

Estimating Student's Viewpoint to Learning from Lecture/Self-Evaluation Texts

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Abstract—Our eventual goal is to help students learn more effectively. Toward this goal, we have asked the students to retrospectively evaluate themselves and the class by looking back at what they have learned, and we analyzed the answer-texts in order to capture them objectively. We found that their viewpoints affect their performances. Students with wider viewpoints get better performances than those with narrow viewpoints. In this paper, we analyze the answer texts for two contrasting targets; lecture (L) vs. student (S), and good point (G) vs. bad point (B). We propose an index for measuring the term usage and analyze the answer texts using this index. We find that most terms are exclusively used in either one of the contrasting questions. For the numbers of exclusively-used terms, L and G respectively outperform S and B. Thus, students pay more attentions to lectures than themselves and to good points than bad points, as they evaluate. Further, the terms exclusively used in the combination of L-S and G-B, i.e., LG, LB, SG, and SB, show the points of evaluation view of students more specifically.

Keywords—Text Mining; Text Analysis; Term-usage; Educational Data Mining; Lecture Data Analytics.

I. INTRODUCTION

The aim of our series of studies is to know our students in order to help them succeed to their full potential in their university studies. As a part of such studies, we have been analyzing the answer texts to a retrospective evaluation questionnaire about lectures and the students themselves [4]–[10]. For example, we have been investigating the students' attitudes to the lectures/learning by analyzing the free texts obtained as the answer to the question related to what they have learned in class. The results show that the students with high examination scores incline to use the terms that indicate the students' wide viewpoints and wide interests. By contrast, those with low grades often respond the terms directly related to the lecture's main topic [8]–[10].

Such studies of educational data analysis and analytics are conducted as Educational Data Mining (EDM) [12]. For example, Romero et al. [13] gave a comparative study of data mining algorithms for classifying students using e-learning system data. Its major interest is on predicting the student's performance outcome. Our focus is on the student's psychological tendency in learning, such as eagerness, diligence, seriousness. Many studies in EDM use the target data which are obtained from learning management systems. Different from them, our target data can be obtained in everyday lectures.

The study by Ames et al. [1] has a similar motivation to ours. They investigated the students' attitudes to the class, learning, and others, on the basis of the answers to questionnaire items. However, their underlying data were obtained by asking the students to choose the rate from 1 to 5 for each question item. In our case, even though 2 of our question items

are asking to rate from 0 to 100, other questions are asking for an answer in a free-text format.

Our data analysis style is different from the major studies in EDM. Most of them somehow intend to analyze the big data, and the data obtained automatically as log data. By contrast, we would rather take the approach of dealing with small data, because our target data themselves may be very small [5] [7]. Also, the data we deal with are representing students, who we have to educate and take care of them all. Thus, we have to pay attention to all the data, even the data locate as outliers, separated from the central area.

The aim of this paper is to perform an answer text analysis in order to know more about students' attitudes to learning and their points of view while taking a class. We also aim to develop new methods of analysis through case studies.

The rest of the paper is organized as follows: In Section II, we describe the data we use for analysis. In Section III, we present our interesting findings in our previous studies. In Section IV, we conduct the analysis by focusing attention on the terms used by the students in the answer texts from questions about good/bad points of the lectures and students themselves. We analyze what types of terms are used in what contexts and try to find their points of view during learning in the class. Finally in Section V, we conclude the discussions and findings in this paper.

II. TARGET DATA

The data used in this paper came from a class in 2009 named "Information Retrieval Exercise" in a two-year women's university [4]–[10]. The students were in their second year, and thus, were going to graduate. The number of registered students was 35. The class was a compulsory course for librarian certificate. Thus, the students of this course were more motivated than students in other courses. The major aim of the course for the students was to become expert information searchers so that they have enough knowledge about information retrieval, and enough skills in finding appropriate search engine sites and search keywords on the basis of understanding the aim of the retrieval. One course consists of 15 lectures. A lecture started with a five-minute quiz every time, and the answer sheets were used for recording attendance of students.

Also, homework was assigned every week. Its aim was to make the students review what they had learned in the class and to study preliminary knowledge for the next class. At the same time, the students were requested to write a lecture note every week, which was also aiming to make the students review what they had learned. The homework score reflected the frequency and quality of the submitted homework.

The term-end examination of the course consisted of 3

questions. The first question was to find the search engine sites, and to summarize their characteristic features, together with discussing the methods for information retrieval. The second question was to find the Web sites about e-books and on-line material services. The third question was to find and argue about the information crimes in the Internet environment. The aim of these questions was to evaluate the skills for information retrieval, including the skills for planning and summarizing. These skills were supposed to have been acquired during the course through in classes exercises and by doing homework. We used the score of term-end examination as the measure for the student's performance.

We also asked the students to answer some questions related to their overall evaluation of the course. These questions are [10]:

- (Q1) What did you learn in this class? Did it help you?
- (Q2) What are the good points of the lectures?
- (Q3) What are the bad points that need to be improved?
- (Q4) What score you give to the lectures as a whole? (With the numbers from 0 to 100, where the pass level is 60 as in the same way to the examination score.)
- (Q5) Write comments on the course, on the lectures and the lecturer, if any,
- (Q6) What are your good points in learning attitudes and efforts for the course?
- (Q7) What are your bad points that should have to be improved?
- (Q8) How do you evaluate your diligence and eagerness to study? Choose one of "excellent", "good", "fair", "rather poor", and "poor".
- (Q9) Have you asked the lecturer any questions? Choose one of "asked questions more than once", "asked question once", "had not asked questions", "could not ask questions that came up with", and "no questions came up at all". Describe in detail about the question(s) you asked, and whether the lecturer answered appropriately,
- (Q10) Have you done some research or information retrieval in order to find the answers of some questions after school hours? Choose one of "retrieved often", "retrieved sometimes", "had not retrieved for solving questions", and "no questions came up with at all". Describe in detail about what you have done,
- (Q11) What score you give to yourself as the evaluation of your own efforts and attitude toward the course. (With the numbers from 0 to 100 as in the same way as in Q4), and finally,
- (Q12) Write other comments, if any.

For an example of answer texts, we take a student. Her answers to the first half of the questionnaire were as follows: (Q1) I think I can learn the elementary methods of information retrieval, how to choose appropriate keywords, and others, for getting the information I am looking for. What I have learned is helpful when I do assignments of other lectures. (Q2) I got to know what I did not know before, and about foreign libraries. (Q3) Presumably, the lecturer has quite a lot of things to teach, and thus, the lecture time was often too short to cover all the contents planned in advance. I felt sorry about that. I have no idea how to solve this problem. How about ensure to finish the contents to be dealt with next time? Alternatively, how about reducing the time spent to comment on students

homework? (Q4) 87. (Q5) I would like to take this lectures in the first semester, before having the practical training at a library. Then, it might be more effective in various situations; especially at the practical referencing training.

For the remaining questions about herself, she answered as follows: (Q6) The good point for me was I tried as hard as possible to tackle the homework, even though I thought I was not good at operating machines and dealing with information. Also, in order to submit better homework, I completed the homework by trying to reflect on what the lecturer had talked about. (Q7) I have been misunderstanding about homework, without thinking about the lecturer's intention. I should have recognized it earlier. Further, it was wrong to complain to the lecturer about homework assignment. Now, I know I made a mistake about it, so I will not fail again. I agree that it is my own responsibility what I learn from what are given to me in a class. Here after, I will try to recognize other person's intention first, and behave accordingly. (Q8) Fair. (Q9) No questions to ask. (Q10) No investigation for questions. (Q11) 79. (Q12) Although I was not very skilled in dealing with machines and thus, was worried whether I could follow before the lectures, it was nice that I got enough time to operate a PC and got used to it through doing the homeworks and others. From now on, I will try hard to make use of what I have learned in the lectures.

III. FINDINGS IN OUR PREVIOUS STUDIES

In this section, we illustrate a couple of findings in our previous studies. The study in Section IV is carried out on the basis of these findings.

A. Analytics of Numerical Items [4]–[7]

We started with investigating the correlation between the self-evaluation scores (which is obtained from (Q11)) and the examination scores. The result shows that the students who have high examination scores evaluate themselves from a very low scores up to a very high scores, which means that those students who evaluate low would have the self-image that "I am the person who can do better than what I have been doing". These students have a good desire of self-improvement.

By contrast, the students who have poor performance seem to believe in themselves without evidence, and evaluate themselves something like, "I do fairly well in my study". Another possibility is that they actually recognize very well about their poor efforts and poor performance. Still, or maybe because of it, they wanted to believe that they have put in good effort, instead of admitting to their lack of effort. In this way, they could avoid facing what they really were, and keep their pride. As a result of such a phenomenon, the correlation coefficient between the self-evaluation scores and the examination scores becomes a negative value of -0.1 .

B. Analytics of Word Usage [8]–[10]

Table I shows the words (translated into English) that appear in the texts more than 5 times and their number of occurrences in the answer texts to (Q1), in the decreasing order of the number. We can see that the words related to the lectures appear in high frequencies. For example, the word "Search" appears 88 times in the answers for (Q1), which is the most frequently used one among all words. Also, the words "Information", "Library" and others appear in the list. The lecture-related words are 6 (20%) among 30 words, whereas 4 (29%) among 14 words with frequencies more than 10.

TABLE I. EXTRACTED WORDS AND THEIR OCCURRENCES (FREQ.> 5)

Word	Freq.	Word	Freq.	Word	Freq.
Search	88	Way	16	Think	8
Class	37	Examine	16	Do	8
Information	37	Keyword	13	Get	8
I think	34	Are various	11	Various	7
Library	33	Use *	10	Feel	7
Learn	32	Help	10	Function	7
Know	30	Necessary	9	Result	7
Myself	21	Use *	9	Important	7
How	21	Internet	8	Opportunity	6
Now	17	Personal Computer	8	This time	6

* Different words in Japanese

In a corresponding analysis between the students and the terms they used, we divided the students into 5 groups. The member of the group with the highest average examination score characteristically used the technical terms and the terms from broader points of view, in comparing Japan and the world, such as “Foreign”, “National”, and “Japan”. It is interesting to see that the terms which are relating to the homework assignments do not appear in this group. Thus, we can say that the students in this group attended the lectures with the attitude of learning in a broad perspective.

In contrast, the students in the group with the lowest average examination score used quite a lot of frequently-used general terms, and did not use technical terms at all. It is interesting to see that many students used a lot of terms they have learned during the lectures, e.g., “Learn”, “Master”, “Study”, “Useful”, and “Use”. So, we can guess, they paid a lot of attention to the terms which are directly relating to the main topics of the course, whereas they did not pay much attention to such things like, their background, their relation to the related concepts, their values in our society.

IV. ANALYSIS OF LECTURE/SELF AND GOOD/BAD POINTS OF STUDENTS

In this section, we analyze and discuss how terms are used in evaluating the lectures and the students themselves as well as whether they are used for positive points or negative ones on the basis of the results described in the previous section. Firstly in Subsection IV-A, we describe the outline of the process for data analytics, which consists of two parts; term/word extraction from the texts and investigation of their usage. The first part is described in Subsection IV-B, and the second part in Subsections IV-C and IV-D.

A. Outline of the Analytics

As we have shown in Section II, (Q2) and (Q3) asked the students to point out the good and to be improved points, respectively. Similarly, (Q6) and (Q7) respectively asked the good and to be improved points of the student herself. Thus, we call these questions LG (meaning Lecture-Good) for (Q2), LB (meaning Lecture-Bad) for (Q3), SG (meaning Self/Student-Good) for (Q6), and SB (meaning Self/Student-Bad) for (Q6) in order to recognize them with ease.

The aim of this paper is to investigate what kinds of terms are used in which evaluations for lecture, self/student, good point, bad point, and try to find the students’ points of view in evaluation. First, we extract terms from the texts that are supposed to somehow represent the views for evaluations.

Then, we characterize the terms using indexes for measuring the weights between lecture and self, good and bad points.

B. Term Extraction

We start with extracting the terms used in the answer texts of students for the questions (Q2), (Q3), (Q6), and (Q7), or LG, LB, SG, and SB, respectively.

Let n be the number of students, $n = 35$ in our case, and let $\mathcal{S} = \{s_1, s_2, \dots, s_n\}$ be the set of students. Each student s_i ($i = 1, 2, \dots, n$) is supposed to answer the questions (Q2), (Q3), (Q6), and (Q7). Let $\mathcal{Q} = \{LG, LB, SG, SB\}$ be the set of questions, and let $Ans_{i,q}$ be the answer text, or string of characters, of the students $s_i \in \mathcal{S}$ for the question $q \in \mathcal{Q}$. Note that $Ans_{i,q} = ""$ (empty string) means that the student s_i did not answer to the question q .

By applying the morphological analyzer, i.e., KH coder [2] and MeCab [3], to the text $Ans_{i,q}$, we are able to create the set of “terms” $\mathcal{T}_{i,q} = \{t_1, t_2, \dots, t_{m_{i,q}}\}$, where each term $t_k (\in \mathcal{T}_{i,q})$ is of the form $w : p$, where w is a word and p is its part of speech (PoS). We will sometimes identify the term $w : p$ with the word w in this paper; especially when it is not important which part of speech p the word w has.

Let $\#_{i,q,t}$ be the number of occurrences, or frequencies, of the term t in the text $Ans_{i,q}$. Note that $\#_{i,q,t}$ represents the number of the occurrences of the term t in the bag of words of $Ans_{i,q}$, and thus, $\#_{i,q,t} = 0$ if $t \notin \mathcal{T}_{i,q}$. We also define $\mathcal{T}_i = \bigcup_{q \in \mathcal{Q}} \mathcal{T}_{i,q}$, $\#_i t = \sum_{q \in \mathcal{Q}} \#_{i,q,t}$, $\mathcal{T}_q = \bigcup_{s_i \in \mathcal{S}} \mathcal{T}_{i,q}$, and $\#_q t = \sum_{s_i \in \mathcal{S}} \#_{i,q,t}$. Then, let $\mathcal{T} = \bigcup_{q \in \mathcal{Q}} \mathcal{T}_q (= \bigcup_{s_i \in \mathcal{S}} \mathcal{T}_i)$.

Now, we extend the set $\mathcal{Q} = \{LG, LB, SG, SB\}$ to the set $\mathcal{Q} = \{LG, LB, SG, SB, L, S, G, B, All\}$, so that $\mathcal{T}_L = \mathcal{T}_{LG} \cup \mathcal{T}_{LB}$ and $\#_L t = \#_{LG} t + \#_{LB} t$. We also define \mathcal{T}_S , \mathcal{T}_G , and \mathcal{T}_B in the same way. Further, $\mathcal{T}_{All} = \mathcal{T}_L \cup \mathcal{T}_S$ and $\#_{All} t = \#_L t + \#_S t$. We may omit the suffix *ALL* for brevity.

In our case, $\#\mathcal{T} = 605$, $\sum_{t \in \mathcal{T}} \#t = 1322$, and thus, a term appears about 2.2 times in average. The term that appears maximum times is the verb “do” with 72 times, and 361 (about 60%) terms appear only once.

 TABLE II. TERM OF FREQUENCY ≥ 9 WITH ITS TYPE

No.	Word:PoS	Frq.	Type	No.	Word:PoS	Frq.	Type
1	Do(する):v	72	L’G’	21	Say(いう):v	12	L’B’
2	Think(思う):v	46	L’B’	22	Investigate(調べる):v	11	L’G’
3	Homework(宿題):n	45	S’B’	23	No(ない):adj	11	L’G’
4	Not(ない):o	45	L’B’	24	Do(やる):v	11	L’G’
5	Can(できる):v	38	L’G’	25	See(見る):v	10	L’G’
6	Lecture(授業):n	35	L’G’	26	Good(良い):adj	10	L’G’
7	Exist(ある):v	35	L’B’	27	Other(他):n	10	L’G’
8	Become(なる):v	31	L’B’	28	Interest(気):n	10	S’B’
9	ToIntroduce(紹介):n	25	L’G’	29	NotMuch(あまり):adv	9	L’G’
10	Time(時間):o	23	L’B’	30	Good(よい):adj	9	L’G’
11	Lecturer(先生):n	20	S’N	31	Person(人):n	9	L’G’
12	ToSearch(検索):n	19	L’G’	32	Understand(わかる):v	9	L’B’
13	Me(自分):n	19	L’G’	33	Many(多い):adj	9	S’B’
14	Library(図書館):n	19	L’G’	34	Easy(やすい):adj	9	S’B’
15	Know(知る):v	17	L’G’	35	Acquire(つける):v	9	S’B’
16	Assignment(課題):n	14	S’B’	36	Not(ぬ):o	9	L’G’
17	Listen(聞く):v	13	L’B’				
18	Everytime(毎回):o	13	S’B’				
19	Talk(話):n	13	S’B’				
20	DoSubmit(提出):n	13	L’G’				

Table II shows the list of most frequently used terms t with $\#t \geq 9$, which are 36 in number and the rate of their total frequencies is about 54%. Note that the noun having “To+verb” form in English shows that it is a “sahen-noun”, which allows to add the verb “suru (Do)” and turns into its verb-form. For example, the 9th term “紹介 (pronounced show-kai)” is a noun, meaning “introduction”, or “to introduce”. By adding “する (suru)” it becomes a verb “紹介する (show-kai-suru, introduction-do)”, meaning “do introduce” or the verb “introduce”. In the table, such nouns are translated into English in the form of “To+Verb”. As a sahen-noun and its verb form are so close to each other, they could be dealt with identically, as they are the same in the intention of those who use them.

Many terms in the table were popular for (Q1), which asked the students what they had learned in the class. For example, the most frequently used term “ToSearch(検索):n” appears as the 12th term in the table. The second one appears as the 6th. These terms might be those the students remembered most when they looked back at the lectures and at themselves.

By contrast, the terms that do not appear many in (Q1) include the very first term “Do(する):v”, the 11th, and those from 17th to 22nd of Table II. The use of the term “Do”, however, might not be very important because it is used so often that its usages might not mean much. The use of terms from “listen” (17th) to “investigate” (22nd) are probably related to the 16th term “investigate”, and it means that it remains in their mind about what their homework assignments were like, and what they did, or did not.

C. Term Usage Analysis using LS- and GB-indexes

In order to investigate further about how terms are used in evaluation texts, we introduce a new index, which quantifies how much is a term used in contrasting evaluation context. Let t be a term ($\in T$). The LS-index of t is defined as follows:

$$\iota_{LS}(t) = \frac{\#Lt - \#St}{\#Lt + \#St}$$

By definition, $-1 \leq \iota_{LS}(t) \leq 1$, and $\iota_{LS}(t) = 1$ iff t appears only in L, i.e., t appears in either one of LG or LB and it does not appear in SG nor SB. Also, $\iota_{LS}(t) = -1$ iff t appears only in S, and $\iota_{LS}(t) = 0$ iff t appears in the same number in L as in S, or $\#Lt = \#St$. We define $\iota_{GB}(t)$ in the same way:

$$\iota_{GB}(t) = \frac{\#Gt - \#Bt}{\#Gt + \#Bt}$$

Figure 1 shows how terms are located with the indexes LS and GB. We divide the terms into 25 groups by combining 5 groups both for LS (x) and for GB (y) axes, namely, S, S', N, L', and L for LS axis, and G, G', N, B', and B for GB axis. Precisely, we define the groups as follows: $S = \{t \in T \mid \iota_{LS}(t) = -1\}$, $S' = \{t \in T \mid -1 < \iota_{LS}(t) < 0\}$, $N = \{t \in T \mid \iota_{LS}(t) = 0\}$, $L' = \{t \in T \mid 0 < \iota_{LS}(t) < 1\}$, and $L = \{t \in T \mid \iota_{LS}(t) = 1\}$. We define G to B in a similar way, and finally, we define from SG to LB by combining the two group types. For example, $S'G' = \{t \in T \mid -1 < \iota_{LS}(t) < 0, 0 < \iota_{GB}(t) < 1\}$.

From the figure, we have an impression that the first quadrant ($\iota_{LS}, \iota_{GB} > 0$) contains the most terms, followed by the fourth quadrant ($\iota_{LS} > 0, \iota_{GB} < 0$), the third quadrant ($\iota_{LS} < 0, \iota_{GB} < 0$), and the second quadrant ($\iota_{LS} < 0, \iota_{GB} > 0$) is the one with the least terms. Thus, students used more terms to evaluate lectures than themselves, and they used more terms to evaluate good points about lectures than bad points. Further,

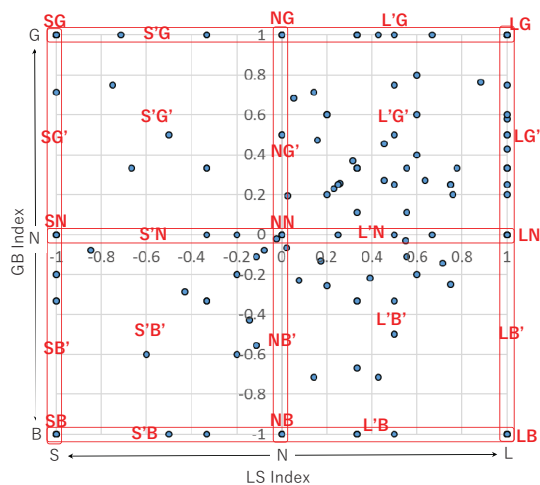


Figure 1. Distribution of Terms with LS (x-axis) and GB (y-axis) Indexes

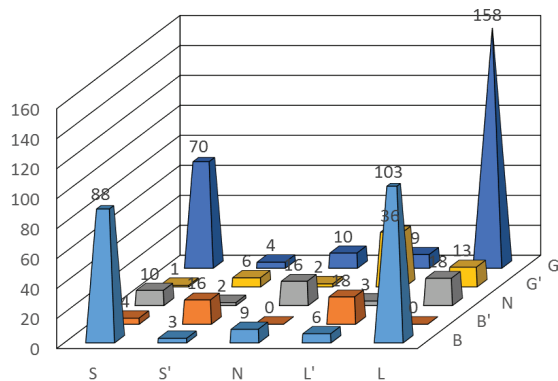


Figure 2. Term-Distribution by LS (x-axis) and GB (y-axis) Index Types

we recognize that they used more terms in evaluating bad points about themselves than good points.

Figure 2 shows how the terms are distributed to the 5x5 groups, and Table III shows the actual numbers. From the table and the figure, we can see most (nearly 70%) terms are located at the 4 corners (namely LG, SG, SB, and LB types), and $\#LG > \#LB > \#SB > \#SG$ in their numbers of terms. This result exactly matches with the observation we had in Figure 1, where we observed that $\#L'G' > \#L'B' > \#S'B' > \#S'G'$.

These results say that students use more terms regarding (probably, pay more attention to) lectures than students themselves. Further, they use more terms, or pay more attention to

TABLE III. FREQUENCIES FOR COMBINED TYPES OF LS AND GB

	S	S'	N	L'	L	Sum
G	70	4	10	9	158	251
G'	1	6	2	36	13	58
N	10	2	16	3	18	49
B'	4	16	0	18	0	38
B	88	3	9	6	103	209
Sum	173	31	37	72	292	605

TABLE IV. TERMS FOR LG/LB/SG/SB TYPES

No.	SG (Self-Good) (70)	Frq.	LG (Lecture-Good) (158)	Frq.
1	ToMakeEffort(努力):n	5	Usually(普段):adv	5
2	Before(以前):adv	2	Oversees(海外):n	5
3	MakeEffort(頑張る):v	2	ForeignCountry(外国):n	4
4	Important(重要):adj	1	Fun(楽しい):adj	3
5	Yahoo(yahoo):o	1	Atmosphere(様子):n	3
6	Opportunity(きっかけ):n	1	Various(様々):adj	3
7	NotYet(まだまだ):adv	1	Japan(日本):n	3
8	Google(グーグル):o	1	Photo(写真):n	3
9	Hear(開く):v	1	IC(IC):o	3
10	ToFunction(機能):n	1	Tag(タグ):n	3
11	ToGrow(成長):n	1	Many(たくさん):adv	2
12	Immature(未熟):adj	1	Ages(時代):n	2
13	Part-TimeJob(バイト):n	1	Knowledge(知識):n	2
14	Somehow(なんとか):adv	1	Ties(縁):n	2
15	Vacancy(空き):n	1	ToPractice(実習):n	2
16	Interval(合間):n	1	Like(好き):adj	2
17	FindSpareTime(縫う):v	1	University(大学):n	2
18	All(すべて):adv	1	Engine(エンジン):n	2
19	GoodAt(得意):adj	1	Usage(使い方):n	2
20	NumbeOfTimes(回):n	1	CanGo(行ける):v	2
No.	SB (Self-Bad) (88)	Frq.	LB (Lecture-Bad) (103)	Frq.
1	ToReflect(反省):n	7	Want(ほしい):adj	5
2	FromNowOn(今後):adv	4	ToDivide(配分):n	4
3	Keep(守る):v	3	Reduce(減らす):v	3
4	When(いつ):adv	2	So(そう):adv	3
5	ToRegret(後悔):n	2	ToExplain(説明):n	3
6	OtherParty(相手):n	2	Short(短い):adj	2
7	Regret(悔しい):adj	2	One(一つ):n	2
8	ToManage(管理):n	2	Plan(予定):n	2
9	Continue(続く):v	2	Teach(教える):v	2
10	BeInterrupted(途切れる):v	1	Answer(答え):n	2
11	Margin(余裕):n	1	ThisTime(今回):adv	2
12	CanGo(いける):v	1	PreviousTime(前回):n	2
13	BarelyInTime(ぎりぎり):adv	1	Painful(辛い):adj	2
14	Immediately(すぐ):adv	1	Hear(聞き取る):v	2
15	QuiteALot(たっぷり):adv	1	Wide(広い):adj	1
16	BarelyInTime(ギリギリ):adj	1	Enjoyable(うれしい):adj	1
17	Everything(何事):n	1	Lonely(さみしい):adj	1
18	Repeat(繰り返す):v	1	Sorry(すいません):o	1
19	Review(見直し):n	1	ToCut(カット):n	1
20	ToBeSatisfactory(充実):n	1	Dormitory(寮):n	1

good points than bad points for lectures, and they pay more attention to bad points than good points for themselves.

A possible interpretation of such results is that the students are generally generous to others and they try harder to find good points than bad points as they evaluate the lectures and the lecturer, and at the same time, they try hard to find something to be improved as they evaluate themselves. We need to investigate further on this issue.

D. Term-Usage Analysis for Self/Lecture-Good/Bad

In this subsection, we investigate what specific terms are used in the types at the 4 corners SG, SB, LG, and LB. Table IV shows the 20 terms belonging to each of them. As these index values are either 1 or -1, they are used exclusively in the corresponding evaluations. Note that some terms with frequency 1 may not appear in the table.

The SG (i.e., Self/Student-Good) type is the one having the least number of terms among the 4 types. As we have a look at the terms in this type, we can see that the terms relating to their efforts are conspicuous. For example, the first term “ToMakeEffort(努力):n”, which occurs 5 times and the third term “MakeEffort(頑張る):v”, which occurs twice are a noun and a verb expression, respectively, which admire their efforts. Another term, which occurs twice is “Before(以前):adv”. It appears in the st03’s answer text to (Q6) in the sentence “It made me use the PC more often than before”. This sentence does not admire her effort directly. However, it is a kind of outcome of the lectures and her efforts, and it can be considered as a sort of indirect admiration of her efforts in learning.

As we have a look at the terms in the SB (i.e., Self/Student-Bad) type, we can see that a lot of terms appearing in this type are those that express regret. For example, the terms “ToReflect(反省):n”, “ToRegret(後悔):n”, and “Regret(悔しい):adj” directly express the student’s regret.

The most frequently specified points of regret is about submitting homeworks, especially that they did not submit some of them, or they submitted late. The terms “Keep(守る):v”, “ToManage(管理):n”, “BarelyInTime(ぎりぎり):adv”, and “BarelyInTime(ギリギリ):adj” are relating with submission of homeworks. Further, 4 out of 7 appearances of the term “ToReflect(反省):n” relate to homework submissions.

Among the remaining 3 appearances, 2 cases are relating to private talks and lack of concentration to the lectures. The rest one mentioned misunderstanding of the lecture’s aim, which most other students might not be able to recognize at all.

For the LG (i.e., Lecture-Good) type, we can see that many terms relating to the introductory talks of libraries where the lecturer had visited appear in the list. All the terms “Oversees(海外):n”, “ForeignCountry(外国):n”, “Japan(日本):n”, and “Photo(写真):n” appear in the context of introductions to the libraries, especially the ones overseas, where the students could not visit. Further, some appearances of the first term “Usually(普段):adv” are relating to this issue something like in the context “As we could not visit overseas library usually, I always admired when a foreign library was talked about”.

The 9th term “IC(IC):o” and the 10th one “Tag(タグ):n” refer the talk about IC tags, or RFID tags, installed to libraries, which is a research topic of the lecturer. This is another topic which does not belong to the major topics of the lecture at all.

Even with these topics are digressed ones from the major topics of the lectures, they attracted the students so strongly, and thus, they might also arouse the students’ interest to the lectures and the major topics themselves. Actually, according to our previous studies, the students who admire such talks have better outcome (examination scores) than those who do not [8]–[10]. This result inspires the importance of arousing students’ interest in the lectures.

As we have a look at the terms in the LB type, we recognize that a lot of terms are related to the time scheduling problem. A lecture often started with showing one or two assignment reports of students for the previous lecture, and gave additional lecture together with some commentaries to the reports. Often it took a lot of time for such commentaries and just little time remained for the teaching of new material. Some students pointed out this problem. More specifically, the terms “ToDivide(配分):n”, “Reduce(減らす):v”, “ToExplain(説明):n”, and “Short(短い):adj” are all related with this problem; some are

just pointing out, some are suggesting solutions. Further, one case for “Want(ほしい):adj” is a requirement on this problem.

The first term “Want(ほしい):adj” shows student’s requirement in general, and thus, it was used for a variety of requirements. A student asked for decreasing the amount of homeworks. Another one asked for additional explanations.

To summarize our observations in this subsection, students paid a lot of attention to their efforts mostly as they praised themselves (SG) and regretted their insufficiency of efforts and diligence (SB). For lectures, they praised the subsidiary talks because what they heard was new to them and helped them with widening their eyes to what they had never experienced before (LG), and they pointed out the problem of time management (LB).

The specific points we have from the analysis of this subsection are very specific to the data we used, and thus, it is quite hard to generalize. However, at least, we are able to demonstrate the usefulness of the methodology of taking contrasting concepts, which consists of introducing indexes for measuring usage, classifying and extracting characteristic terms, and analyzing how they are used, and why.

V. CONCLUDING REMARKS

We have been studying the student’s attitudes toward the lectures. Our eventual goal in the research topic of this study is two-fold: The first one is to find new facts and tips for helping our students with more effective learning, and the other is to develop new concepts and measuring methods which can be used for the first goal. Thus, understandability is very important in our study. This is the reason why we rather choose naive methods of analysis than to use more sophisticated, but less humanly understandable methods.

In this paper, we took the questions (Q2), (Q3), (Q6), and (Q7) of a retrospective evaluation questionnaire as the target data in an answer text analytics. They asked for good/bad points of lectures and the students themselves. Different from our previous studies, we focused on the terms instead of dealing with students directly. We introduced a new index which measures the weight of usage between two contrasting concepts. By using the indexes for L vs. S and G vs. B, we divided the terms appeared in the answer texts into 5×5 groups. We found that most of them locate at the 4 corners only, which means they are used specifically to evaluate either LG, LB, SG, or SB. By investigating the terms in the 4 corners, we found that the students evaluated themselves from the viewpoint of their efforts, and they evaluated the lectures from various viewpoints; introductory talks of libraries for good points and time-scheduling problem for bad point.

In comparison with the relation to their outcome, i.e., examination scores, we found that the usage of terms did not correlate very much, which is different from the analytics for the question (Q1). This difference might come from that (Q1) asked the students for evaluation in general, and thus, the answer texts correlate more closely with the students’ viewpoints. The questions for the study in this paper focused on the good/bad points, and thus, the answers came from a wide standpoints, which did not relate directly to the students’ ability/attitudes in learning.

Even though our current status of study is in a very beginning stage, the methods developed in our previous studies have shown high potential in our studies. It will become a necessary knowledge management tool for student development [9] in

the near future, because it is a very important topic for the institutional research (IR) for universities [5].

Our future study topics include the following: (1) To develop a method for devising the new ideas further, and to perform refinement of dedication to the study of student effort, and attitudes to learning, measuring diligence(s) of students [11], together with the further analysis of the evaluation texts. Also, it is worth comparing our model with other types of models. (2) By collecting data from a different class, to analyze them, and to verify if the results of this study are also holds. Also, it is important to find out the characteristic features of each class by comparing them. It will be interesting to investigate what features are gender-specific. (3) To generalize the analysis methods and to integrate them into an automated data analysis platform.

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