Empirical Study on Teaching Effectiveness Using English Medium Instruction for Non-English Major Student—A Case Study of a Statistics Course

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Abstract. English medium instruction is one of the tools for higher education internationalization in China. The paper will take a statistics course as a case study to identify the influencing factors that would affect the English teaching effectiveness. The results from a regression analysis indicate that the learning attitude, i.e. students’ willingness to read teaching materials before or after class, overall learning capability, here refer to GPA, and the mathematical background of the students are significant factors on teaching effectiveness at significant level of 1%, 3% and 6% respectively. While the students’ capability in English learning, i.e. students have already passed College English Test Band 4 (CET4), and students have already learned other courses taught in English before this statistics course, are not significant factors on English teaching effectiveness.

Introduction

English medium instruction is referred to using textbook in English version, teaching material written in English, lecturing and evaluation in English for non-English major students when teaching core courses. In 2001, The Chinese Ministry of Education (CME) released a document of several options on further improving the teaching quality for undergraduate program, and encouraged bilingual teaching in colleges and universities. Since 2007, there are 100 courses were taught in English, demonstrated and certified by CME in order to promote the use of English medium instruction and increase the college teaching quality. According to Shanghai Municipal Education Commission (SMEC), Shanghai will open a resource-shared system for courses registration. The international students in Shanghai are able to take courses cross different universities and also get credits recognized by each school through the system. In 2015, SMCE has sponsored 153 projects of college courses taught in English for international students in Shanghai, and each project lasts two years for experimentation. The projects aim to encourage the international communication between college students in Shanghai and abroad, and facilitate various cooperation between universities in Shanghai and abroad. The course projects also intend to improve Chinese students’ capability in English and their professional innovation. Since the courses taught in English face more challenge than the courses taught in Chinese for Chinese students, it is critical to identity the key factors that help to increase the teaching effectiveness of courses taught in English, which will be practical to provide suggestions on further promotion of internationalized for all college courses.

The applied statistics is a required course with 3 credits, offered for students major in economics or in management. Currently, there are two options for teaching the course, under option 1 the course will be taught in Chinese as usual, under option 2 the course will be taught in English, which requires the lecturer using English version textbook, PPT and tests. Normally, the prerequisites for both options are the same, the students who register for applied statistics must have taken the courses of calculus, algebra and probability. In addition, the students are required to have certain capability in English comprehension in order to take course taught under option 2, such as already have the certificate of CET4. For those who do not passed CET4, students are suggested to choose option 1.
The book of Elementary Statistics, widely used by many Colleges and Universities in U.S.A, is the required textbook for option 2. The reasons for choosing this book are because: i) the definition of key concepts and guidelines for problem solving are listed after each chapter; ii) exercises for each section and quiz for each chapter; iii) examples after each important concept or method for demonstration purpose, and try it yourself after each example for practice purpose. For course evaluation, class performance accounts for 40%, including homework, question in class and attendance, mid-term accounts for 20%, and final exam accounts for 40%, while all exams are closed book test.

Data and Model Specification

Data for analysis in this paper is from a survey collected in spring semester of 2017, and the students who answered the questions are sophomore major in international trade. The survey is designed to ask questions about the students’ capability in English comprehension and math, and students' overall academic performance, such as GPA. There were 98 questionnaires has been collected in total, among which 5 objective questions and 1 open questions are used for the empirical analysis in this paper. The major questions and their answers are summarized in Table 1.

Table 1. Major Questions in the Survey.

| No. | Question                                                                 |
|-----|--------------------------------------------------------------------------|
| 1   | Have you passed the College English Test Band 4 (CET4)?                  |
| 2   | Please list the names of courses you have registered that are taught in English |
| 3   | What is your best score for math?                                        |
| 4   | What is your average GPA for first year in college?                      |
| 5   | What are your major difficulties for taking statistics course taught in English? (multiple choice) |
| 6   | What would you suggest for further improving teaching effectiveness?      |

Regarding to question#5, most of students, i.e. 75.5% of 98 students believe that English capability is the biggest obstacle for learning statistics taught in English. The 2nd biggest difficulty for learning statistics taught in English is the teaching content of statistics course itself. The answers to question#5 are summarized in Table 2.

Table 2. Summary of Answers to Question 5.

| Reason                                      | # of students | Frequency(%) |
|---------------------------------------------|---------------|--------------|
| Students’ English capability                | 74            | 75.5%        |
| Statistics course is difficult              | 64            | 65%          |
| Teaching approach used by lecturers is not interesting | 12            | 12.2%        |
| Other reason                                | 11            | 11.2%        |

Six variables will be used for regression analysis, i.e. STAT, CET4, NB2, MATH, GPA and PDF. STAT is the explained variable, using the final score of 2017 spring semester for statistics taught under option 2 to measure the teaching effectiveness. The rest of five variables are the explanatory variables. CET4 is a binary variable, value of which is one suggests that the student already passed college English test, otherwise will be zero. NB2 is the number of courses taught in English that each student has already taken before taking statistics. Both variables of CET4 and NB2 are the indicators measuring students’ capability in English. MATH is a variable that measures students’ capability in math, using the best math score that student has ever had for the first year in college. GPA is the variable that describes students’ overall academic performance in college for the first year. PDF is a variable that describes students’ motivation of self-learning, and the length of time that students spend online for reading the teaching material is used from the record of school's EOL system. The descriptive statistics about all variables used for regression analysis in this study is summarized in Table 3.
To identify the key factors that affect the students’ academic performance in learning statistics, a multiple linear regression was run in Stata SE 13.0 and Ordinary Least Squared (OLS) method was used for estimation of Eq.1 as following:

$$STAT = a_0 + a_1 \times CET4 + a_2 \times NB2 + a_3 \times MATH + a_4 \times GPA + a_5 \times PDF$$

To assure the unbiasedness and efficiency of OLS estimation result [1], Variance Inflation Factor (VIF) was used for detecting multicollinearity and Breusch–Pagan (BP) test was used for detecting heteroscedasticity. The average value for VIF was 1.55, and maximum value of VIF is 2.33, far less than 10, suggesting the multicollinearity problem probably does not exist. The lagarangian multiplier (LM) test statistics of BP test was 33.93 with p-value close to zero, suggesting there was sufficient evidence to believe that heteroscedasticity problem does exist in the regression. Since the specific structure of heteroscedasticity problem was unknown, the feasible generalized least square (FGLS) method can not be used. Therefore, in order to assure the consistency and efficiency of estimation, the robust standard errors for each estimated coefficient were reported and used for test on significance of single coefficient. There were 94 observations used for regression, R-squared was 0.5249, suggesting overall fitness of the regression was good. The regression results were listed in Table 4.

### Empirical Results

In the regression, the coefficients of the explanatory variables of CET4 and NB2, which describe students’ capability in English are insignificant. This finding seems contradictory to the common belief that English level is the most important factor on teaching effectiveness for courses taught in English. The coefficients of explanatory variables of MATH, GPA, and PDF are statistically significant at 10%, 5% and 1% respectively.

**English Capability**

From the perspective of descriptive statistics, over 75% of the students responding to the survey believed that poor English capability prevents them from taking courses taught in English. It seems that the students’ English capability is the most important factor for English teaching effectiveness. But based on the theory of inferential statistics, the p-values of estimated coefficients of CET4 and NB2 are 0.12, greater than 0.05 significant level. The regression results suggest that the final grades of students who passed CET4 were not significantly higher grades than the grades of those who did not passed CET4 for statistics course. Similarly, the number of bilingual courses students have taken before taking statistics did not help to increase their final grade of statistics course. Probably, because
98% of students who took the statistics course already passed CET4 in the survey, the variability in term of English capability among the students was negligible, the significant impact of English capability on teaching effectiveness was not be found.

Math Capability
Mathematics are the prerequisite courses before taking statistics, no matter which teaching option has been chosen. The estimated coefficient of MATH had positive sign and was statistically significant with p-value of 0.06. It suggested that better understanding in math did have positive and significant impact on students’ performance in statistics course. Prerequisite on math capability becomes the 3rd important factor on teaching effectiveness of statistics course. For those who have problems in understanding algebra and probability, it is impossible or very difficult to understand new knowledge of applied statistics.

Learning Capability
The 2nd important factor is students’ overall learning capability (GPA), which is consistent with common sense. The estimated coefficient of GPA was positive and statistically significant at 6% s. It implied that those students who were good at learning for the first year in college, were also good at learing statistics course taught in English.

Learning Motivation
Students’ self-learning motivation, indirectly represented by the variable PDF, was found to be the most important and significant factor on students’ performance in statistics course. The estimated coefficient of PDF was positive and statistically significant at 1% from the regression. Also a t-test of two samples with different variances was used to examine the difference between students who did not read the posted teaching material (hereinafter as group 1) and those who did read the posted teaching material (hereinafter as group 2) in term of average test score in statistics. Group 1 had 47 students, whose average test score was 78.86. Group 2 had 52 students, whose average test score was 83.28. The difference in average test score between these two groups were statistically significant. The significant test on the single coefficients from the regression was consistent with the t-test statistics on significant difference between group 1 and group 2: the more self-motivated students were likely to achieve better academic performance, since they spent more time on the course with positive attitude toward learning.

Conclusion
Couple things could be done to improve the teaching effectiveness when using English medium instruction. First, encouraging students spend more time on reading before or after class. In the regression, PDF is a variable that indirectly reflects students ‘self-motivation and learning attitude. For instance, in order to stimulate students’ motivation, the lecturer could post teaching material online for every chapter before each class, or give students some credits for browsing or downloading the posted teaching material, or stimulate students’ learning interest by connecting statistical theory with the real problems in daily life. Secondly, prerequisites are the must for anyone who wants to take a new course at higher level. In this case study, MATH and English capability are pre-required for taking the applied statistics course taught in English. For any course, students who do not meet the prerequisites will not allow to register the new course [2]. Thirdly, English capability is an indispensable factor for any course that will use English medium instruction, although no evidence was found to support the idea in this case study. The reason is probably that the significant difference in term of English teaching effectiveness could only be found for those who are at initial level of English capability, but not for those who have medium or higher level of English capability [3].

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Reference

[1] J. Wooldridge Introductory Econometrics: A Modern Approach. 5th ed., Cengage Learning, 2012. pp. 94, 267.

[2] Li-zhi Cui. Thoughts about Enhancing the Teaching Quality of Applied Statistics. Journal of Anhui Industry University of Technology (Social Science Edition). 2012(1):114-115.

[3] Ming-li Yu. The Impact of English Capability at Lower Level on Teaching Effectiveness of English Medium Instruction. Foreign Language in China, 2011, 8(3):74-81.