

An Experiment on the Effective use of Web-Based Learning Materials in English Learning

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Abstract: - The authors have conducted research on the development of web-based teaching materials for English language education, educational support systems, and effective teaching methods that utilize these systems. These include the development of teaching methods and curricula using ability-based class organization in face-to-face classes, the development of web-based learning materials that support effective learning, and web-based educational support systems developed to support continuous independent learning via the web. Some of these have already been used in actual educational situations and have already achieved educational effectiveness.

Based on the results of these researches, this paper conducted a learning experiment aimed at developing an effective learning instruction method that combines face-to-face classes and web-based learning. In the learning experiment, lessons were conducted that had features to promote continuous learning, such as scheduling, proficiency assessment at the start of the lesson, learning based on proficiency reassessed for each lesson, and self-monitoring learning that allows the learners to grasp their own learning situation, and we analyzed whether these were effective in sustaining learning.

In addition, it has traditionally been thought that the learning materials selected by the instructor are appropriate for their learning content and learning level, and that there is no need to consider changes or modifications, but this paper also attempted to analyze such learning materials themselves.

Keywords: *web learning, self-study in web learning, motivation for learning, face-to-face classes, a self-monitoring method*

1. Introduction

We are currently developing a learning method that utilizes Web-based learning materials by conducting many learning experiments, such as analyzing the learning effect of Web-based learning materials and creating effective Web-based learning materials.

The authors have also focused on integrating face-to-face classes and Web-based learning, and have accumulated research on this topic.

In this paper, we also conducted a learning experiment using Web-based learning materials in a face-to-face English class, and attempted to develop an effective learning instruction method that utilizes Web-based learning materials from the experiment.

In particular, when analyzing the results of a learning experiment, it was common to evaluate the experiment on the assumption that the learning materials were completed in advance, but in this paper, we evaluated whether the learning materials themselves were appropriate for each individual learner.

We believe that this will enable us to provide individual learners with appropriate learning materials at that time and in that place.

The learning materials we use are provided via the Web, and we are able to grasp the learning situation of individual learners, provide learning materials at an appropriate level during learning, and provide appropriate advice to the learners based on their learning performance at that time.

In this learning experiment, we used these systems to conduct an experiment aimed at developing a more practical learning instruction method for developing Web-based learning materials to be used in face-to-face classes. Based on the results of past research, this paper conducted an experimental lesson using a Web learning support system that incorporates:

- 1) dynamic learning materials that change into five levels of proficiency in order to provide appropriate Web learning materials to learners;
- 2) a scheduling function and
- 3) a self-monitoring learning method set up to maintain continuous learning;
- 4) a system that judges the proficiency level of individual learners as they learn and presents instructional messages.

The results of the experiment were analyzed, and a new method of using Web learning materials in face-to-face lessons was proposed.

In addition to analyzing the learning results, this paper also analyzed whether the learning materials themselves were appropriate for the learners. In the learning experiment conducted by the authors, we paid particular attention to the following two points to solve this problem.

First, since web learning is basically individual learning for each learner, it is necessary to explain to each learner how the learning is related to and necessary for the content to be learned in face-to-face classes and to ensure that they understand it. The questions posed in this web learning experiment were about grammar and vocabulary, which are important foundational parts not only for grammar learning but also for language activities centered on communication skills such as listening. In this way, at the start of the experiment, we motivated the learners by explaining how the results of self-study in web learning would be reflected in the content of face-to-face classes and why it was necessary. In individual learning activities such as online learning, motivation for learning is an important factor in continuing learning, so we paid particular attention to this point. One clear difference between face-to-face classes and online learning is that in face-to-face classes, the teacher takes the lead in managing the learning content, lesson development, schedule, and grasping the level of participation of the students by attendance, whereas in online learning, the students must manage most of this themselves. This means that while students can learn at their own pace and at their own level, it also means that they are more likely to be self-engaged. There is also a risk that learning will not progress if students are unable to properly manage themselves. In order to address this issue of self-control, a self-monitoring method was adopted in this learning experiment, as described below.

Another point to note when introducing web learning was the timing and time schedule of web learning. In a normal face-to-face class, 60 to 70 minutes of the 90-minute class time is set aside for this, and the instructor leads the learning according to the contents of the textbook. Students work on the learning problems in the textbook, check the explanations, and ask questions as necessary. Web learning begins in the remaining 20 minutes of the class. This was because all of the students were new to this type of web learning, and the instructor's assistance was needed to become familiar with how to operate it. In addition, by starting part of the learning during class time, it was also intended to make it easier for students to start individual learning using the web. Since only a

certain amount of time was allocated during class time, if students were unable to complete all of their learning within that time, they were required to complete their answers by the set deadline (the next week's class day).

In this way, we ensured a smooth transition from teacher-led face-to-face classes to online learning, which requires students to take the initiative and manage themselves.

2.Objectives

An English learning experiment using web-based materials was conducted in two classes. Both classes were foreign language courses in the liberal arts program at a four-year university, and the students were not majoring in English. The classes met once a week for 90 minutes over a 15-week semester. For convenience, the two classes are referred to as Class 1 and Class 2, and an overview is provided below.

1. Target classes

(1) Class 1

Experiment period: First half of 2008 (April-July), Mondays, 1st and 2nd period (9:00-10:30)

Participants: second-year students, Faculty of Agrarian Economy,(specialty of Finance) Azerbaijan State Agricultural University

Course: Comprehensive English B-1

Textbook: New English File pre-intermediate

(2) Class 2

Experiment period: First half of 2008 (April-July), Tuesdays, 3rd and 4th period (10:40-12:10)

Participants: first-year students, Faculty of Agrarian economy, (specialty of Economy) Azerbaijan State Agricultural University Course: Comprehensive English A-1 (required)

Textbook: New English File elementary

2. Experimental Method

When conducting the learning experiment, a questionnaire was administered at the beginning and end of the class to confirm the students' English learning experience, their awareness of learning, and their impressions of the experiment. In addition, the learning materials were adjusted to suit each student's level of proficiency relationship between the two, thereby integrating the two different learning styles.

3.Methods

In order to set questions that matched the actual learning, the students' level of proficiency was assessed before the start of the experiment. Details are as follows.

(1) Flow of the learning experiment

The learning experiment was conducted from the 7th to 13th weeks after regular classes, during which online learning and the experimental classes were explained and a questionnaire survey was conducted.

In order to link face-to-face classes and online learning, the learning experiment conducted face-to-face classes (regular classes and online learning) and independent online learning were conducted in the following flow, and this was repeated every hour.

A. In face-to-face classes

① Check attendance → ② Regular classes using textbooks (60-70 minutes) → ③ Online learning in class

(Only one study session in the last 20-30 minutes of class)

B. Independent online learning (study at home)

Restudy the questions that were answered incorrectly in the online learning conducted in class. In addition, students were required to answer all questions correctly by the next class day.

(2) Learning materials classified by proficiency level

In the learning experiment, in order to provide effective web materials according to each learner's proficiency level, the learning materials were provided after judging the English level of each learner. There were five proficiency levels for the English materials, from A to E, with A being equivalent to the 3rd grade of the Japanese Practical English Test (hereafter referred to as EIKEN), C being equivalent to the pre-2nd grade of EIKEN, and E being equivalent to the 2nd grade of EIKEN, while B and D are intermediate levels between the 3rd grade, the pre-2nd grade, and the 2nd grade.

EIKEN 3rd grade is equivalent to junior high school graduation, and 2nd grade is equivalent to high school graduation.

However, considering that the subjects were not specialized in English and that the general decline in academic ability of university entrants and the need for remedial education have become an issue in recent years, it was thought that this would not be a low level of academic ability.

(3) Web learning

Web learning was carried out in the following manner.

① Question format

Each class hour, 20 questions were given every week at a level that was tailored to each learner based on the learner's proficiency level. The questions are randomly selected from the learning data (600 questions) for each level, so even if the students are at the same level, different questions are asked to each student. The questions are multiple choice, and the student selects the correct answer by clicking a button from one of the four options. If the student answers correctly, the student can see the Japanese translation and explanation of the English sentence that was the question, but if the student answers incorrectly, the student proceeds to the next question.

② Proficiency Assessment Test

First, each student performs a proficiency assessment at the start of the web learning, and the student is asked questions at the proficiency level determined there in the first learning session. After that, the learning level (described below) is assessed again at the end of each web learning session (web learning during class time), and the next web learning proficiency level is determined. The determined level is programmed to change sequentially depending on the results of each session after the start of the experiment.

③ Learning Level Change

The learning level determined in the first proficiency assessment changes depending on the results of each session. The learning level change is determined using the following criteria.

Table 1 Assessment levels and display to learners

Judgment level	Criteria for Judgment	Display to learners (instruction)
1	80% or more correct answers	You can study at a higher level
2	60% or more correct answers	With a little more effort, you can move up to a higher level.
3	More than 40% correct	This is the appropriate level for your proficiency, but if you neglect to study, you will drop to a lower level.
4	Less than 40% correct	We encourage you to move your learning to a lower level.

The assessment level is determined by the percentage of correct answers to all 20 questions posed in the web learning. Unanswered questions are assessed as the same as incorrect answers. After answering all 20 questions, the learner is shown guidance for this learning session according to the assessment level. Table 1 shows the assessment levels, the assessment criteria, and the display content for the learner. Note that if the learning level is A, the learning will not be moved to a lower level even if the assessment level is "4". Also, if the learning level is E, the learning will not be moved to a higher level even if the assessment level is "1". The learning level of the learner will change depending on the results of each learning session. It is expected that an increase in the rate of correct answers will lead to a move to a higher learning level, which will lead to increased motivation to learn. Conversely, if there are fewer correct answers, there is a risk of moving to a lower learning level, which is expected to stimulate the learner.

④ Scheduling

If students do not get all 20 questions right during class, they are required to answer the questions repeatedly until the next class day (8 days) by that time. Since the program sets the answering deadline (11:59 p.m. on the next class day), students cannot answer questions outside of that period. Whether or not students can complete the required tasks within the set period also tests their self-management ability.

⑤ Self-monitoring

When students have finished answering the last 20 questions, they proceed to the learning record input screen. They enter the number of correct answers and the number of incorrect answers they got in this lesson, and also write their self-evaluation of their learning results in the comments field. This is to allow each student to understand their own grades and learning situation, and it is mandatory as part of self-monitoring learning because it is believed that being aware of the learning results rather than studying vaguely will lead to improved proficiency.

(4) Questionnaire (at the beginning and end of class)

At the beginning of class, in order to measure whether the subjects' learning history, their approach and attitude toward English learning showed any correlation with their learning results, a questionnaire covering 13 items, such as reasons for taking the class, obtaining qualifications, the age at which they started learning English, and their requests for the class was administered. In addition, at the end of the class, a questionnaire covering 19 items, such as the amount of practice problems, the difficulty of computer operation, the suitability of the problem level, and the learning effect was administered.

4. Results

1. Analysis of the survey results

The survey results collected at the beginning (first day) and end (last day) of the experimental class and the results of the experimental class were analyzed. At the beginning of the class, the survey was conducted on "purpose of taking the class," "English-related qualifications already obtained," "experience with English learning (including watching English songs and dramas in daily life)," and "approach to the class." The survey results at the end of the class showed that differences in the learning environment, such as the atmosphere of the class, influenced the students, as the students' perceptions differed in each class. The results of the analysis of the survey results and the results of the learning experiment are as follows.

① Reasons for taking the course (at the beginning)

When the students were asked about the main reason for taking the subject in a multiple-choice format, the most common answer was "because I need credits," with 23 students (92.0%) in class 1 and 18 students (100.0%) in class 2. Other reasons for studying English were "I'm interested in English" (7 people, 28.0%), "I'm interested in the content of the classes (textbooks)" (6 people, 20.0%), and "To prepare for a job interview" (1 person, 4.0%). In class 1, there were no students who said "I want to get an English qualification." In class 2, there were two

students each who said "I want to get an English qualification," "I'm interested in English," and "To prepare for a job interview," and there were no students who said "I'm interested in the content of the classes (textbooks)."

② English learning experience (at the beginning)

We compared the proficiency of students based on when they started studying English and whether they watched English songs or dramas in their daily lives. We divided students into a group who started studying English in junior high school and a group who started studying before junior high school, and compared their proficiency. The former had an average of 1.33 (variance: 0.27), and the latter had an average of 1.34 (variance: 0.33), so there was no difference in proficiency. Between the group that often listens to English songs and the other group, the former had an average proficiency score of 1.21 (variance: 0.13) and the latter had an average of 1.35 (variance: 0.31), while the latter had an average of 3.46 (variance: 0.22) and an average of 3.00 (variance: 0.33) in ability assessments. Between the group that often watches English movies and dramas and the other group, the former had an average proficiency score of 1.30 (variance: 0.15) and the latter had an average of 1.34 (variance: 0.33), while the latter had an average of 3.16 (variance: 0.14) and an average of 3.00 (variance: 0.36) in ability assessments.

No significant differences were observed in any of these.

Looking at the specific number of respondents and their percentages by class, in terms of when they started learning English, 15 people (60.0%) in Class 1 and 10 people (55.6%) in Class 2 started learning English in junior high school, while 9 people (36.0%) in Class 1 and 7 people (38.9%) in Class 2 said they started learning English in the upper grades of elementary school. Only 1 person in both Class 1 and Class 2 had started learning English before that. Regarding viewing of English movies and dramas, there were 0 students in both classes who "watch very often," 4 students (16.0%) in class 1 and 3 students (16.8%) in class 2 who "watch often," 10 students (40.0%) in class 1 and 8 students (44.4%) in class 2 who "watch occasionally," 7 students (28.0%) in class 1 and 5 students (27.8%) in class 2 who "watch rarely," and 4 students (16.0%) in class 1 and 2 students (11.1%) in class 2 who "don't watch."

③ Motivation to study English (at the beginning)

The participants were divided into a group that had prepared and reviewed in advance and had been diligent in their English studies, and a group that had not, and their proficiency, ability assessment, and number of study sessions were compared.

The former had an average of 1.86 (variance: 0.94) and the latter had an average of 1.23 (variance: 0.12) in terms of proficiency, while the latter had an average of 2.74 (variance: 0.22) and 3.09 (variance: 0.33) in terms of ability assessment, and the former had an average of 4.45 (variance: 0.65) and the latter had an average of 4.69 (variance: 2.23), with no significant difference.

The participants were divided into a group that had an English qualification they were planning to obtain while at university and a group that did not, and their proficiency and number of study sessions were compared.

The former had an average of 1.6 (variance: 0.5) and the latter had an average of 1.3 (variance: 0.2), with no significant difference. The number of times the students studied was 3.8 times on average (variance: 2.0) for the former and 4.8 times on average (variance: 1.9) for the latter.

④ Web-based learning procedures (at the end of the class)

In class 1, 10 students (41.7%) found the Web-based learning procedures "slightly tedious" and 3 students (12.5%) found them "quite tedious," meaning that more than half of the class found the procedures to be tedious.

On the other hand, in class 2, 4 students (22.2%) found them "easy," and 13 students (72.2%) found them "almost easy," meaning that almost all students, except for one student who found them "slightly tedious," viewed them positively.

This shows that students' perceptions differ depending on the class.

⑤ Amount of practice questions (number of questions) and learning level (at the end of the class)

In the Web-based learning, 20 questions were given each time, and students were instructed to answer all questions correctly by the next class (repeated learning). Regarding the number of questions, 15 students (62.5%) in class 1 answered "just right," while 9 students (37.5%) answered "a little too many." In class 2, 17 students (94.4%) answered "just right," while only 1 answered "a little too few." Regarding the level of the questions, the group who felt that the questions were appropriate for them and the group who did not were compared in terms of proficiency and ability assessment. The former group had an average of 1.48 (variance: 0.56), while the latter had an average of 1.23 (variance: 0.11), with no significant difference. The former group had an average of 2.83 (variance: 0.21), while the latter group had an average of 3.35 (variance: 0.32). Looking more closely at each class, in class 1, 11 students (45.8%) answered that the questions were "slightly difficult," followed by one student (4.2%) who answered that the questions were "too difficult." In class 2, 7 students (38.9%) answered that the questions were "almost correct," followed by three students (16.7%) who answered that the questions were "correct," with half of the students answering that the questions were appropriate for their level. In other words, it is thought that the students in class 2 are more proficient than those in class 1, but the experimental results do not necessarily show this tendency, and further investigation is necessary.

⑥ Self-monitoring (at the end of the experiment)

In the experimental lessons, students were instructed to monitor their own learning status while studying. In the experiment, we investigated whether the assessment of their proficiency and the display of learning guidance messages were helpful for learning. In class 1, 2 students (8.3%) answered "helpful," 9 students (37.5%) answered "mostly helpful," and in class 2, 5 students (27.8%) answered "helpful," and 6 students (33.3%) answered "mostly helpful." Here again, class 2 showed a more effective result. Regarding whether the number of correct answers, the number of incorrect answers, and self-evaluation were useful for understanding their learning outcomes, 7 students (29.2%) in class 1 answered "helpful" or "somewhat helpful," while 9 students (50.0%) in class 2 answered "helpful," meaning that half of the students answered "helpful," and conversely, 0 students answered "not very helpful" or "not useful."

⑦ Effects of Web-based Learning (at the end of the study)

The group who answered that Web-based learning was useful was compared in terms of proficiency and ability assessment. The former had an average of 1.40 (variance: 0.37), while the latter had an average of 1.16 (variance: 0.04). The former had an average of 3.00 (variance: 0.32), while the latter had an average of 3.16 (variance: 0.33), with no significant difference.

Comparing whether their English skills had improved by seriously engaging in Web-based learning with the group who did not, the former had an average of 1.44 (variance: 0.31), while the latter had an average of 1.28 (variance: 0.28), and the former had an average of 3.04 (variance: 0.42), while the latter had an average of 3.00 (variance: 0.27), with no significant difference in either case.

Looking at the specific number of respondents and their percentages by class, in class 1, 3 people (12.5%) answered "helpful," 13 people (54.2%) answered "somewhat helpful," and in class 2, 10 people (55.6%) answered "helpful," and 5 people (27.8%) answered "somewhat helpful."

In class 1, 8 people (33.3%) answered "a little improved," 11 people (45.8%) answered "can't say," 4 people (16.7%) answered "not much improvement," and 1 person (4.2%) answered "no improvement." In class 2, 10 students (55.6%) said they had "improved a little," 6 students (33.3%) said they "couldn't say either way," 2 students (11.1%) said they "didn't feel much improvement," and 0 students said they "didn't improve at all." Here again, class 2 students were more likely to evaluate online learning more positively.

⑧ About online learning (at the end of the course)

In online learning, the group that answered properly every time was compared in terms of proficiency, ability assessment, and number of times they studied with the group that answered properly and the group that had chosen answers randomly. In terms of proficiency, the former had an average of 1.34 (variance: 0.30), while the latter

had an average of 1.35 (variance: 0.31). In terms of ability assessment, the former had an average of 2.91 (variance: 0.29), while the latter had an average of 3.13 (variance: 0.34), and no significant differences were observed in either proficiency or ability assessment. In terms of the number of times they studied, the former group averaged 4.3 times (variance: 2.08), while the latter group averaged 5.1 times (variance: 1.14), showing a significant difference ($t=1.98$, $p \leq 0.05$). In other words, this shows that the group that did not study seriously studied more, and we would like to use this as a reference for future instruction.

Specific answers by class: In class 1, when asked whether they had carefully chosen their answers, 12 students (50.0%) answered "I always thought carefully about my answers" and "I thought carefully about my answers half the time and chose randomly half the time," while in class 2, 9 students (50.0%) answered "I thought carefully about my answers every time," and 8 students (44.4%) answered "I chose randomly to finish the assignment," showing that almost all students in both classes had thought carefully about their answers, but 1 student (5.6%) in class 2 answered "I chose randomly to finish the assignment."

Regarding the approach to online learning, in class 1, 3 students (12.5%) were "Satisfied", 12 students (50.0%) were "Mostly Satisfied", 7 students (29.2%) were "Neither Satisfied nor Unsatisfied", 1 student (4.2%) was "Slightly Unsatisfied", and 1 student (4.2%) was "Unsatisfied". In class 2, 4 students (22.2%) were "Satisfied", 10 students (55.6%) were "Mostly Satisfied", 2 students (11.1%) were "Neither Satisfied nor Unsatisfied", 2 students (11.1%) were "Mostly Unsatisfied", and 0 students were "Unsatisfied".

2. Analysis of the Experimental Results

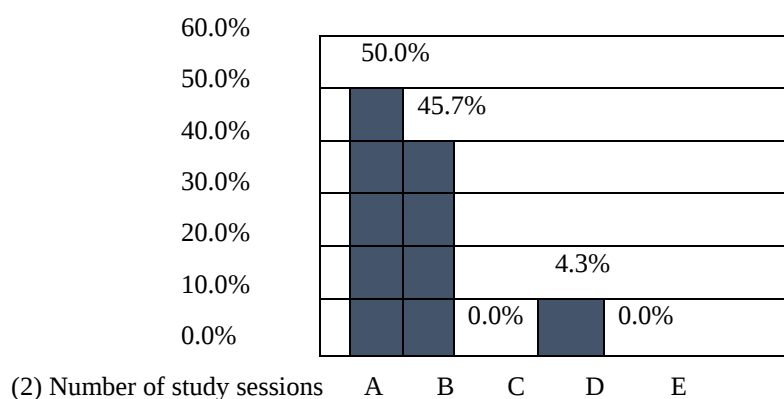
The learning experiment required students to answer all questions correctly in class by the deadline of the next class day.

It has features such as scheduling, assessment of proficiency levels for individual students at the start of class (first class), learning support by reassessing proficiency levels each time depending on changes in grades, and self-monitoring learning in which students are instructed to grasp their own learning situation. The results of the learning experiment are shown below.

(1) Proficiency

Figure 1 shows the percentage of proficiency judgment results for learners in the entire learning experiment. In the figure, the horizontal axis shows proficiency levels divided into five levels (A to E, with E being the highest level of proficiency). The vertical axis shows the percentage of all learners in each proficiency level. As can be seen from the figure, most learners were at levels A and B, and the rest were at level D. Since proficiency was judged automatically each time based on the learning results, the learners' proficiency levels are considered to be A and B (approximately equivalent to Eiken Grade 3).

Figure1. Proficiency rate in learning experiments

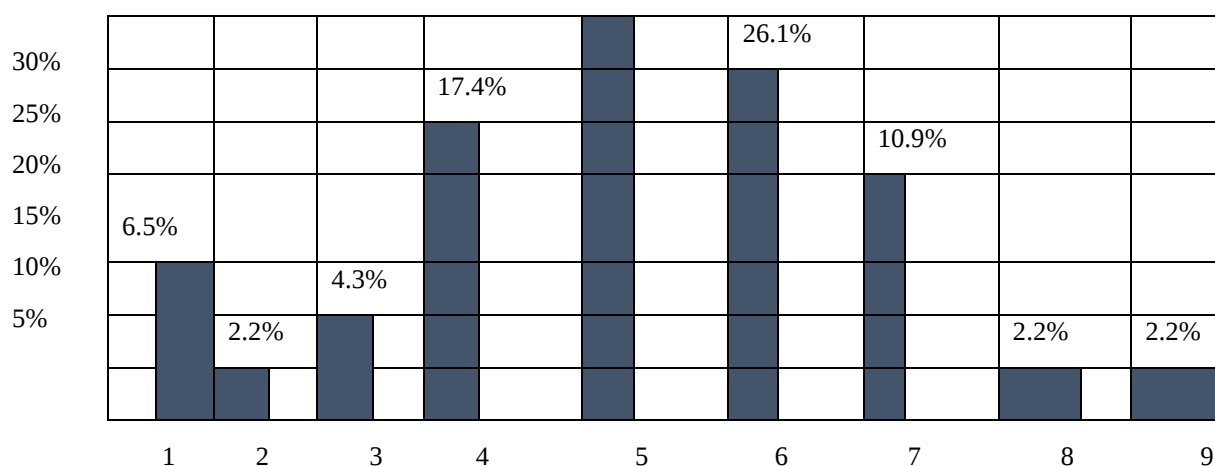


(2) Number of study sessions

The student must answer all questions correctly by the next lesson using the scheduling function, and therefore repeats the study. Figure 2 shows the ratio of the number of study sessions to the total number of study sessions.

In the figure, the horizontal axis shows the number of study sessions, and the vertical axis shows the ratio of the number of study sessions to the total number of study sessions. In the figure, the horizontal axis shows the number of learning experiments, and the vertical axis shows the percentage of all learning experiments. The average number of times was 4.75 (variance: 0.27), and as shown in the figure, it can be seen that students repeated their studies multiple times outside of each class. This is thought to be the effect of setting up a schedule.

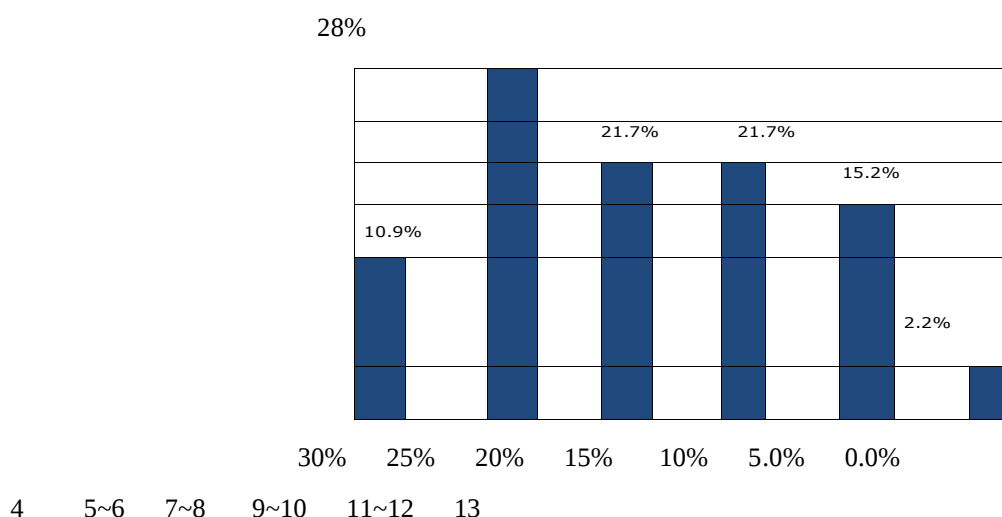
Figure 2. Proportion of learning times in the learning experiment



(3) Number of correct answers

The number of questions presented for each lesson was 20. Figure 3 shows how many questions the learners answered correctly in the first lesson of each lesson. In the figure, the horizontal axis shows the number of correct answers. The average number of correct answers was 8.39 (variance: 0.36), which means that the questions could not be answered without continuing the lesson for a while. Given the effect of the dynamic learning material setting function, it is considered that the questions were at an appropriate learning level for each learner.

Figure 3. Number of correct answers for each lesson (first time only)



Analysis of Web-Based Materials Used in Learning Experiments

When evaluating the results of a learning experiment, it is assumed that the learning materials used are appropriate for each learner's level of proficiency and are of uniform quality. However, in past learning experiments conducted by many researchers, including ours, as far as the authors know, there has been little evaluation of whether the learning materials used in the learning experiment were appropriate for each learner's ability level, and learning experiments are often conducted on the assumption that the learning materials prepared in advance by the

experimenter are appropriate. In addition, even if the learning materials are divided according to learning levels, there has been no investigation or analysis as to whether all of the learning contents are of a uniform learning level.

In this study, we attempted to evaluate from the experimental results whether the contents of the learning materials set as the same level used in the learning experiment are actually uniform for the learners.

(1) Determination of proficiency

First, before conducting the learning experiment, we evaluate the proficiency of each learner with respect to the learning content, and provide materials appropriate to the learner's level based on the results. The system then reassessed the learner's learning status during the learning process and provided the most appropriate learning materials in real time for the changing level of proficiency. The system also notified the learner of the changes in level and evaluated the current learning status, displaying messages that took into consideration the learner's motivation and continuity in learning, such as "If you put in a little more effort, you can be promoted to a higher level" or "If you neglect to study, you will be demoted to a lower level," as shown in Table 1.

As mentioned above, the initial proficiency level of the learners was determined using learning materials created in three stages, assuming five levels (A to E). However, since it was the beginning of the study, an approximate proficiency level was determined for the time being. In addition, the hierarchy of proficiency levels can be determined by the instructor, and this time, the learning experiment was conducted using five levels.

(2) Learning materials and the rate of use of materials by learners

As the study progresses, the appropriate proficiency level is determined for each learner and learning materials are provided, which allows the level of learning materials to be changed in a more detailed manner (see Table 1). The materials themselves are not created in advance for individual learners, but are materials created by instructors in advance assuming a certain level. Therefore, here, we evaluated whether the individual questions in the learning materials (individual questions presented to learners) indicate a homogeneous proficiency level for learners from the results of the learning experiment. Table 2 shows the materials provided to learners and the percentage of learners who used them. From Table 2, we can see that as a result of dynamically providing learning materials by determining the proficiency level of individual learners during learning, 85.0% of the learners used learning materials at Eiken Grade 3 level (A) out of the three levels of learning materials prepared in advance, 14.3% used Eiken Grade Pre-2 level (B), and 0.7% used Eiken Grade 2 (C), indicating that most learners were studying materials at Eiken Grade 3 level (A).

Table 2. Learning materials used in the experiment and the rate at which students used the materials

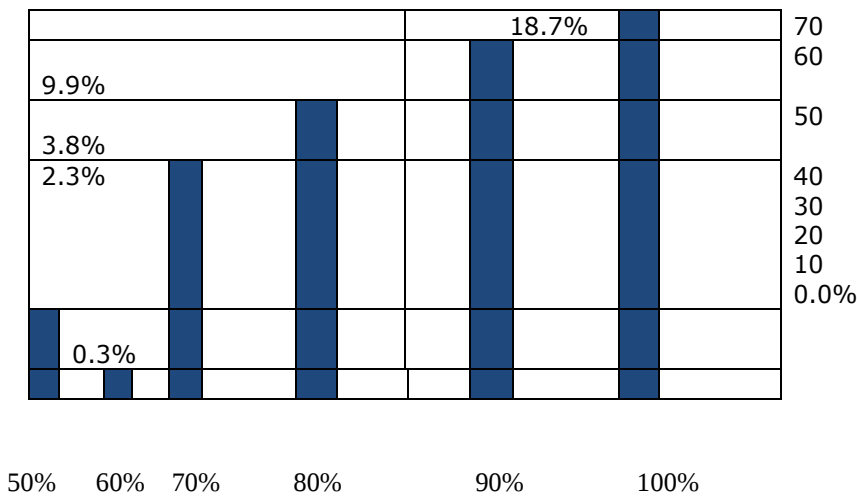
Learning Materials	Number of questions	Usage rate of teaching materials (%)
Eiken Grade 3 (A)	600	85.0
Eiken Grade Pre-2 (B)	600	14.3
Eiken Grade 2 (C)	600	0.7

(3) Results of the learning experiment on learning material A

Here, we tried to analyze learning material A, which is at the level of the Eiken Grade 3 test, based on the results of the learning experiment. Figure 5 shows the percentage of correct answers for all learners for each question in learning material A. In the figure, the horizontal axis shows the percentage of correct answers, and the vertical axis shows the percentage of the total number of questions.

As already mentioned, of the 20 questions that were asked each time, students were required to try again within the deadline for any questions that they got wrong, and ultimately get all 20 questions right. As a result of repeated learning, the average correct answer rate for all learners was 92% (variance: 0.014). Graph in Figure 4

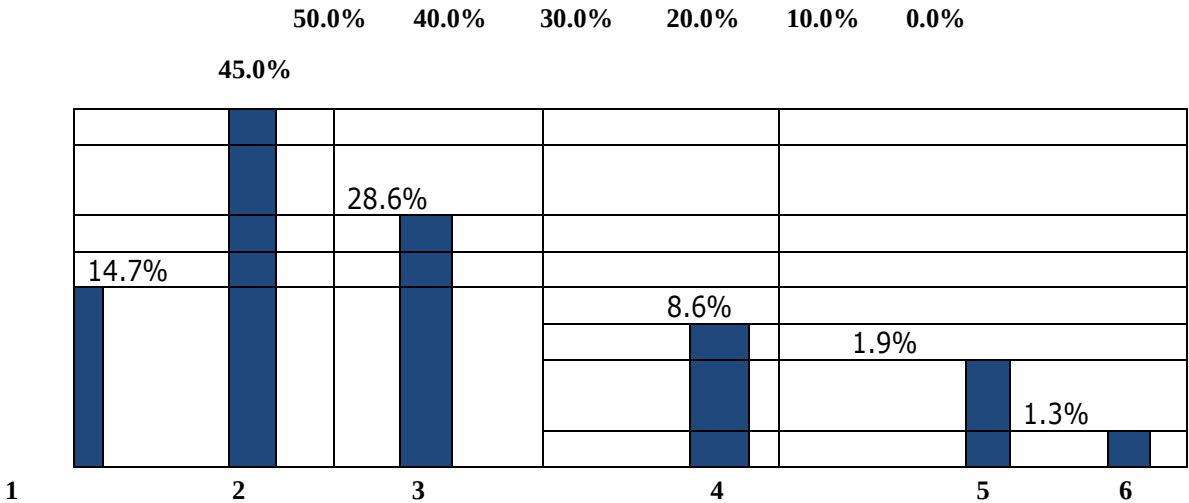
Figure 4. Percentage of correct answers to learning material A



In the figure, 64% of the questions (384 questions) were answered 100% correctly by all learners, and 93% (558 questions) were answered 80% or more correctly, indicating that the content of this learning material is at a fairly homogeneous learning level. However, although there are a small number of questions, there are also questions with a correct answer rate of 60% (1% of all questions) and 50% (2% of all questions), and we believe that it is necessary to consider whether these questions indicate appropriate learning content.

Figure 5 shows how many times a learner repeatedly answered each question in the learning material before obtaining a correct answer. In the figure, the horizontal axis shows the number of times of study, and the vertical axis shows the percentage (%) of the total number of questions. The average number of times of study for all learners is 2.12 (variance: 0.94), and 90% of the questions were answered correctly within three study attempts. However, although they are a small number (12%), there are also questions that have been studied more than four times. Considering the correct answer rate for the questions shown in Figure 5, it seems necessary to investigate the existence of questions that are not homogeneous in the learning content. However, although they are a small number, not answering these questions correctly does not necessarily mean that the student does not have the learning ability corresponding to the proficiency level. We believe that it is necessary to repeat the learning experiment and move these questions to an appropriate level in the future, or to avoid using them for level assessment.

Figure 5. Number of times studying learning material A (%)



5. Discussion

Generally, it is difficult to properly grasp the proficiency of individual learners from the results of a questionnaire survey at the start of learning or a one-time placement test. The results of this learning experiment showed that by using the proficiency assessment function of this learning experiment system, it is possible to determine the appropriate proficiency of each learner by reassessing their proficiency each time during learning in line with the learner's learning progress.

It was also found that most learners continued to study until they answered all the questions correctly in each class, thanks to the number of times they studied that were recorded in history for each class and the scheduling function using a computer that set strict deadlines, so that they could maintain their learning continuity.

In addition, the content of the learning materials selected by the instructor was previously definitive, and it was unthinkable to change them each time, but the results of the experiment showed that the correct answer rate and the number of times they studied until they obtained the correct answer could be influenced by the materials.

It was found that some questions were significantly different in terms of the level of the questions. This showed that even if the learning materials were assigned to a certain learning level, the level must be changed depending on the learner's reaction.

As mentioned above, the Web learning materials that we propose, which change appropriately for the learner during learning, are effective in that the learner can study questions tailored to their own proficiency level while grasping their own learning results within a certain period of time, and the level of the materials can also be evaluated. However, as is clear from the learning experiment, it was also revealed that differences in the learning environment, that is, the atmosphere of the class to which the learner belongs, can affect the motivation to learn.

In the future, we would like to improve the self-monitoring learning experiment, not only to improve the motivation to learn, but also to investigate the effect of the learning environment on the learner and attempt a logical analysis, and to aim to develop a more practical teaching method that combines face-to-face classes and Web learning.

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