資料包絡分析法在評估 EMI 教學之應用

Application of Data Envelopment Analysis method in evaluating EMI teaching

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摘要

隨著全球發展趨勢，台灣近年開始推行雙語教學，導致各個教學機構增設全英語授課（EMI）課程。 本研究運用資料包絡分析法（DEA），以台灣東部某大學資訊工程系修讀 EMI 課程的學生為研究對象，評估 EMI 課程對學生學習成果的有效性。 透過對問卷調查所獲得的數據進行分析和解釋，本研究旨在為加強 EMI 環境中的教學實踐提供見解。

關鍵字：全英語授課(EMI)，雙語教學，資料包絡分析法(DEA)，效率評估

Abstract

In line with global trends, Taiwan began to promote bilingual education, leading to the proliferation of English-Medium Instruction (EMI) courses across diverse educational institutions. By applying the data envelopment analysis (DEA) method, this study evaluates the effectiveness of EMI courses on student learning outcomes by studying students taking EMI courses in an information engineering department at a university in eastern Taiwan. Through analysis and interpretation of data obtained from questionnaire surveys, this study aims to provide insights into enhancing teaching and learning practices in EMI environments.

Keywords: **English-Medium Instruction (EMI), Bilingual Education, Data Envelopment Analysis (DEA), Efficiency Assessment**

Introduction

EMI teaching is defined as "The use of the English language to teach academic subjects (other than English itself) in countries or jurisdictions where the first language of the majority of the population is not English." (Macaro, Akincioglu, & Han, 2020) As Taiwan promotes bilingual teaching, universities have also begun to offer various professional courses with English as the intermediate language. In addition to English proficiency, factors such as teachers' teaching methods, students' learning methods, and course types may also affect the efficiency of EMI courses. DEA provides a systematic framework for evaluating the effectiveness of decision-making units (DMUs). This analytical approach allows for a comprehensive assessment of the performance of these entities by considering multiple inputs and outputs, resulting in a nuanced understanding of their operating efficiency and effectiveness in achieving expected results. Therefore, this study uses questionnaires combined with data envelopment analysis to analyze students' satisfaction and performance in several types of EMI courses and considers factors such as students' English proficiency, learning methods, and course teaching methods. It aims to provide information on the correlation between the efficiency of EMI courses and its influencing factors.

Literature Review

Li used questionnaires and Likert scales to evaluate the learning effects of EMI and found that students mainly use English in class but mainly communicate in Chinese in private, and students have a positive attitude towards teachers using a mixed teaching model of Chinese and English in class (Li, 2022). Banker, Charnes, and Cooper proposed the BCC model in 1984, the BCC model can process multiple inputs and outputs to obtain maximum output(Banker, Charnes, & Cooper, 1984). Montoneri, Lee, Lin, and Huang used the BCC model to evaluate English writing learning performance. Each student represents a DMU to analyze learning efficiency and concluded that learning performance is highly positively correlated with teaching skills. (Montoneri, Lee, Lin, & Huang, 2010).

Methodology

The main purpose of this study is to evaluate the effectiveness of students' EMI courses in the field of computer science and to observe whether other factors affect

students' learning satisfaction and performance.

Participants: The research sample was 67 students who studied in the EMI course offered by the Information Engineering Department of a university and filled out the questionnaire. Participants were selected based on enrollment in EMI courses in different courses, including mathematics, algorithms, software engineering, etc.

Data Collection: Questionnaires were collected from students in the spring semester of 2023. The questionnaire design is mainly quantified using the Likert scale, including the questionnaire proposed by Li in 2022 (Li, 2022) and the questions designed by the researcher based on the Felder Silverman learning/teaching style model (Felder, 1988).

Data Analysis: The collected survey data will first be calculated with descriptive statistics. BlackBox DEA was then conducted to analyze the efficiency scores and explore the relationship between several factors.

Result and Discussion

According to the overall black box DEA efficiency score, all students' efficiency scores are greater than 0.7, and 26 DUMs are relatively efficient, as shown in Figure 1 and Table I. By course category, the embedded systems course has the highest efficiency scores, followed by image processing, mathematics, and computer science and programming is the lowest. When courses are divided into elective courses and compulsory courses, students have higher efficiency scores in elective courses.

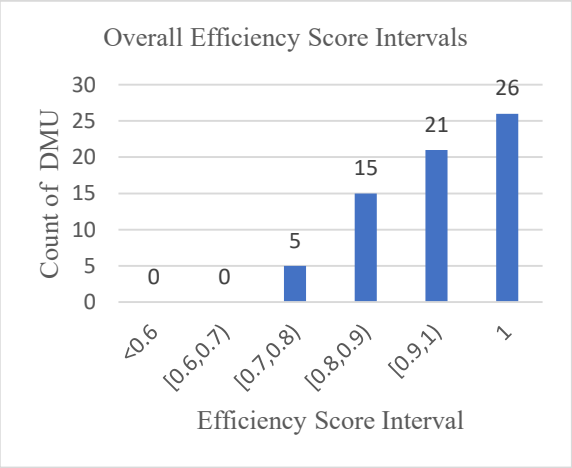

Figure 1. Overall Efficiency Score Intervals

Table I. Overall Efficiency Score Intervals

Overall Efficiency Score Intervals	
Efficiency Score Interval	Count of DMU
<0.6	0
[0.6,0.7)	0
[0.7,0.8)	5
[0.8,0.9)	15
[0.9,1)	21
1	26

Future Study and Conclusion

Future studies could consider adding students, more types, or EMI courses in other fields. In conclusion, this study has the same results as Montoneri, Lee, Lin, and Huangs' study in that there is a positive correlation between learning performance and teaching skills. The students' frequent use of English in class and Chinese in private and students' positive attitude toward mixed use of Chinese and English are the same as those found in Li's study. Furthermore, this study found that students' efficiency scores in elective courses were higher than those in required courses.

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