The Relation between Comments inserted onto Digital Textbooks by Students and Grades earned in the Course

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Abstract. When students read textbooks in the classroom, they usually apply active reading. The practice of marking in university textbooks is a familiar one. They scribble comments on the margin, highlight elements, underline words and phrases, and correlate distinct parts to foster critical thinking. While the use of annotations during active reading supports the students themselves, these can also be useful for other readers. Investigations were carried out to evaluate the comments inserted by students onto their digital textbooks and how this relates to their eventual grade earned at the end of course. The results of our study highlight two main factors influencing students; eventual grade, quantity and quality of annotation. Students who wrote a lot of comments and focused upon the more important keywords in the text trend to receive a higher grade. Accordingly, our analysis was based on number and quality of text word selection.

Keywords: annotation, electronic note-taking, grade, digital textbook, comments

Introduction

When students read textbooks in the classroom, they usually apply a very active reading, as opposed to the more passive mode of reading we employ when reading for pleasure. The practice of annotating university textbooks with a pen or pencil is perhaps the most familiar illustration of active reading. Universities generally require students to buy their books. They scribble comments in the margin, highlight elements, underline words and phrases, and correlate distinct parts to foster critical thinking. While the use of annotations during active reading supports the students themselves, these can also be useful for other readers[1]. Making annotations on books and learning materials is part of the students' everyday life[2]. Although there are many computer-based annotation systems, many people still prefer to actually print out digital documents and then make annotations on physical paper using standard pen and pencil[3].

With the growth of digital media, the document tradition is moving forward while the annotation tradition is being left behind. While many kinds of digital annotation

systems have been proposed, there are also challenges ahead: not only are these shortcomings in the technology, but also we must educate students to overcome reluctance to use much system. It is clear we need to address these problems regarding annotation in the digital environment[4].

There is other important student behavior as taking note with a pen and paper which is known traditional note-taking[5,6]. Traditional note-taking remains an activity that many students in higher education continue to rely upon heavily[7]. The long-established tradition of note-taking may also benefit from recent advances in digital technology. We also have a comprehensive understanding of the many issues that surround the process of traditional pen-on-paper note taking; for example the relationship between note taking and the storage function on notes , optimal note-taking behaviors, the relationship between note taking and one's score on a test, etc[5-6,8-11].

Many studies or projects involving in-class and online educational technology include note-taking or annotation applications[2-4,7,9]. In-class and online note-taking or annotation systems are often based upon the methodologies of traditional note-taking or annotation on paper documents. Therefore, it is valuable to know the ways in which students today manage their note-taking and annotation practices when they are using digital textbook, and also how they view traditional note-taking with a pen and paper versus electronic note taking and annotation.

The authors chose the digital textbooks(DTs) using Microsoft Word 2003 because of its annotation and note-taking features[12]. MS Word is the only digital system that supports in-line annotations among annotation and note-taking systems[4]. Digital textbooks(DTs) are uploaded to the server and then students download the DTs to their portable personal computers for use in each lecture. Students then write comments on DTs in their classrooms[13]. At first, HTML tags are inserted into each set of comments with the selected text in the DT with a macro for Word 2003, and then each set of comments with the selected text to add HTML tags is extracted with PerlScript[14,15]. The students were divided into two distinct groups: cluster-A, defined as those DTs in which students have inserted many comments, and cluster-B, in which students have inserted few comments[14]. The number of comments inserted by students is gauged to be one of the useful indexes for quantitative analysis of student motivation[14]. A preliminary study was carried out on how to relate a student's grade earned at the end of course to the number of comments on his/her digital textbook. What the authors discovered appears to suggest that there is a positive correlation between the number of comments inserted by students and their grades earned at the end of course [15].

In this paper investigations are carried out to evaluate the comments inserted by students onto their digital textbooks and how this relates to their eventual grade earned at the end of course. Our study highlights two main factors influencing students; eventual grade, quantity and quality of annotation. It is investigated whether students who wrote a lot of comments and focused upon the more important keywords in the text have a tendency to receive a higher grade. Accordingly, our analysis is based on number and quality of text word selection.

Method

Overview

The authors chose the digital textbooks(DTs) using Microsoft Word 2003 because of its annotation and note-taking features. In the MS Word the composition of a textual annotation takes place in a sub-window within the main editing window. MS Word is the only digital system that supports inline annotations in many annotation and note-taking systems. In the DT, comments are inserted without overwriting the original text and also are indicated by assigning the annotator's name between double brackets. When reading the DT, students may filter comments by the author and may also opt to hide all comments.

Digital textbooks(DTs) are uploaded onto our department's server in Tsurumi University(Stage 1 in Fig 1) and then students download the DTs to their portable personal computers for using in lectures(Stage 2 in Fig 1). Students write comments on DTs in their classrooms(Stage 3 in Fig 1). The DTs with comments inserted by students were collected at each end of the semester in 2005, 2006 and 2007. The authors analyze the comments inserted into DTs. At first, HTML tags are added into each set of comments with the selected text in the DT with a macro for Word 2003(Stage 6 in Fig 1), and then each set of comments with the selected text to add HTML tags is extracted from HTML documents with PerlScript(Stage 7 in Fig 1).
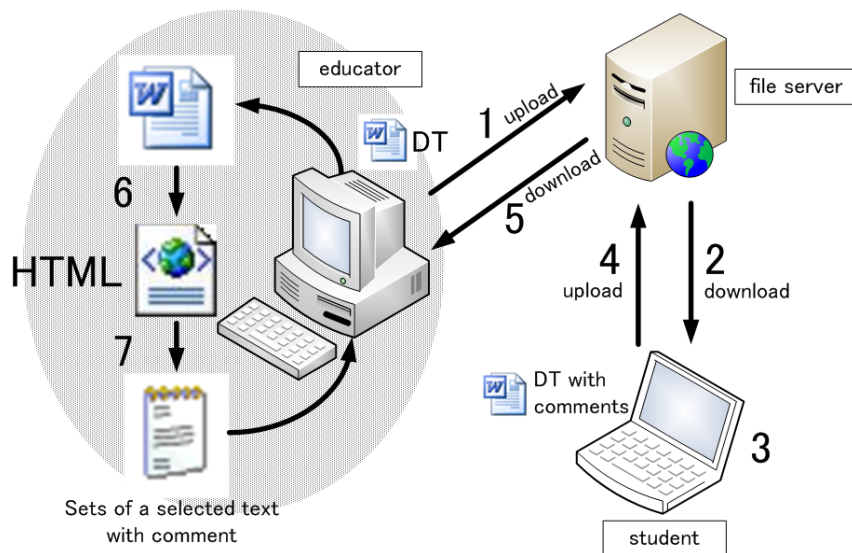

Fig. 1. Extraction process of comments inserted by students on Digital Textbooks.

Subjects

Students select a part of the text in DT and then a frame of comment, coupled with the selected portion of text, is inserted into DT automatically. Students write annotations and/or notes within the frame such as their opinions, the meaning of a word or phrase, or questions to teacher etc (Fig 2). Though inserted comments are automatically numbered in order, students find it easy to manage their comments created in the classroom.

Fig. 2. Comment with a selected portion of text inserted by student in Digital Textbook.

Procedure

Digital textbooks(DTs) in Japanese are prepared by each teacher taking charge of the courses, "Introduction to Networks" and "Introduction to Multimedia", with Microsoft Word 2003. The pages of two DTs, "Introduction to Networks" and "Introduction to Multimedia", are 41 and 54, respectively. The DTs in each of the two courses are composed of alphanumerical texts and graphics such as figures, tables and images. In the opening lecture of the course, teacher explains to students about how to use the DT and encourages students to add comments during the lecture on their DT. The teacher suggests to students that adding comments will lead to the improvement of their learning abilities, and also explains to students that their DT will be collected for investigation at the end of the course.

   In the final lecture of the course, students upload their DT with their comments and annotations to the server. Their eventual grades in the course are based on the weighted combination of the three following requirements: class participation, assignment and /or quiz, and examination. The eventual grade is composed of S(100-90 points), A(89-80 points), B(79-70 points), C(69-60 points) and D(59-0 points). Students who receive a grade of S, A, B or C succeed in getting credit for the course. On the other hand, students who receive a grade of D, fail to get credit for the course.

Data Analysis and Results

The number and percentage of students who added comments to Digital Textbooks(DTs) are shown in Table 1. As identified above, students annotate text in their DTs using the comment feature of MS Word. Both courses of "Introduction to Networks" and "Introduction to Multimedia" are required courses during the first year in the Department of Library, Archival and Information Studies, at Tsurumi University. However, because the number of students who registered for the course can fluctuate over the course of three years, some students, however, who failed these courses in the first year must repeat the course in their second year.

The total number of students who registered for the two courses over three years of 2005, 2006 and 2007 was 510. The percentages of students who submitted their DTs to the server were distributed from 62.1 to 84.5. The average percentage of all students who submitted their DTs per the total number of students was 74.1. The percentages of students who added comments to DTs were distributed from 83.1 to 100.0. The average percentage of students who added comments per the total number of students who submitted their DTs was 92.7.

As exemplified above, most of the students who submitted their DTs added comments. In three classrooms of "Introduction to Networks" in 2006 and "Introduction to Multimedia" in 2005 and 2006, the ratios of students who did not add comments as annotations onto their DT were 10 percents or more in the number of all students submitted DT in the course.

Some of students who did not add comments used the features of the highlighter pen and/or color change in a form of annotations onto their DT. Most of students who did not submit their DT failed to get a credit for the course. The teachers encouraged their students to add comments during the period of lectures in 2007. Compared with previous years, the students who added comments onto DTs in two classrooms of "Introduction to Networks" and "Introduction to Multimedia" in 2007 have leveled up over 95 percents. Being able to show that adding comments improves their scores will clearly encourage students to implement this practice more vigorously.

Table 1. The number and percentage of students who added comments to Digital Textbooks(DTs).

Course	Year	Registered students (RS)	Students submitted DTs (SS) (% for RS)	Students added comments to DTs (% for SS)
Introduction to Networks	2005	84	69 (82.1)	67 (97.1)
	2006	84	71(84.5)	59(83.1)
	2007	83	67(80.7)	65(97.0)
Introduction to Multimedia	2005	82	60 (73.2)	54 (90.0)
	2006	90	60 (66.7)	54 (90.0)
	2007	87	54(62.1)	54 (100.0)
Total Number		510	381(74.1)	353(92.7)

Table 2 shows the average numbers of comments in each grade at two courses of "Introduction to Networks" and "Introduction to Multimedia". The average numbers of comments at the course of "Introduction to Networks" are 36.91+/-15.73 (mean +/- standard deviation) in S, 31.78+/-18.21 in A, 20.68+/- 15.54 in B and 11.12+/-13.47 in C, respectively. The average number of comments has clearly seen a decline from grade S to grade C. The average numbers of comments at the course of "Introduction to Multimedia" were 49.80 +/-11.43 (mean +/- standard error of the mean) in S, 28.51in A, 22.23 in B and 13.71in C, respectively. The average number of comments has also clearly seen a decline from grade S to grade C. In both cases, we can point to a trend that high-performing students who got better grades added more comments in the form of annotations than low-performing students who received a poor grade. It can be supposed from the results of our experiments shown in Table 2 that the average number of comments per student being aimed at a group of the same grade have a positive relation with their eventual grades earned in the course.

Table 2. The average number of comments inserted by each student onto DT and their eventual grades earned in two courses of "Introduction to Networks" and "Introduction to Multimedia".

Course	Introduction to Networks				Introduction to Multimedia			
Grade	S	A	B	C	S	A	B	C
Mean	36.91	31.78	20.68	11.12	49.80	28.51	22.23	13.71
SD	15.73	18.21	15.54	13.47	20.56	20.65	15.25	12.43

The left side of Fig 3 is a scatter plot of the number of comments inserted by each student on the DT made up with each grade earned in the course of "Introduction to Networks", and the right side of Fig 3 shows a scatter plot of the number of comments inserted by each student on the DT made up with each grade earned in the course of "Introduction to Multimedia".

The number of comments in each grade widely dispersed from zero to higher counts. For example, the number of comments in a group of grade A in "Introduction to Networks" widely dispersed from zero to 101. We already mentioned before the eventual grade was worked out based on the weighted combination of the three following requirements: class participation, assignment and /or quiz, and examination. However, it needs to be investigated further why some students who did not add many comments could receive a higher eventual grade.

The average number of comments per student being aimed at every 381 students was 24.02. In other instances, the groups of grade C in both of "Introduction to Networks" and "Introduction to Multimedia" included students to add comments over 40. The number of 40 comments in the groups of grade C is relatively higher than the average number of comments being aimed at every 381 students. We need further study of which analyze the contents written by students within a frame of comment in the form of annotation to understand more exactly the relation between comments and eventual grade earned in the course.
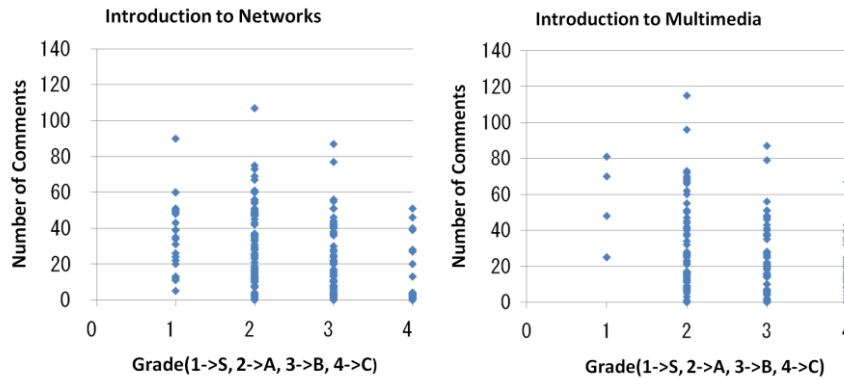
Fig. 3. Scatter plots of the number of comments inserted by each student on DT in their eventual grade earned in two courses of "Introduction to Networks" and "Introduction to Multimedia".

The higher frequency terms being ranked within the top 10 were picked out from all words and phrases selected by students in their annotation on the DTs of "Introduction to Networks"(Table 3) and "Introduction to Multimedia"(Table 4).

Some terms were translated from Japanese to English and then listed in tables. The number of comments is calculated automatically in each word or phrase at first and then similar words or phrases were brought together in a single term manually. As the term of "OSI" is high up on the list of higher frequency terms in "Introduction to Networks", "OSI with (section number)" and "OSI with (Japanese words)" are put all together into the term of "OSI".

Table 3. The higher frequency terms picked out from all words and phrases selected by students to add comments onto the DT of "Introduction to Networks".

Order	S		A		B		C	
	words or phrases	Number of comments	words or phrases	Number of comments	words or phrases	Number of comments	words or phrases	Number of comments
1	flow control	11	flow control	37	routing	34	Introduction to Networks	9
2	protocol	8	routing	34	protocol	22	IP	9
3	bluetooth	7	broadcast	27	Introduction to Networks	20	flow control	8
4	OSI	7	physical layer	24	flow control	19	INS	5
5	buffer over-flow	7	data link layer	23	transport layer	19	packet	5
6	routing	7	buffer over-flow	23	IP	17	routing	5
7	physical layer	6	packet	22	packet	17	error control	5
8	data link layer	6	bluetooth	20	physical layer	16	physical layer	4
9	IP address	6	OSI	20	OSI	16	data link layer	4
10	ACK	6	Introduction to Networks	19	router	15	network layer	4

In the case of "Introduction to Networks", the terms of which are protocol, names of some primary protocols of the OSI reference model, flow control, routing or router, and packet were used often by students among all grades. In the case of "Introduction to Multimedia", the terms of which are ASCII, Open (Web), Stor(aged Information),

font, binary file, CD-ROM, ANK and JIS were also used often by students among all grades.

Table 4. The higher frequency terms picked out from all words and phases selected by students to add comments onto the DT of "Introduction to Multimedia".

Order	S		A		B		C	
	words or phrases	Number of comments	words or phrases	Number of comments	words or phrases	Number of comments	words or phrases	Number of comments
1	RAM	5	ASCII	48	ASCII	37	Open	16
2	ROM	5	Open	36	multimedia	30	ASCII	16
3	ASCII	5	multimedia	30	digital contents	29	Stor	13
4	font	5	Deep	28	Open	27	binary file	13
5	semiconductor memory	4	Stor	27	CD-ROM	21	font	11
6	binary file	4	JIS	23	text file	21	CD-ROM	9
7	property	4	ANK	19	hard disk	19	hard disk	9
8	Open	3	binary file	16	Deep	19	floppy disk	9
9	DIF	3	bitmap format	15	floppy disk	17	ANK	9
10	JIS	3	escape sequence	15	ANK	16	Deep	9

Fig. 4 and Fig. 5 show the similarities of terms which appeared often among four grades. Grade S is used as of control point in Fig 4, and grade C is used as of control point in Fig 5. Being based on the lists of higher frequency terms picked up from each grade, the similarities of terms in "Introduction to Networks" and "Introduction to Multimedia" were calculated in both of Fig 4 and Fig 5. The number of terms and frequency of appearance in "Introduction to Networks" are 22 and over 5 in grade S, 22 and over 13 in grade A, 22 and over 9 in grade B, 19 and over 4 in grade C, respectively. The number of terms and frequency of appearance in "Introduction to Multimedia" are 18 and over 3 in grade S, 22 and over 11 in grade A, 19 and over 11 in grade B, 20 and over 7 in grade C, respectively.
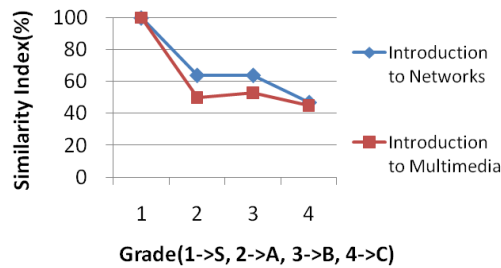

Fig. 4. The similarity of high frequency terms picked out all words and phrases selected by students verified among four grades used grade S as of control point.

The percentages of similar terms in grade A, B, C in "Introduction to Multimedia" are 50%, 53% and 45% of grade S, respectively. The percentages of similar terms in grade A, B, C in "Introduction to Networks" are 64%, 64% and 47% of grade S,

respectively(Fig 4). The percentages of similar terms in grade B, A, S in "Introduction to Multimedia" are 79%, 59% and 50% of grade C, respectively. The percentages of similar terms in grade B, A, S in "Introduction to Networks" are 59%, 55% and 41% of grade C, respectively(Fig 5). Both figures, Fig 4 and Fig 5, illustrate that the similarities of terms which appeared often among four grades positively relate to eventual grades earned at the end of the course.
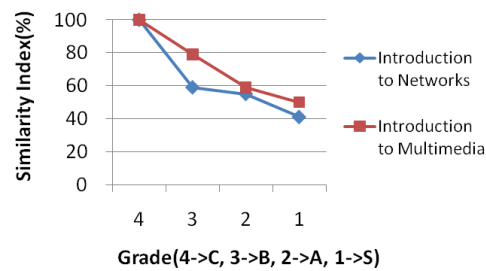

Fig. 5. The similarity of high frequency term picked out all words and phrases selected by students verified among four grades used grade C as of control point.

Conclusion

In the study, we found the average number of comments per student being aimed at a group of the same grade related to the eventual grades earned at the end of course, in other words, high-performing students who got better grades added more comments in the form of annotations than under-performing students who received a poor grade.

There are already many studies concerning for the behavior of students' practice of adding annotations to their textbooks printed on the paper and taking notes in lectures[1, 5, 6, 8]. In our study, students added their comments in the form of annotations onto their digital textbooks using the comment feature on MS Word. We found also on their digital textbooks the other kinds of annotations: Example for highlighting important words, where a part of sentence was changed to a different color, or writing some words within text not to use the comment feature on MS Word. It needs to be investigated further what kind of differences there are between the practice of annotations and note-taking by students on digital textbooks and those on printed textbooks.

We also found in the study the similarity of terms which appeared often among four grades positively related the eventual grades earned at the end of course. We need further study of which analyze the contents written by students within a frame of comment in the form of annotation to understand more exactly the relation between comments and eventual grade earned in the course.

With the growth of digital environment, the document tradition is changing from paper to electronic. As more of our educational material moves to the computer, supporting annotation and note-taking digitally becomes an important task. At the same time, technology gives us unprecedented control over the annotation and note-taking process. We should study student behavior and practices and what changes will

are likely to occur through use of digital textbooks as opposed to the more traditional approach in the learning environment of the paper-and-pen on the classroom. The digital textbooks should be improved and applied to the lessons for increasing student motivation and for encouraging better grades. The next major step will be to make a system to extract a set of annotated text and annotation data added by students onto the digital textbooks and then to analyze the data automatically.

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