Sum of Squares	df	Mean Square	F
Science Exam (Covariate)	76851.48	1	76851.48	1652.03**
Feedback Types (Main Effect)	417.52	1	417.52	8.98**
Error	6233.59	134	46.52	
Total	83502.59	136		

<Table 4> The Result of Statistical Test with ANCOVA   ** p<0.01

V. Summary and Discussion

The purpose of this study was to show the effect of types (standardized type vs. differentiated type) on academic

achievement in learning with computerized tests. The learning with computerized test was defined as an academic practice with test items and appropriate feedbacks, which were provided by a computer program. The standardized type feedback was defined as a unified feedback that was provided for all students at a time after the test administration. On the other hand, the differentiated type feedback was defined as an individualized feedback that was provided for each student, if he/she wanted, at any time during the test administration. Based on the literature review, it was assumed that the differentiated type feedback was more effective than the standardized type feedback for learning with computerized tests.

For this study, two computerized test programs with different feedback types were developed with HTML, PHP, and SQL computer languages and a science achievement test was developed by two high school science teachers. The science achievement test's content and face validity were examined by 5 high school science teachers and its Cronbach's alpha coefficient was 0.82.

The research subjects were 137 10th grade students from 4 classrooms within 2 high schools in Korea. They were divided into two groups. One group took 3 weeks' learning program with a computerized test using standardized type feedbacks. The other group also took a 3-week learning program with a computerized test using differentiated type feedbacks. After learning with computerized tests was administered, the science achievement test was administered to all students belonging to both groups.

The result of data analysis with ANCOVA was that the differentiated type feedback was more effective than the standardized type feedback for learning with computerized tests (F=8.98, p<0.01). The standardized type feedback group's mean score of the science achievement test was 66.04 (SD=25.93) and differentiated type feedback group's mean score of the science

achievement test was 70.38 (SD=23.65) after learning with computerized tests for three weeks. In conclusion, this study shows that the differentiated type feedback is more effective than the standardized type feedback for learning with computerized tests.

However, there are some restrictions to generalize this study's results because of the limited number of students and the short period of educational treatment. To generalize this study's result, more examinees and longer time of treatment are required.

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