

Approaches to the Approximate Tabulation of the Duration of Student Visits when Working with Digitized Course Materials within the Class

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ABSTRACT

In order to use course materials within a class or preparation and review for students, we created digital materials that correspond to a class on introductory statistics in PDF format on the Moodle learning management system. To obtain useful data for class improvement, we collected such information regarding the use of the materials in the weekly class as date and time, student ID number, viewing time, and page view history. To boost students' motivation for viewing course materials, we administered quizzes, and we have attempted to tabulate approximately the duration of course materials visits. As a result, we found a correlation between the average point of visit duration course materials usage and the average score of quizzes and obtained suggestions for future lesson improvement.

KEYWORDS

visit duration, learning history, e-learning, educational data mining

1 INTRODUCTION

In recent years, there has been much activity in digitizing materials in the field of education, and there have been widely practiced lessons utilizing digital materials. Around the world, digital materials are loaded into an e-learning system, which allows for the accumulation of the learning history, the study of educational data mining to improve the course's management and increased teaching improvements[1]. We investigated the student visit duration with course materials and tried to tabulate approximate visit duration for each student.

Generally, teachers think students should read the teaching materials used in the class, and motivating students to read can be difficult. In this research, to boost students' motivation for viewing course materials, we implemented lessons that required the viewing of digital materials in every class as well as quizzes that tested students' knowledge of the content.

As summarized in Romero's paper(2007a), digitizing materials such as conventional paper texts and quizzes and then posting them on an e-learning system makes it possible to collect learning history that is useful for improving teaching methods from various viewpoints, such as by page view history and test results[2]. Also, the development of new methods for increasingly more effective training was expected by means of targeting the learning history accumulated and applying data mining techniques to finding data, leading to improved teaching[3][4].

In order to clearly understand the effects of materials and motivation when addressing class improvement, collecting accumulated learning history early via e-learning systems is an important issue to be analyzed[5][6]. In past lessons of blended learning, numerous studies were carried out as a result of the analysis of page views, and the scores of quizzes that corresponded to materials and teaching evaluation questionnaires[7].

Romero(2007b) et al. also classified trends of data mining in the field of education, such as in statistical analysis, visualization, and text mining, and investigated the various methods that have been attempted[8]. Furthermore, it has been shown that using learning history in Moodle to classify learners with features from the results of mining

can be applied to improve the educational effects of data mining overall[9][10][11].

2 OVERVIEW OF THE CLASS AND COURSE MATERIALS

2.1 PDF format course materials

This study investigated a class titled “Introduction to Social Data Analysis,” which corresponded to the blended learning model and was performed while viewing course materials on Moodle in traditional face-to-face teaching. Files were created in PDF format, a format that can be viewed via a PDF Viewer by clicking on a link in the table of contents that we created in the Moodle topics format.

Table 1. Course materials (Spring semester 2013)

Chapters	PDF files	Pages
1 Excel Introduction 1	6	29
2 Excel Introduction 2	8	9
3 How to calculate using spread sheet	8	11
4 Social research and statistics	10	14
5 Probability and probability distributions	9	10
6 Frequency distribution table and histogram	7	11
7 Deviation, variance, standard deviation	5	11
8 Normal distribution, deviation value	5	11
9 Discrete variables and cross-table	7	12
10 Attribute correlation	7	11
11 Correlation	11	17
12 Regression analysis	8	13
13 Random numbers and simulation	7	8
14 Conclusion, final exams		
Total	98	167

The contents of the digitized course materials contained a commentary concerning introductory statistics, using Excel and related exercises. The course materials contained information from

approximately 167 B5-size pages, including figures, and were converted into 98 PDF files (Table 1). The aim was to learn the basic techniques required for the analysis of statistical data in the classroom while actually using Excel.

2.2 Overview and implementation of quizzes

The data indicates the educational effects of using quizzes; they are an essential consideration in order to perform class improvement. The quizzes consisted of multiple choice questions that students select one answer from the five methods. In this paper, we conclude that reading comprehension of teaching materials increases through the use of quizzes. The materials were taught in weekly class and the quizzes were administered at the beginning of the following week.

2.3 Page view status

In this study used the Moodle topics format to identify a link for viewing the PDF file or external referrer and displayed a page title as a heading for the resource.

Also we used Moodle’s quiz function and conducted one quiz for each chapter. One batch of quizzes was created with 10 questions each on content from the last chapter learned. Students chose 5 questions from the 10 questions randomly, to be scored on a 10 point scale.

Table 2. Page Views Status in 2013 Spring Semester

Log collection duration April 10 - July 31	
Target dates	109
Enrolled students	63
Total number of page views	22,001
Average per day	202
Total within the class	16,997
Average within the class	1,214
Total outside the class	5,004
Total outside the class per day	46

On the Moodle log report page, students' learning history was kept from the course enrollment. For example, accessed PC's IP address, student ID and name, operations performed on Moodle, and the resource page title opened by students was stored in a table that teacher could be viewed.

Learning history in this study was collected during the session in the spring semester in 2013. The page view history was collected from the first class day to July 31 and the report submission was closed on the same day (Table 2).

3 APPROXIMATE TABULATION OF VISIT DURATION

3.1 Policies of tabulation and error

Using the Moodle, if a page was opened, such as sections or exercises in the course materials, the opened time for each individual student was recorded.

The entry page, which is the starting point of viewing in the table of contents corresponding to the page of the course, is recorded in Moodle as "course view". The exercises and commentary page are recorded as "resource view". Further links to external referrers are recorded as "url view", and an object of the submission is recorded as a "assign view".

In this paper, visit duration is calculated by the next formula.

$$\text{visit duration} = (\text{exit page opened time}) - (\text{entry page opened time})$$

The reason we calculated as described above is that when opening the PDF files or an external referrer from Moodle, only the opened time is recorded, but not the closed time; the last closed time of the page that was not displayed.

In this study, when the lesson ends, students shut down the PC and go out of the classroom, so there is an error of visit duration in the lesson. The error is from the opening time of the last page view to the finish time of the lesson that is not recorded.

In addition, in order to grasp the difference between visit duration within a class and outside of a class, we tabulated both. Visit duration within the class was determined as the time of the starting

and ending of the lesson. There is less error of visit duration in class than outside class.

Since some students came in early to the classroom and logged on early, we tabulated class visit duration from 5 minutes before class. The viewing of less than 1 minute was tabulated by rounding the seconds.

3.2 Visit duration within the class

Table 3 shows the tabulated visit duration within the class, and Figure 2 shows the visit duration spent by each students. Total time spent within the class was 833 hours 21 minutes. From the tabulation of students' visit duration within the class, in spite of doing face-to-face lectures in unison, the distribution of the data has become uneven; the average was about 13 hours and 13 minutes.

Table 3. Visit duration of within the class

Total	833:21:00
Average	13:13:40
Minimum value	3:20:00
Maximum value	18:31:00
Number of sample	63

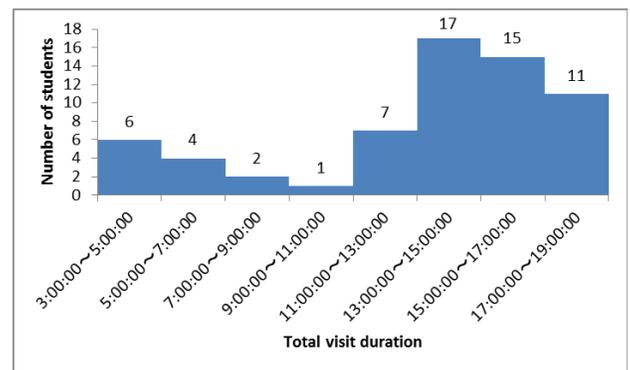


Figure 1. Histogram of students' total visit duration within the class

We measured 90 minutes of class 14 times, therefore the theoretical maximum value is considered as 90 minutes × 14 times = 21 hours

before or after. But in this case, the maximum value of the counting result was 18 hours and 31 minutes (Table 3).

From the Figure. 1, 13 students (20.6%) had a value of less than 11 hours (Figure. 1). Since these 13 students included those who no longer came to class in the middle of the semester and fewer attendance students, less visit duration appears (Figure. 2).

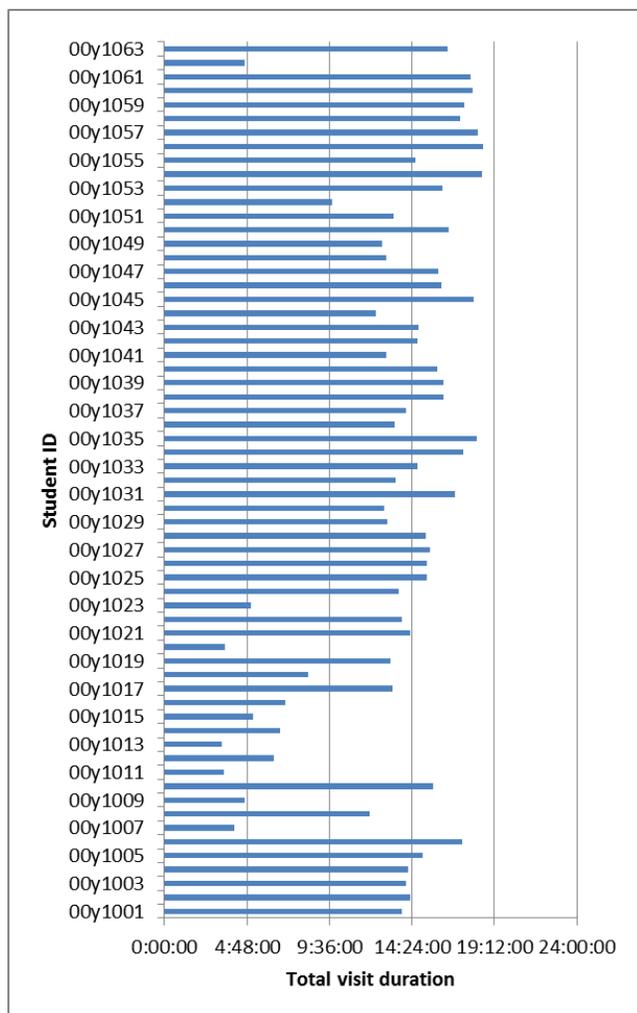


Figure 2. Students' total visit duration within the class

3.3 Visit duration and average quiz score

We also examined the correlation between the individualized visit duration within the class and quizzes 9 times the average score, and it turns out that a correlation coefficient there is quite strong at 0.839 (5% of significance level two-tailed probability , $t(63)=2.000$, $p<.05$) (Figure 3).

When we looked in classroom during class, the majority of the students tend to open the course materials as instructed by the teacher.

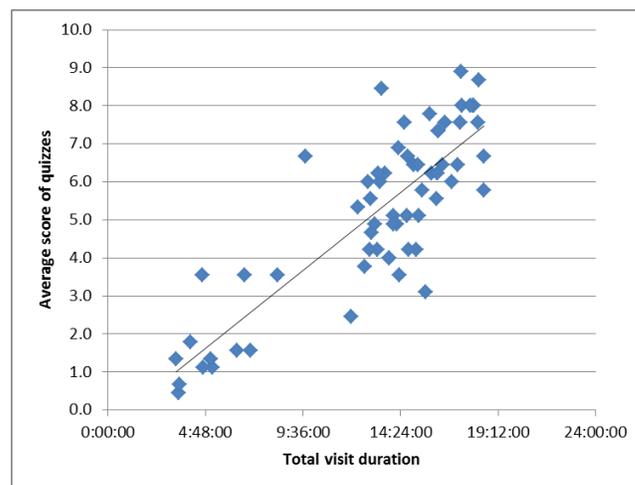


Figure 3. Scatter diagram of students' total visit duration within the class and average of quiz scores

However, there are some students who did not open the digital materials on Moodle in their own personal computer in classroom. Also, there was, every semester, student who tried to operate a PC while watching the course materials that are displayed on the monitor on the teacher's desk. For such students, it is important to acquire the habit of opening the course materials. For example, when students enter the data for practice in the classroom, it does not display on the monitor on teacher's desk, therefore the teacher gave occasional guidance so as to be able to watch the course materials on their own personal computer. In addition, in the scatter diagram of the visit duration and average quiz scores within the class, it was distributed more in the vicinity of the regression line. Also, at the lower left side of the scatter diagram, there are some students who have a lower visit duration and lower average quiz score.

4 VISIT DURATION AND DISTRIBUTION OF QUIZ SCORES

We carried out the quizzes 9 times within the semester. Students who did not taken the quiz show 0 points. Looking at the graph, it can be seen

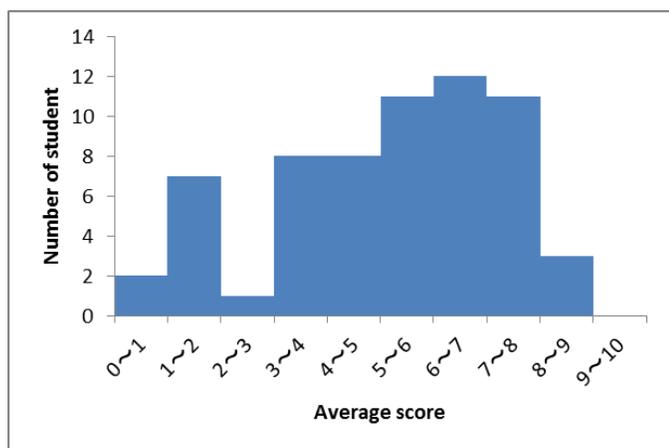


Figure 4. Histogram of the average score in the quiz 9 times

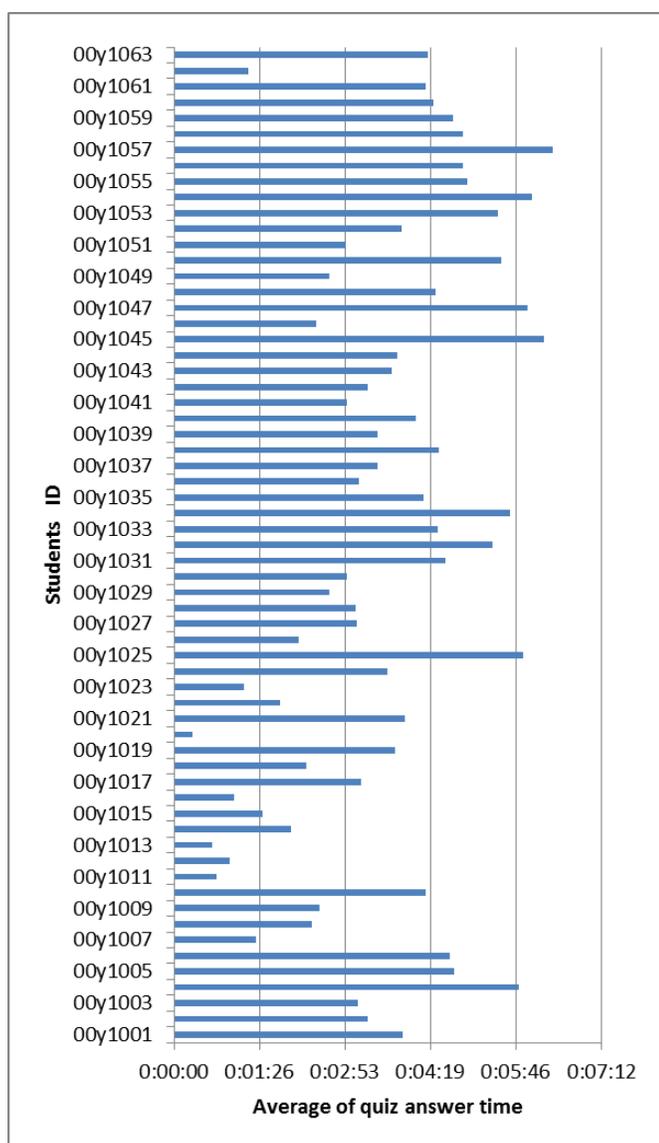


Figure 5. Student's average of quiz answer time

that the average point in the under-three point category is the low score group (Figure 4).

If you look at the number of page views of the course materials for this low-scoring layer, it can be seen that there is a small number of page views. Ten people (15.87%) corresponded to this layer; the attendance count was extremely low about one to four times. In previous research, there is a correlation between good results on quizzes and higher page views[12].

There were many cases when students finished quizzes early. The time restriction of the quiz was 7 minutes, but when a student ended early, we have no way of knowing whether students were working on a quiz seriously.

When a student answered the quizzes in Moodle, the answer beginning time of the quiz and the closing time were recorded for each student correctly. In this study, the answer time of the quiz was also tabulated for every student (Figure. 5). The time was recorded by character data in Moodle. Therefore we converted it to data of a figure and calculated.

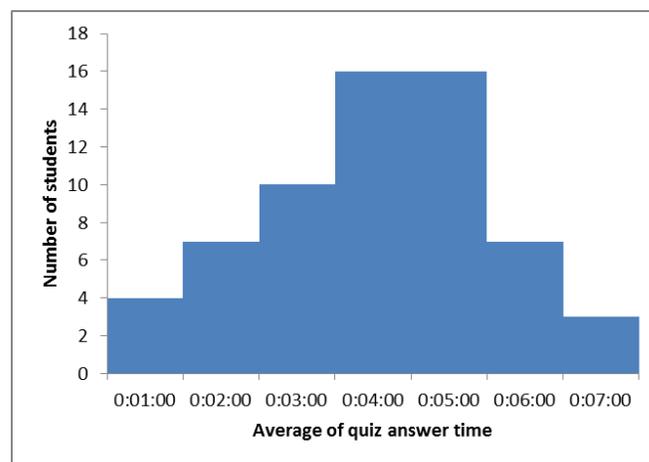


Figure 6. Histogram of the average answer time in the quiz 9 times

Figure 6 shows the histogram of the average time of the quiz performed 9 times in the semester. As a result, the students who finished a quiz in 4 to 5 minutes take up 52.4% of the whole (Figure 6).

Also, when correlation between the answer time of the quiz and the average score was checked, we found that the longer the answer time, the higher the average score. The coefficient of correlation was 0.798(5% of significance level two-tailed

probability, $t(63)=2.000$, $p<.05$). It seems that the student who ends the quiz rather early may tend to give up (Figure 7).

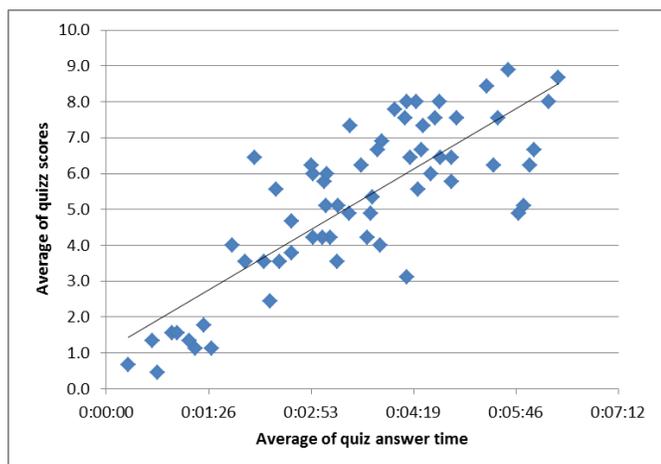


Figure 7. Scatter diagram of average of quiz answer time and average of quiz scores

5 CONCLUSION AND FUTURE WORK

It is necessary to conduct further research on Moodle learning history discussed in this paper in order to determine whether students read the contents of course materials. This means that the number of students who do not read, but just open the software appears to be large, and whether the created digitized course materials were actually read or not needs examination.

There is a positive correlation between course materials visit duration of each student within the class and the average scores of quizzes. Therefore, we need to also continue to devise effective studies to view the course materials in the future, to be able to develop easy, intuitive course materials to attract students.

ACKNOWLEDGMENT

This work was supported by JSPS KAKENHI Grant Number 15K00498.

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