An Exploration on the Influence of Emotion Words for SAT Essays for Chinese Students

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Abstract. Nowadays, studying oversea has received extreme favor in China and Chinese students who intend to study overseas in a high ranking university require more than a passing grade on their SAT writing test. However, researches on the factors that affect the score of the SAT essay for Chinese students were not enough and the researches based on sentiment analysis were even less. In this study, sentiment analysis is applied to the gathered SAT essays to explore the sentimental features of Chinese students in SAT essay from the point of sentiment polarity. In more details, word level will be the target of sentiment analysis in this paper, suggesting that the paper focuses on the emotion of each single word in the essay, that is to say, emotion words. Sentiment polarity generally refers to the negative, positive and neutral, which are corresponding to negative words, positive words and neutral words. A set of 570 Chinese students SAT writing corpus was included as the data source and after data processing, descriptive analysis and Pearson correlation coefficient are employed to analyze the text. It concludes that for Chinese students positive words are used more frequently and the positive correlation between the number of emotion words and essay score reveals that using more emotion words will improve the scores of SAT essay.

Introduction

As studying abroad becomes more and more popular in china, many students try their best to apply for foreign universities for further study, and American universities are the preferred ones. The National Bureau of Statistics of China said almost 460,000 Chinese students chose to study overseas in 2014 and the trend continued. Meanwhile, SAT (Scholastic Assessment Test) is one of the most widely utilized college admission tests in the United States. The research of the College Board in 2015 shows that there are 211,238 Asians participating in the SAT test and accounts for about 12% in the whole participants. According to the online test preparation company, ArborBridge, it was estimated that around 55,000 Chinese students participated in the SAT test in 2014, with testing numbers ever increasing. This has led to 328,547 Chinese students studying in the USA for 2016.

The SAT writing section, which is added to the SAT in March 2005 and became an optional, but still an indispensable part of the SAT since the reform in 2016, includes both multiple-choice items and an essay. The essay writing tests a student’s ability to write effectively in response to an issue provided with a prompt. The evaluation of the SAT essay is comprehensive with a lot of aspects into consideration. The College Board lists the following items what will be referred to when graders rate those essays: the development of a point of view, the logical presentation of ideas, clear reasoning sustained focus, appropriate choices of evidence, skillful coherence, effective organization, precise use of language and engagement with the reader. Except those semantic features, additionally, some other attributes easy to quantify were put forward, such as essay length which is referred most frequently, widely accepted readability index, vocabulary features (Olinghouse & Wilson, 2013) [1] and so on.

For the fact that seldom researches paid attention to the sentiment of the essay, this paper quantified the sentiment of the essay based on the emotion words in each essay and explored whether there is a relationship between the sentiment and the essay score for the Chinese students. With the intention, 572 Chinese students who intended to take SAT essay test participated and 571 essays were
collected as data source. For that NRC (National Research Council Canada) Emotion Lexicon is a well-accepted dictionary and identifies each word with sentiments (positive and negative) and eight basic emotions (anger, fear, anticipation, trust, surprise, sadness, joy, and disgust), NRC Emotion Lexicon was used as a tool to quantify the emotion words.

Literature Review

Many researches have proposed many features related to the SAT essay score, such as sustained focus, precise use of language, the development of a point of view, skillful coherence, the logical presentation of ideas, clear reasoning, appropriate choices of evidence, effective organization, and engagement with the reader, according to College Board. However, some criticisms have been leveled at the SAT essay by critics, including: handwriting (Setoodeh, 2005) [2], the sophistication of examples (Skutches, 2005) [3], essay length (Winerip, 2005) [4], and the essay prompt topic (Baron, 2005) [5]. More specific of which is that they reward essay length over content when scoring the essays in college admission. It is important to note that many studies on the relationship between word count and essay score have found there to be a significant positive relationship between the two, with correlations in the .60s–.70s (Mattern, Camara, & Kobrin, 2007)[6]. Kobrin et al. (2011) [7] coded some essays on all kinds of features regarding their length and content to find the relationship of prompt characteristics and response features with essay scores. The results indicated that essay length was related to scores, but the correlation was not nearly as high as previous critics had claimed.

Additionally, in essay scoring, the vocabulary usage has been regarded as one of significant criteria, which is closely related to composition score. Generally acknowledged, the application level of automatic scoring system E - rater in vocabulary as a rating factor of composition score, high scores of the composition part usually behaves better than low scores of the part in the aspect of vocabulary usage, and human raters who rank selected sentence from a composition is more fastidious than a poor vocabulary usage composition score. While few researches focused on the emotion words. In this paper, emotion words are the main concerns with sentiment analysis employed.

According to Wikipedia, sentiment analysis means that applying natural language processing, text analysis, computational linguistics, and biometrics to variable contexts, such as the reviews of the movie (Bo & Lee, 2004)[8], posts on the social media (Agarwal, Xie, Vovsha, Rambow, & Passonneau, 2011) [9] and so on. In this paper, the sentiment polarity is noticed intensively. NRC Emotion Lexicon (also called NEL for short in the following text) is included as the tool to identify the polarity of each word, which is created in Amazon's Mechanical Turk, a crowdsourcing platform and consists of 14200 words. Moreover, each word in the NRC Emotion Lexicon is identified with not only negative or positive polarity, but also eight basic emotions (anticipation, trust, surprise, disgust, sadness, joy, fear and anger)

Methodology

Data Collection

Within this research, 570 Chinese students participated and were given different essay prompts casually. The essays were ranked by two graders following the SAT essay scoring regulation and the final score would be the sum of two graders’ given score. In the end, 570 essays were written out and entered into the computer.

To ensure the research reasonable and meaningful, the gotten SAT essays should be checked if there is grading errors, data entering errors or others. The Java language is used based on Eclipse to split every essay into single words and counting up the number of words as essay length for every essay. With the result of box-plot with the SPSS package as a reference, manual inspection marked five essays unusual, which were due to the data entering error and punctuation lost. In the end, 565 SAT essays were proved to be credible being the research data source.
In this study, MSSQL 2008’s full-text search function is used to store the NRC Emotion Lexicon and query the data when T-SQL statement is a SELECT statement. With the help of MSSQL 2008, the inflected forms of a word were analyzed as a single item and got the same index result. Moreover, to explore the role of emotion words in SAT essay score, the emotion words were quantified and if the emotion word appeared multiple times, then the word were quantified multiple times. Therefore, each emotion word in every essay was marked with the sentiments (positive and negative) based on the structure of the NRC Emotion Lexicon. Part of the result was shown in Table 1. After tagging the words, the raw result for each essay was aggregated and part of the aggregated result was shown in Table 2.

### Table 1. Example of raw result data.

| ID    | Word   | NELWord | positive | negative |
|-------|--------|---------|----------|----------|
| 10001 | external | external | 0        | 0        |
| 10001 | constrains | constrain | 0        | 1        |
| 10001 | put | put | 0 | 0 |
| 10001 | work | work | 0 | 0 |
| 10001 | heart | heart | 0 | 0 |
| 10001 | person | person | 0 | 0 |
| 10001 | lacked | lack | 0 | 1 |
| 10001 | answer | answer | 0 | 0 |
| 10001 | agreed | agree | 1 | 0 |

### Table 2. Example of aggregated result.

| ID    | Score | num_all_word | num_NEL_Word | positive | negative |
|-------|-------|---------------|---------------|----------|----------|
| 10001 | 28    | 274           | 110           | 27       | 2        |
| 10002 | 28    | 292           | 100           | 32       | 4        |
| 10003 | 34    | 295           | 114           | 28       | 5        |
| 10004 | 24    | 294           | 91            | 28       | 5        |
| 10005 | 22    | 220           | 74            | 18       | 8        |
| 10006 | 31    | 341           | 106           | 25       | 7        |
| 10007 | 28    | 280           | 77            | 21       | 7        |
| 10008 | 32    | 352           | 100           | 30       | 3        |
| 10009 | 32    | 294           | 84            | 31       | 5        |
| 10010 | 40    | 473           | 137           | 27       | 8        |

Note: “ID” is the identification of each essay; “Score” means the essay score; “num_all_word” is the number of words in each essay, including emotion words and non-emotion words, which is also called essay length; “num_NEL_words” is the number of emotion words for each essay. “positive” represents how many words of each essay are of positive sentiment, between the emotion words; “negative” represents how many words of each essay are of negative sentiment between the emotion words.

### Data Analysis

The data analysis includes descriptive statistic, correlations between all the variables—score, essay length, the number of words of NRC Emotion Lexicon and the words’ sentiments and eight basic emotions—and linear regression analysis to probe into the degree of relationship among variables with SPSS package employed. For that essay length is not under control and has a strong relationship with score as previous studies suggest, length was put as the control variable in the SPSS package when analysis was done.

### Results

Table 3 shows the comparison of positive words and negative words used in the 565 essays. “total_word_num” means the total number of positive and negative words in the NRC Emotion Lexicon for all research essays and it is to say that 11,905 positive and 4198 negative words were used in the 565 essays. The row “more_words” means that for 565 essays, only 30 of them have more...
negative words than positive one and the left are adverse. In summary, more positive emotion words rather than negative emotion words are applied in the Chinese ESL students’ essay.

Table 3. Positive and negative usage comparison.

|                  | num_NEL_positive_word | num_NEL_negative_word |
|------------------|-----------------------|-----------------------|
| total_word_num   | 11905                 | 4198                  |
| more_words       | 535                   | 30                    |

Table 4 shows the descriptive statistics of essay score, number of essay words, number of stop words and number of NLE words. As the table 4 shows, every essay has an average of almost 80 NLE words (SD=33.84), accounting for 33% of the essay.

Table 4. Descriptive statistics of essay score, length, number of stop words and NRC words.

|                  | N       | min | max | mean    | Standard deviation |
|------------------|---------|-----|-----|---------|--------------------|
| Score            | 565     | 5   | 66  | 29.79   | 11.958             |
| num_all_word     | 565     | 42  | 659 | 240.52  | 96.455             |
| num_NEL_Word     | 565     | 13  | 219 | 79.89   | 33.842             |

Table 5. Correlation with SAT essay score.

| variable          | Correlation with SAT essay score | Pearson Correlation | Sig. (2-tailed) | Partial correlation | Sig. (2-tailed) | N    |
|-------------------|----------------------------------|---------------------|-----------------|--------------------|-----------------|------|
| NLE_words         |                                  | .628                | .000            | .162               | .000            | 565  |
| word_count        |                                  | .620                | .000            |                    |                 | 565  |

Note: * The partial correlation controls for SAT essay score.

The more words the essay has, the more possible the essay has more NLE words. For example, if the essay only has 30 words, it is impossible that the essay contains 31 NLE words. Additionally, Pearson correlation between essay length and essay score is 0.62 (p is under 0.05) which implies a strong relationship with them. Since essay length is out of control and related, it was used as covariates. The partial correlation between the number of NLE words and essay score was 0.162 and p value was under 0.05 which suggested its significance.

Summary

In this section, the research questions will be restated to arrive at an appropriate conclusion. The paper aims to explore whether there is a relationship between emotion words and writing for Chinese EFL learners. 570 candidates for SAT essay were included as participants and 565 essays were collected and screened. NRC Lexicon Emotion dictionary was taken as research material and every word in NRC Lexicon Emotion is describe into eight basic emotions (anger, fear, anticipation, trust, surprise, sadness, joy, and disgust) and two sentiments (negative and positive). Descriptive analysis and partial analysis were employed and analysis result insisted that emotion words are strongly related to essay score for some reasons, maybe for that they affect students’ writing quality or the graders’ grading process.

With data statistic of the number of emotion word and the word’s sentiments, the research found that Chinese students use more positive words than negative one in writing, just like what they do in speaking (ZHENG & Yu-rong, 2017)[10]. With regard to the second questions which were about the relationship between the number of emotion words and essay score, it can be concluded that the number of emotion words is positively related to the essay score which indicates that using more emotion words can improve essay score and advises students to use more emotion words to convey their emotion.

There are some obstacles which will be noticed in the future research. In this research, gender got no attention, while it has been insisted that gender is a key variable to determine the emotion word usage (ZHENG & Yu-rong, 2017) [10] and that male learners tended to use more feeling and emotion vocabulary than female learners in their written L2 productions (Babanoğlu, 2015) [11].
another study held the view that there is no significant gender differences (Ożańska ponikwia, 2015) [12]. About the gender, many arguments existed and it will be of vital importance for the future research to include the gender as a variable. Last but not least, the sentiment analysis based on the essay can be extended for that NRC Emotion Lexicon identified each word with not only sentiment (positive or negative) and eight basic emotions (anticipation, trust, surprise, disgust, sadness, joy, fear and anger). Since the research has revealed the positive role of emotion words, the future research will explore more from the point of each basic emotion.

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References
[1] Olinghouse, N.G., & Wilson, J. (2013). The relationship between vocabulary and writing quality in three genres. Reading & Writing An Interdisciplinary Journal, 26(1), 45-65.
[2] Setoodeh, R. (2005). Penmanship, the newest SAT worry. Newsweek, 145, 11-48.
[3] Skutches, G. (2005). New SAT essay format is “teaching to the test,” not teaching writing, critical thinking [Opinion]. The Morning Call, D1.
[4] Winerip, M. (2005). SAT essay test rewards length and ignores errors. New York Times, 9.
[5] Baron, D. (2005). The College Board’s new essay reverses decades of progress toward literacy. The Chronicle of Higher Education, B14.
[6] Mattern, K., Camara, W., & Kobrin, J. L. (2007). SAT ® Writing: An Overview of Research and Psychometrics to Date. College Board.
[7] Kobrin, J.L., Deng, H., & Shaw, E.J. (2011). The association between SAT prompt characteristics, response features, and essay scores. Assessing Writing, 16(3), 154-169.
[8] Bo, P., & Lee, L. (2004). A sentimental education: sentiment analysis using subjectivity summarization based on minimum cuts. Paper presented at the Meeting on Association for Computational Linguistics.
[9] Agarwal, A., Xie, B., Vovsha, I., Rambow, O., & Passonneau, R. (2011). Sentiment analysis of twitter data. Paper presented at the Proceedings of the workshop on languages in social media.
[10] Zheng, & Yu-rong. (2017). A Study on Chinese English Learners' Use of Emotion Words. Sino-US English Teaching (3), 169-174.
[11] Babanoğlu, M.P. (2015). A Corpus-Based Study on the Use of Feelings and Emotions Vocabulary by Male and Female EFL Learners. 3(4), 203.
[12] Ożańska ponikwia, K. (2015). Are women more emotionally skilled when it comes to expression of emotions in the foreign language? Gender, emotional intelligence and personality traits in relation to emotional expression in the L2. International Journal of Bilingual Education & Bilingualism, 1-13.