

Students' Utilization of Web Exercise and its Effect on Preparation for the Written Test

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Web による演習問題の利用形態と筆記試験への効果

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The exercise in multiple-choice test style was offered on the Web in advance of the term examination (a multiple-choice test followed by a written examination). Students' utilization and the effect of the explanations in the exercise on the written test have been investigated. According to the questionnaire investigation, most students utilized the materials by printing out the html file in which questions, answers and explanations were given on the same page. Many students took advantage of the exercise to understand the tendency of the questions. In the on-line term examinations, the correct answers and the explanations were sent to the examinees with their scores for preparation for the following written test. Then six questions were asked again in the written test. However, students could not make the best use of these explanations. Some improvements were observed in the questions which could be answered just by "memorizing" items. On the other hand, such improvements were not clearly observed in the questions which required the students to explain the principle based on the essential understanding. These facts suggest that an effective utilization of the materials strongly depend on students' eagerness to study.

Introduction

Along with popularization of the Internet, Web publications have been recognized as a useful communication tool in both directions^{1),2)}. Today, most of universities and schools have a facility for computer literacy education, and many of them are ready to connect with the Internet. These circumstances give a chance to the teachers for developing unique teaching

materials through Web publishing³⁾⁻⁶⁾, which has the advantage of audio and visual presentation in addition to the plain text.

In the field of laboratory medicine, various graphic and image data will be obtained for diagnostic use, and the ability to analyze those data is essential for medical technologists. On the basis of these backgrounds, on-line questions through Web publication are expected to be a suitable education material for practice in

data analysis. We have recently developed an on-line exercise and examination system as an application of the Web publishing to teaching materials, and received favorable responses from students⁷⁾⁻⁹⁾.

According to the questionnaire investigations, which had been made at the end of on-line term examinations, almost all the students gave good evaluation to the Web exercise and examination. They agreed that Web exercise is useful for analyzing graphic and image data, and wanted to have similar style of exercises also in other subjects. They thought that the explanations shown with their results are useful in reviewing and preparing for the written test^{9),10)}.

However, to our impression, their answers are quite questionable. We cannot see a clear effect on the written test results, and are afraid that most of the students make no effort. In the previous report, we have pointed out that the frequency of utilization by students should be considered¹⁰⁾. Thus, in this study, students' utilization of the Web exercise and the effect of the explanations on the following written test have been investigated.

Apparatus and Methods

Server : A Power Macintosh 6100/66 computer (Apple Computer, Inc., Cupertino, CA, USA) equipped with a G3 accelerator card (Sonnet Technologies, Inc., Irvine, CA, USA) was used as a server machine. The server is operated with Macintosh OS (J) 8.1 and connected with SuperTAINS (TAINS=Tohoku University All-purpose, All-round, Advanced Information Network System; the local area network in this university). Personal Web Server 4.0 from Microsoft Corp. (Redmond, WA, USA) was used as a server software.

Clients : Client machines were 40 OptiPlex GXi

133 computers (Dell Computer Corp., Round Rock, TX, USA) operated with Microsoft Windows 95 on MS-DOS. These clients are also connected with SuperTAINS. Microsoft Internet Explorer 5.0 and Netscape Navigator 4.04 were used as Web browsers.

Examinations : The examinees were 37 juniors (Class of 2003) of the Department of Medical Technology in this college. The examination subject was "clinical chemistry", including the laboratory class and the lecture class. Two weeks before the term examination period, we have announced to the students that the on-line examinations given in the last 2 years were offered for exercise on the homepage of our department. The on-line examination (laboratory class) was given on the fourth day of the period, in the style of multiple-choice test. The written test (lecture class) was given after an interval of seven days. Six questions from the on-line examination were asked again in this examination.

System for On-line Exercise and Examination : In principle, Web exercise and Web examination are carried out by the same system as previously described^{8),9)}. Twenty questions were asked on a Web page in the style of multiple-choice test constructed by using form filling format, <input> tag with an attribute of radio button. The style is according to the National Examination for Medical Technologist, but in the questions which require students to select 2 or 3 items, the choices are listed as all the possible combinations (Fig. 1a). By submission of answers, processing of the data was carried out on the server using active server pages^{11),12)}, and the result file was sent to the examinee which contains his/her score, chosen and correct answers, and the explanations (Fig. 1b).

Assessment of the Results : In case of on-line

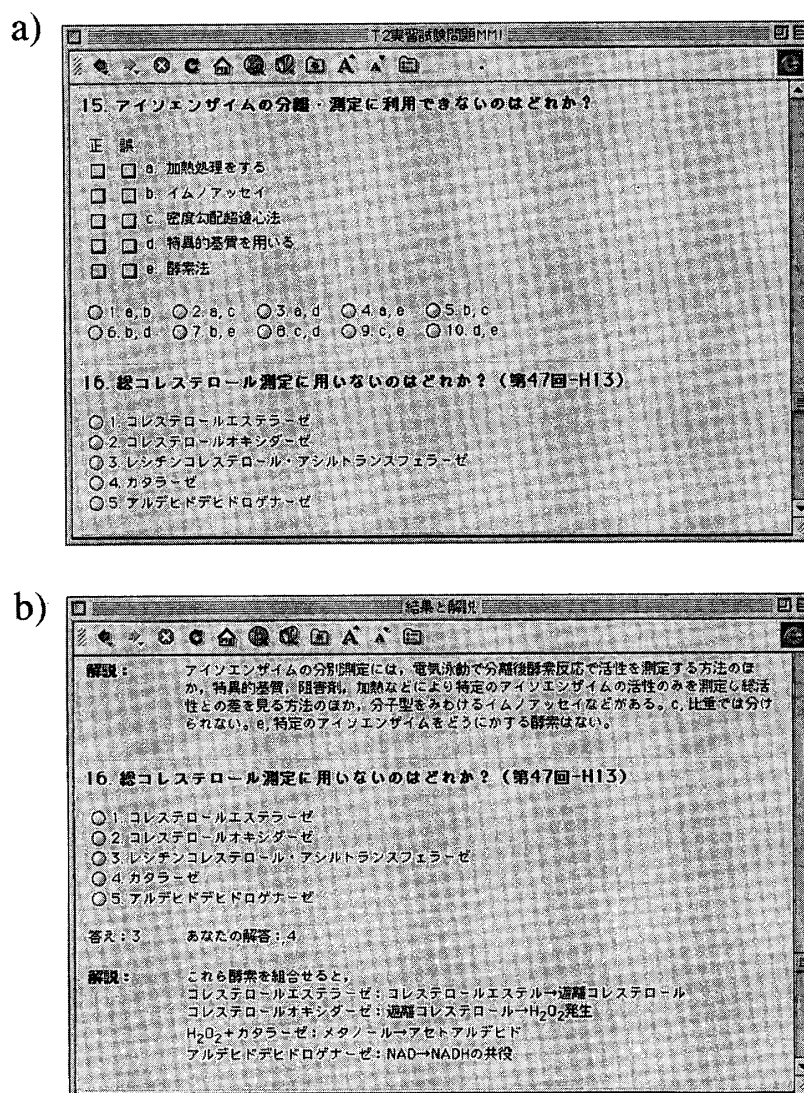


Figure 1. The multiple choice questions page (a) and the results and explanations page (b) corresponding to these questions.

term examination, after reviewing the result, the students were led to the questionnaire page to ask them about their utilization of the exercise (Table 1). Six questions from this examination were asked again in the written examination, and the differences of the results between these two examinations were analyzed.

Results and Discussion

Students' Utilization of the Exercise

As expected, all the students accessed the Web exercise page, and 76% tried the questions given in last 2 years. A quarter of them tried one year's worth of questions. Our interest was focused on how the students utilized the exercise. Although the exercise was offered on the Web, only 7 students (19%) challenged the questions on-line, and no one has ele-

Table 1. Questions and choices in the questionnaire

Q1 : Did you try the Web examination in the last 2 years as an exercise ?
● no
● only questions in 1999
● only questions in 2000
● questions in both two years
Q2 : How did you try them ?
● I tried them on-line.
● I printed out questions file only.
● I printed out explanations file only.
(questions and explanations in one page)
● I printed out questions and explanations files separately.
● I electronically downloaded the file and then tried.
Q3 : What were the merits of the Web exercise for you ?
● I understood the tendency of the questions.
● I checked my weak points.
● I learned just the difficulty of the questions.
Q4 : Could you make good use of the exercise in this examination ?
● enough
● to some extent
● not so much
● not at all
Q5 : What do you think about the Web exercise ?
● useful.
● no need.
● I don't care.
Q6 : Will you use the Web exercise offered in the future ?
● I will try it.
● I am not interested in such exercises.
● I can't decide now.
Q7 : Do you think the explanations shown with your score are useful in reviewing and preparing for coming written test ?
● Yes, they are useful, and I hope I can prepare for the written test.
● They are not useful, waste of time.
● I don't know.

ctronically downloaded the file. The most frequent style of utilization (65%) was to print out the file in which questions, answers and explanations are consecutively presented on the same page (Fig. 2). Eight students (22%) printed out the questions and the explanation

files separately.

It may seem strange that the questions offered on the Web were not tried on-line but printed out. One of the advantages of employing personal computers in education is to realize a "paperless" class teaching¹³⁾. However, it

Students' Utilization of Web Exercise

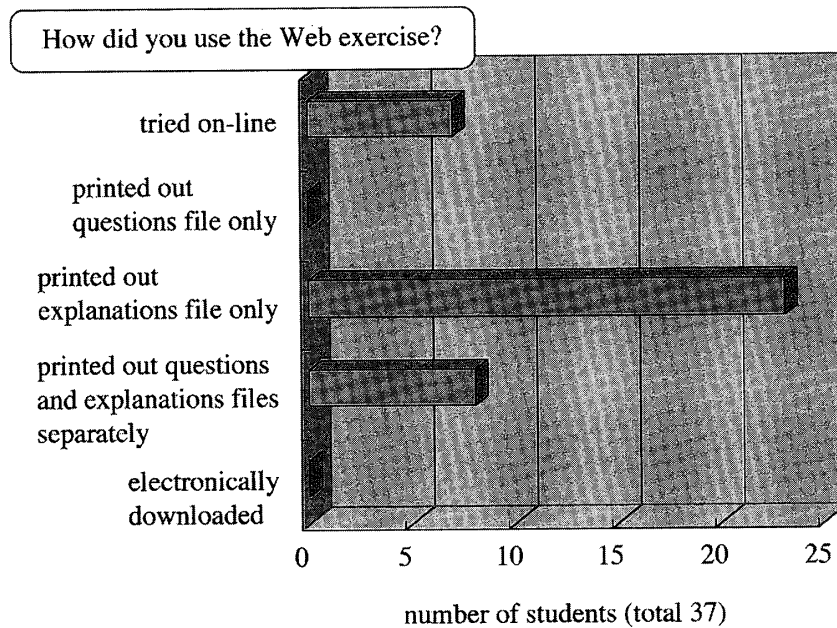


Figure 2. Students' utilization of Web exercise.

seems that the students were not used to the study through looking at the display. They have much experience in the study through reading the hardcopies. In a case, some students may get their eyes smart as a result of looking at the display for a long time. Here, probably printing files, that is, getting the questions in the last examinations was their main object. In addition, few students have their own computer to try the exercise at home, so printing out is considered to be their realistic way.

As for the merit of having exercise, 65% of the students said that they understood the tendency of the questions, and fewer students checked their weak points (Fig. 3). However, they did not think that they made the best use of the explanations (Fig. 4). This self-evaluation is supported by the results in the written test as described below. According to their scores, the students just understood the tendency of the questions, but they seem to have done nothing in preparation for the examina-

tions. This may be reflected in the style of printing out. We think that separated printing of questions and answers (with explanations) is more suitable for exercise, while the students printed them in one file, which may result in just looking answers but not improve their understanding.

Effect of Explanation on the Result in Written Test

The written test was given after an interval of seven days. Considering that 85% of the students thought that the explanations are useful in reviewing and preparation for this examination, six questions from the on-line examination were asked again. When we compare the results between these examinations of different style, the differences between the results were observed. In the case of questions requiring students to enumerate items, the number of the correct items listed was counted in each examination. In multiple-choice test, the number can be determined by analyzing each examinee's choice. As for the questions which

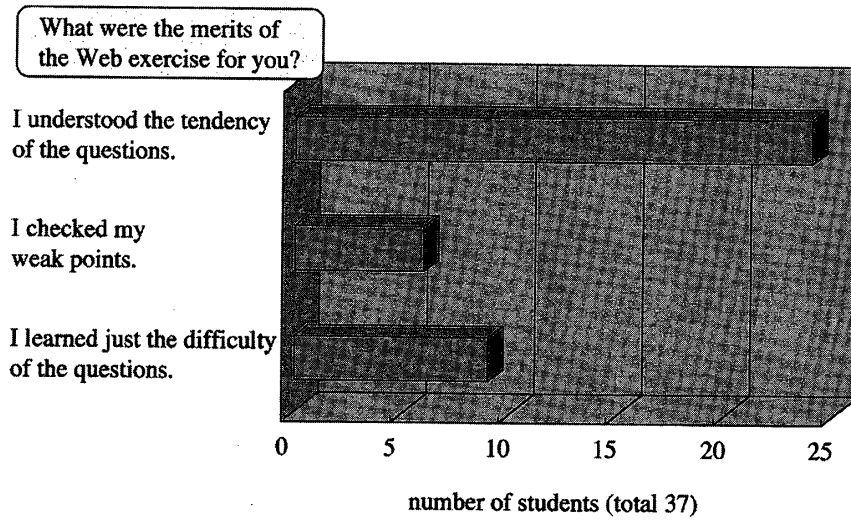


Figure 3. The merits of the exercise for students.

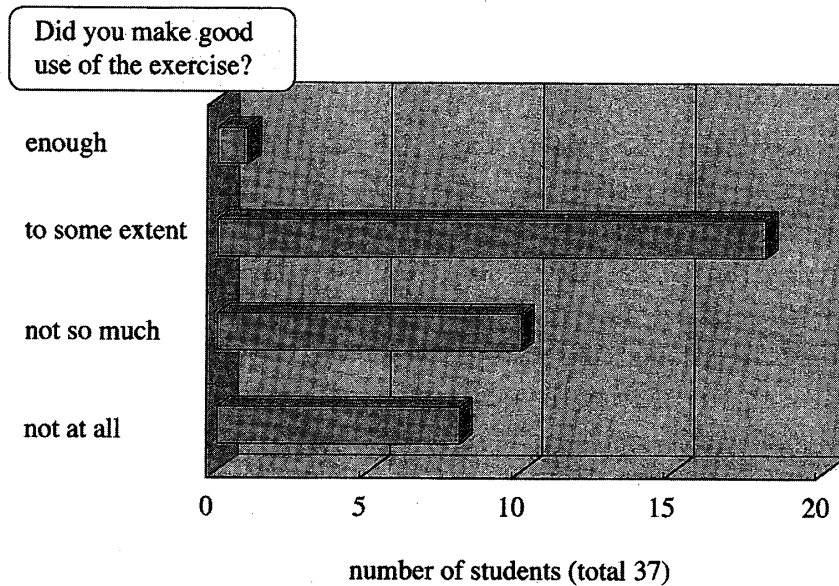


Figure 4. Students' self-evaluation of their utilization of Web exercise.

require some description or explanation, written answer was scored from 0 to 2 (0, wrong answer; 1, correct answer with no or wrong understanding; 2, good understanding) and change of the result was compared for each item listed in multiple-choice.

A typical question of the former case is shown in Fig. 5, on the method for differential determination of isoenzyme activities. This is

an enumeration-type question, where just memorizing items will give good score. The examinee was requested to choose 2 false items (equivalent to choosing 3 correct items) out of 5 choices. Fig. 6 shows the differences of the results between this kind of questions. A good improvement was observed in this case, a considerable number of students with low points in multiple-choice test have improved their

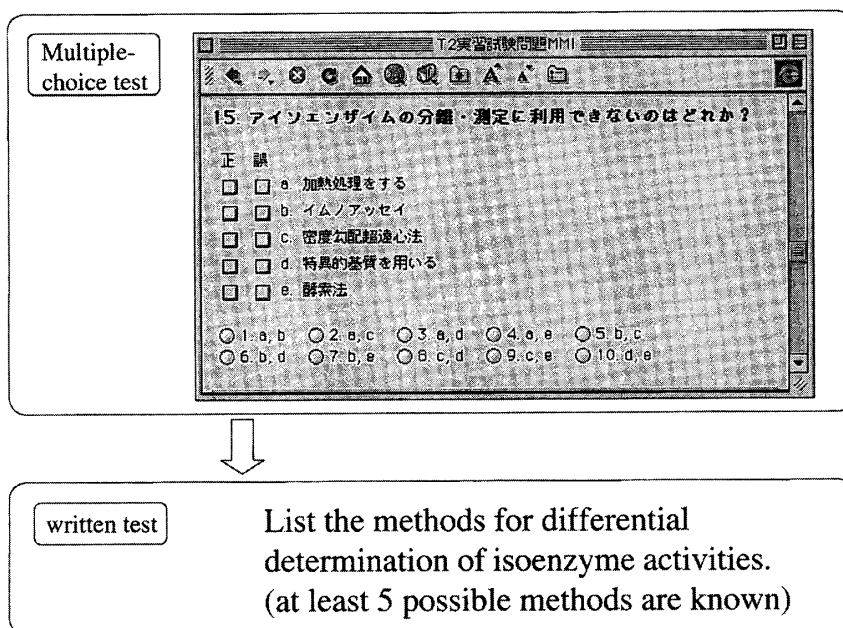


Figure 5. Enumeration-type question in the multiple-choice test and in the written test.

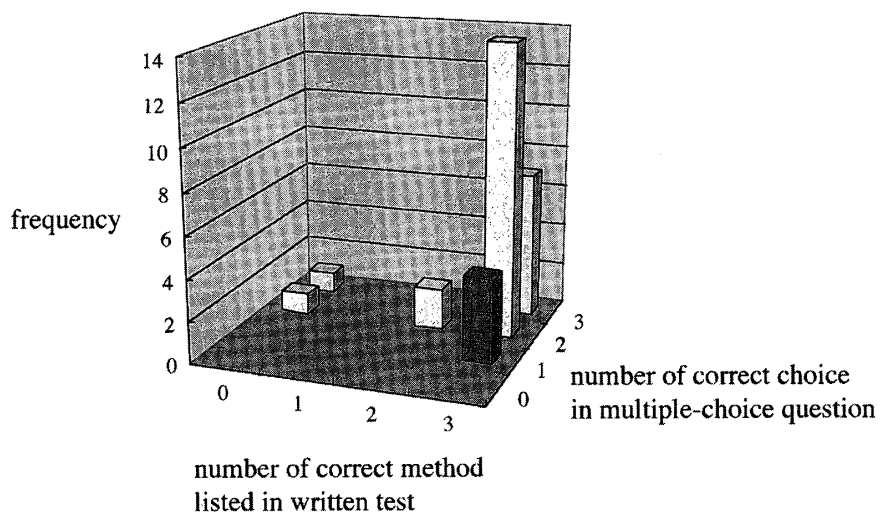


Figure 6. Differences of the results in enumeration-type question.

scores.

On the other hand, such an improvement was not observed in the questions which required the students to explain the principle based on the essential understanding. A typical observation is obtained from the question shown in Fig. 7. In multiple-choice question, an examinee was simply requested to choose

one reagent not needed in the total cholesterol determination, but could not choose correct one without understanding the principle of the method. To evaluate their understanding, explanation of the principle was requested in the written test (Fig. 7). Indeed, the score in the written test was considerably low. Even the students with improved result in the written

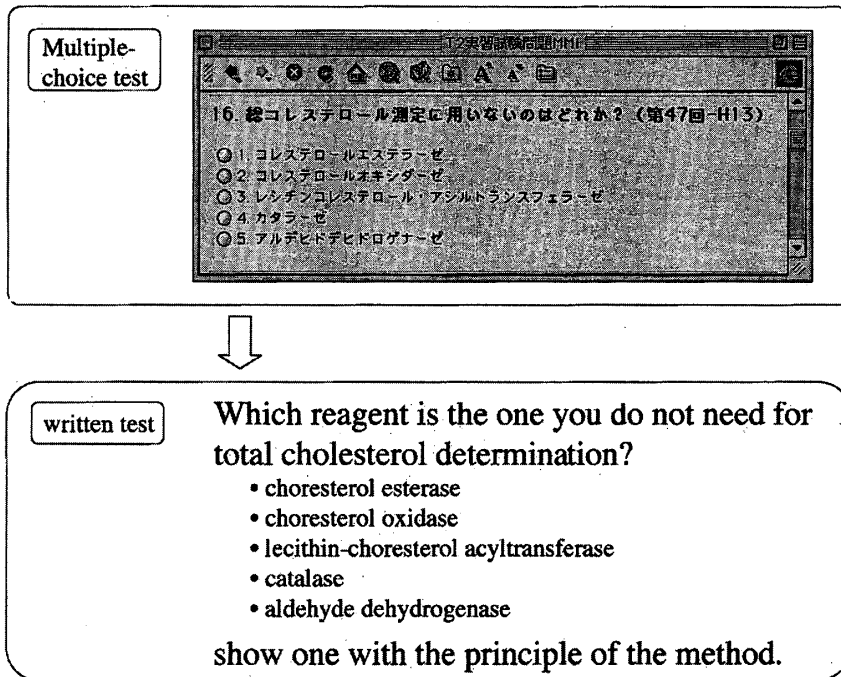


Figure 7. Explanation-type question in the multiple-choice test and in the written test.

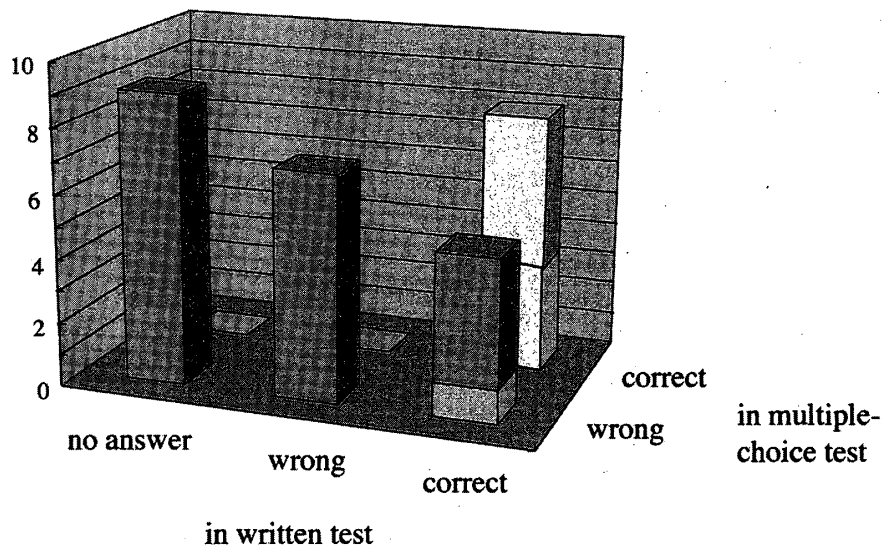


Figure 8. Differences of the results in explanation-type question. In "correct" column, bottom part of the bar shows the number of students who explained the principle correctly.

test (choose the correct item) could not explain the principle (Fig. 8). Here, choosing answers is just through "memorization".

These results suggest that the students are unpracticed to make good use of exercise

materials. They seem to feel easy by printing and keeping the explanation as if they have a master key in their hands. Teachers could be responsible to them for giving some instruction on the utilization of those exercise materials.

Anyway, an effective utilization of the materials strongly depends on their eagerness to study.

In conclusion, exercise materials offered on the Web was mostly utilized by printing out the explanations. The students make good use of them to understand the tendency of the questions. Some improvements were observed in the "memorizing" type questions, but such improvements were not observed in the questions which required the students to explain the principle based on the essential understanding.

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