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Discourse Analysis of Teachers' Commentary on Students

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Abstract: In this paper, we describe the application of sentiment analysis and topic model on abundant teachers' comments. The goal of the analysis is to explore the teachers' sentiment and concerns when making comments. Preliminary findings indicate that students' class performance, completion of homework and subject literacy are still the main evaluation indicators which cannot keep pace with assessment of 21st century skill. Meanwhile, we proposed teachers to make more pluralistic comments for encouraging students' development.

Keywords: sentiment analysis, topic model, 21st century skill, teachers' comments

1. Introduction

21st century skills is an overarching expression for the knowledge, skills, and dispositions seen as prerequisites for success in the future global workplace (Germaine et al., 2016). It has been in heated debate about how to reform the curriculum, teaching method, or assessment system (Voogt et al., 2013). Many results have shown that student evaluation raises their achievements (Black & Wiliam, 2010). However, few researches have delve into in-class teaching activity to see the condition of evaluation.

To have a glance at the current situation of student evaluation, massive teachers' comments have been investigated by natural language processing method. We answer the following research questions:

1) How to infer teachers' emotions by their comments?
2) How to reduce teachers' focus when evaluating?
3) How to interpret these indicators with 21st century skills?

The 21st century skills in this study are referred to use the framework put forward by the National Education Association (2012) as the 4Cs (Germaine et al., 2016): 1) Critical thinking and problem solving skills; 2) Communication skills; 3) Collaboration skills; 4) Creativity and innovation skills.

2. Data and Methodology

Teachers' comments come from a student evaluation system across 8 primary schools in Shanghai and 2224 students. 18 subjects are involved in this dataset, such as Chinese, English, Math, Science and etc. 991979 comments are recorded in the database. Comment here refers to short text in Chinese.

For sentiment analysis, we firstly employed the python library 'jieba' to segment the words. Two corpus are built by hand to distinguish the emotion. Meanwhile, some dictionaries of adverbs of degree are included (Dong, Z., & Dong, Q., 2000). Then, we set different weights to these adverbs (Table 1), thus we can calculate the score according to the degree.

Table 1: The weight allocation.

Types	Examples	Weight	Types	Examples	Weight
'most' type	Fully, deeply, and etc.	2	'ish' type	A bit, fairly, and etc.	0.5
'very' type	Much, badly, and etc.	1.5	'insufficiently' type	Light, slight and etc.	0.25
'more' type	More, such and etc.	1.25	'inverse' type	Not, none, and etc.	-1

Probabilistic topic model is an algorithm whose aim is to discover the hidden thematic structure in large archives (Blei, 2012). Here, a python library is adopted to process these comments. It mainly includes two part, convert the segmented words to vectors and Latent Dirichlet allocation (LDA) (Blei et al., 2003). Three topics were generated after displaying of topic model for each text (positive and negative). In addition, this method is also implemented on different subjects' evaluation discourse to explore the diversity among subjects.

3. Results

As Figure 1 shows, frequently used words in whole evaluation discourse are 'conscientious', 'listen', 'take class' and others, from which can be concluded that most teachers focus on students' class performance (speech, presentation, participation). Meanwhile, the term 'handwriting' is frequently used which indicates writing legibly can leave a good impression on teachers. Actually, a few words can be related to the framework of 21st century skill, such as 'presentation', and 'participation'.

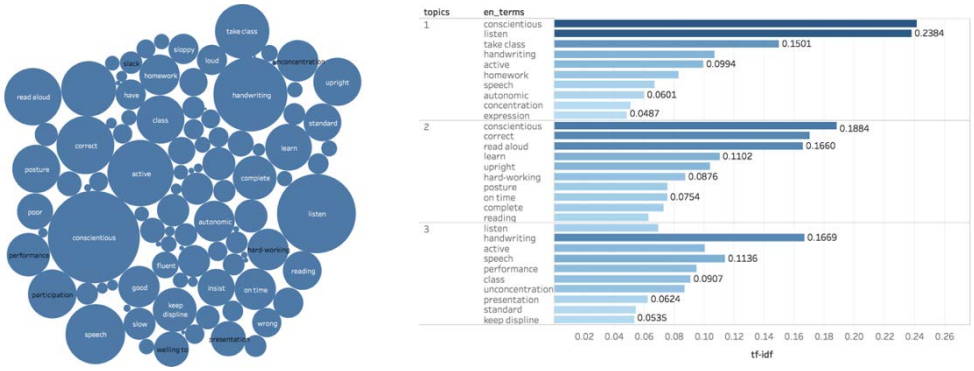

Figure 1 (left). High frequency words in general (left). Three topics and the high frequency words in each topic (right)

In the positive text (red bubbles in Figure 2, left), high frequency words are 'listen', 'read', 'performance', and etc.; In the negative text (green bubbles), high frequency words are 'speech', 'listen', 'homework' and etc. Thus, there is no significant difference with the general text in wording. However, the difference between the positive and negative text can be concluded as the quantity and richness. In the dataset, 958,442 comments are tagged with positive label, the rest 33,537 comments are negative, which illustrates teachers are inclined to make more encouraging evaluation. As for the richness of comments, teachers make subtler expression, such as 'participation', 'presentation', 'performance' in positive text.

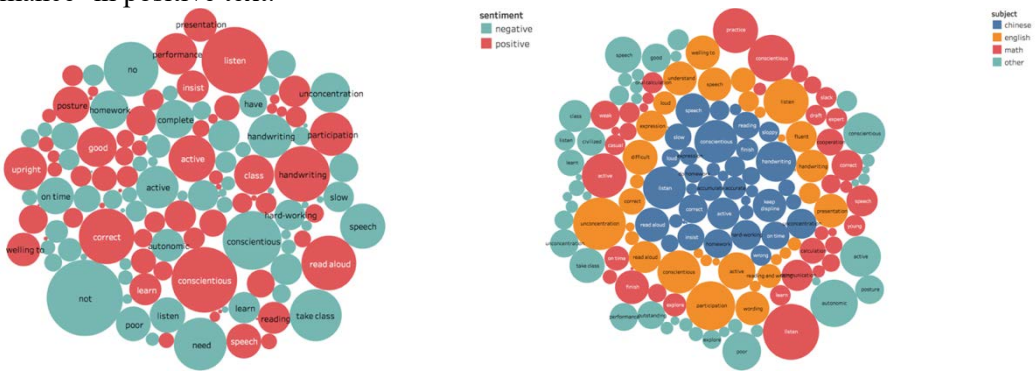

Figure 2. High frequency words in positive comments and negative comments (left). High frequency words in different subjects (right).

Discourse varies from the subjects which indicates different focuses when teachers making comments. In Figure 2 (right), we show the frequently used terms in three topics with different subjects. For Chinese and English class, teachers focus on fostering students' listening, speaking, reading and writing ability. In math classes, some new words raise up, like 'explore', 'cooperation', and others. The

word ‘cooperation’ can refer to the *collaboration skills* in 4Cs, ‘explore’ can be part of *critical thinking and problem solving skills*; In other subjects (Science, PE, Nature, etc.), words about class performance and attitude are frequently used, which may imply that teachers in these classes pay more attention to classroom rules.

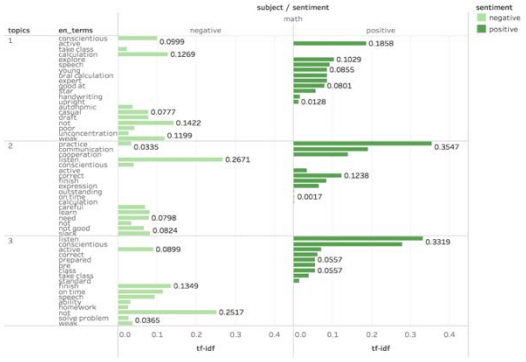

Figure 3. Three topics in Math teachers’ comments

As shown in Figure 3, three topics are generated by topic model with math teacher’s positive comments. In the first topic, except sentiment words, ‘explore’, ‘calculation’ frequently arise which we can name this topic as math ability; for the second topic, the frequency of ‘practice’ are prominent, followed by other words, like ‘communication’, ‘cooperation’, thus this topic can be descripted as communication and cooperation ability; In topic 3, we found ‘listen’, ‘conscientious’, ‘active’ are the most frequently used words, so that we can label this topic as learning attitude. Therefore, teacher evaluation discourse in math subject mainly involves three parts: math ability, attitude, communication and cooperation ability. With this method, all subjects can be summarized into three topics which will facilitate the extraction of main information from abundant content.

4. Conclusions

In this study, we investigated teachers’ comments to be aware of current situation of student evaluation. Results are discussed from three aspects. In general, class performance, completion of homework and subject literacy are still the main evaluation indicators in most class. Meanwhile, teachers are found to make more encouraging(positive) comments to student. In comparison with other subjects, Math is a more comprehensive discipline which manifests the *collaboration skills* and *critical thinking and problem solving skills* in 4Cs. However, a large quantity of comments did not follow the trend of 21st century skills. In this context, some advanced criterion should be set to make pluralistic evaluation. Teachers can build new evaluation system based on the 21st century skills framework.

References

Blei, D. M., Ng, A. Y., & Jordan, M. I. (2003). Latent dirichlet allocation. *Journal of machine Learning research*, *3*(Jan), 993-1022.

Blei, D. M. (2012). Probabilistic topic models. *Communications of the ACM*, *55*(4), 77-84.

Black, P., & Wiliam, D. (2010). Inside the black box: Raising standards through classroom assessment. *Phi Delta Kappan*, *92*(1), 81-90.

Dong, Z., & Dong, Q. (2000). Introduction to hownet. *HowNet, http://www. keenage. com*.

Germaine, R., Richards, J., Koeller, M., & Schubert-Irastorza, C. (2016). Purposeful Use of 21st Century Skills in Higher Education. *Publication of National University*, *19*.

Iwata, T., Watanabe, S., Yamada, T., & Ueda, N. (2009, July). Topic Tracking Model for Analyzing Consumer Purchase Behavior. In *IJCAI* (Vol. 9, pp. 1427-1432).

Voogt, J., Erstad, O., Dede, C., & Mishra, P. (2013). Challenges to learning and schooling in the digital networked world of the 21st century. *Journal of computer assisted learning*, *29*(5), 403-413.