English Teaching Evaluation Model Based on Analytic Hierarchy Process

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Abstract. English teaching is a worldwide and essential education component for human society and talent innovation system. Therefore, the correct evaluation for English teaching methods has become a necessary condition for education system and can assist the supervisors to adjust the education methods to reach more excellent impacts. Currently, existing evaluation methods including machine learning methods, neural network and deep learning to quantify the performance of English teaching. However, these learning methods are limited to analyze complex situations with different teachers and students, which is also a black-box for analyzing the detail reasons that causes the evaluation results. In this paper, we utilize the analytic hierarchy process to evaluate the English teachings and assist the students to improve grades while learning English. Initially, we select the indicators that can affect the English teaching and utilize the collected data to measure the hierarchies of these indicators to obtain an analytic hierarchies process model. Subsequently, we simulate the established model with testing data to investigate the most important indicators with detail accuracy. From our extensive experimental results and comparison performances, we can conclude that our proposed model can investigate the most influence parameters with acceptable identification accuracy.

Keywords: English Teaching Evaluation · Analytic Hierarchies Process · Evaluation indicators · Accuracy Performance

1 Introduction

English teaching has become a vital component in education system around the world. English is widely spoken and utilized as a global language of communication in fields including business, science and technology [1]. The ability to utilize English fluently can open up numerous opportunities for individuals including obtaining better job prospects, academic success and cultural exchange chances. As a result, English has become a core

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subject in many educational systems with teachers seeking innovative methods to engage students and improve their language proficiency and levels [2]. Currently, there are still containing the evaluation challenges that the teachers face, which is the issue that the latest trends and technologies can not dispose in evaluation English teaching including the reasons of evaluation models, evaluation methods and explorations [3].

The analytic hierarchy process is a decision-making tool that has gained widespread utilization in various fields including business, engineering and social sciences, which is developed by Thomas [4]. The analytic hierarchy process provides a structured approach to decision-making that takes into account multiple criteria and their relative importance. The method involves breaking down complex decisions into smaller, more manageable components and evaluating each component based on a set of criteria [5]. Analytic hierarchy process can assist decision-makers to prioritize and weigh different criteria, enabling them to make informed decisions that align with their objectives. In this paper, we will explore the analytic hierarchy process utilization in English teaching evaluation and illustrate the underlying principles of the method. We will also discuss the benefits and limitations of analytic hierarchy process.

In this paper, we utilize the analytic hierarchy process to achieve the English teaching evaluation model for students and supervisors to provide a visible evaluation model. Our primary contributions is summarized as follows:

- We initially utilize the analytic hierarchy process to extract the important indicators that can affect the English teaching performance. The extracted indicators are validated effectiveness through the extensive simulation results.
- Our proposed model is a white-box, which means the inner process is available and can be extended into other evaluation systems. The evaluation process can be quantified.

In reminder of this paper, the content will be primary organized with 5 sections. Initially, an introduction about background knowledge and related evaluation method is presenting in Sect. 2. The structure of proposed analytic hierarchy process evaluation model is presented in Sect. 3. Subsequently, Sect. 4 will provide the detail experimental information and evaluation results. Finally, Sect. 5 will summarize the proposed evaluation model and provide possible future improvements methods.

2 Background and Related Methods Introduction

In this section, we introduce the background knowledge about English teaching evaluation and analytic hierarchy process. Subsequently, several relative contributions by previous researchers are illustrated.

2.1 Background Knowledge

Evaluation is a critical component of English teaching as it enables teachers to assess the effectiveness of their teaching methods and identify areas for improvement. English teaching evaluation can take many forms including tests, exams and classroom observations. These evaluations provide valuable feedback to teachers, helping them to adjust their teaching methods to better meet the needs of their students [6]. Evaluation can also

assist students to identify their strengths and weaknesses, set goals for improvement and track their progress over time.

One of the most commonly used evaluation methods in English teaching is testing. Tests can be used to assess students' language proficiency, as well as their understanding of grammar, vocabulary, and other language skills. Tests can also be used to evaluate the effectiveness of teaching materials and techniques. Another evaluation method is classroom observation, which involves observing teachers as they teach and providing feedback on their performance [7]. Classroom observation can help teachers to identify areas for improvement, such as their classroom management skills or their ability to engage students.

In recent years, there has been a growing interest in alternative forms of English teaching evaluation including self-assessment and peer assessment. Self-assessment involves students evaluating their own language proficiency and setting goals for improvement. Peer assessment involves students evaluating each other's language skills and providing feedback on their performance [8]. These alternative forms of evaluation can help to promote student-centered learning and encourage students to take an active role in their own learning process.

Analytic hierarchy process utilizes a pairwise comparison method, where decision-makers compare each component of a decision to every other component, which is based on a set of criteria. The method assigns numerical values to the relative importance of each component and criterion, which are then used to calculate a final score for each component [9]. This score reflects the overall importance of each component in relation to the decision as a whole. Analytic hierarchy process has been widely used in various fields, including business, engineering and social sciences. It has been used to make complex decisions, such as selecting the best location for a new business or determining the most effective marketing strategy for a product. Analytic hierarchy process has also been used in environmental management, healthcare and other fields [10].

2.2   Related Works

Initially, researcher Bates focuses on different methods and tools used for evaluating English language teaching, including teacher observation, student feedback, and standardized tests. Bates outlines the benefits and limitations of each method and provides recommendations for selecting and using evaluation tools effectively [11]. Rose examines the history of English language teaching evaluation in China, discussing past practices and current challenges. The article discusses the need for a more comprehensive and integrated approach to evaluation, incorporating input from teachers, students, and administrators [12].

Cabi examines the challenges of evaluating English language teachers and suggests the ways to overcome them. The article discusses common evaluation practices, such as classroom observation and student feedback, and provides recommendations for implementing effective evaluation systems [13]. Subsequently, Azarnya discusses the importance of using student evaluations to improve English language teaching. The article provides guidance on designing effective evaluation instruments, interpreting and utilizing the evaluation results and addressing common criticisms of evaluation systems [14].
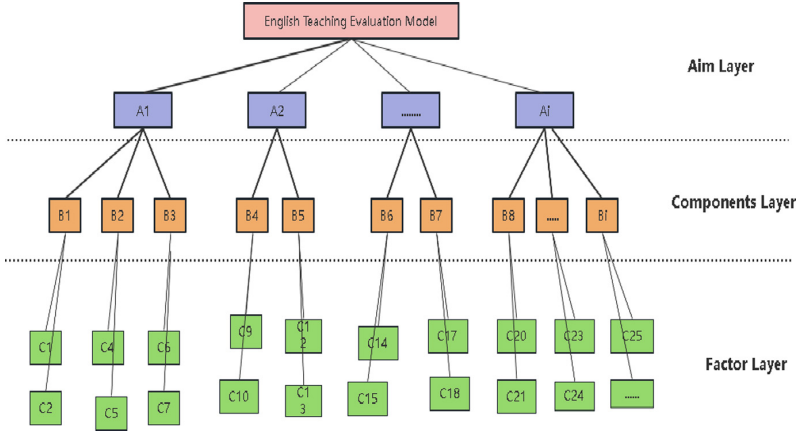
Fig. 1. Evaluation model structure.

3   Evaluation Framework

Initially, we propose a three layers model to evaluate the English teaching performance. Following Fig. 1 demonstrated the general structures of proposed model with the method of analytic hierarchy process. We construct the proposed model with three layers to execute and produce mainly indicators from the input factors layer.

Following Eq. 1 demonstrates the hierarchical total sort consistency ratio, where the *CI* represents the single layer consistency, *a* is the value of feature root and *RI* is the random consistency metric.

$$CR = \frac{a_1 CI_1 + a_2 CI_2 + ... + a_M CI_M}{a_1 RI_1 + a_2 RI_2 + ... + a_M RI_M} \tag{1}$$

4   Experimental Results and Analysis

In this section, we simulate the proposed model with existing neural network evaluation model (NN) and machine learning evaluation model (ML) to estimate the performance of proposed model.

Following Fig. 2 demonstrates the comparison results of evaluation results of proposed model with existing English teaching evaluation model measured by evaluation accuracy, which is calculated by the number of founded factors divided by the total sum of affect factors.

Indeed, the hierarchical total sort consistency (CR) is an essential indicator to evaluate the proposed model. When CR is less than 0.1, the hierarchical total sort is considered to pass the consistency test. The overall order of the hierarchy has satisfactory consistency, otherwise it is necessary to readjust the values of the elements of the judgment matrix with a high consistency ratio. From our calculation process, the CR value is 0.04, which indicates the model can achieve the hierarchical total sort consistency.
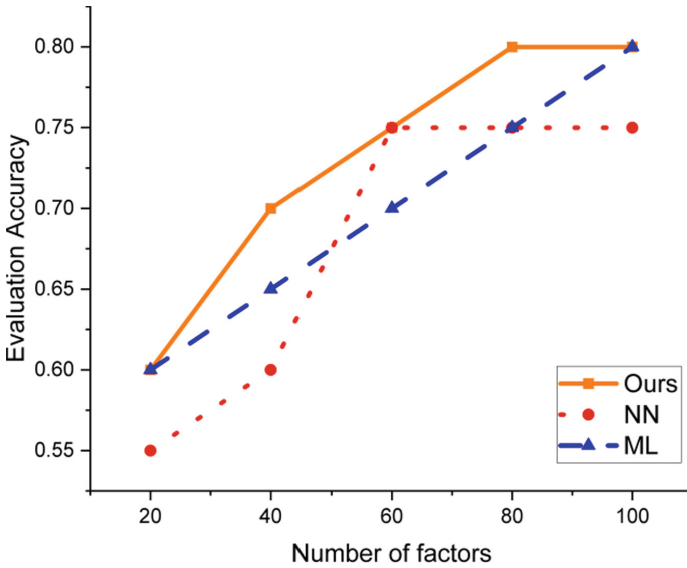
Fig. 2. Evaluation accuracy comparison results.

Table 1. Computation costs comparison results.

Number of Factors	Computation Cost (Second)		
	Ours	NN	ML
40	5.6	6.4	5.7
80	10.5	12.5	11.2
100	14.2	16.1	15.3

Subsequently, the response time is another essential indicator to evaluate the proposed model. Following Table 1 demonstrates the calculation time costs for existing evaluation model and our proposed model.

5 Conclusion

In conclusion, the proposed model can be utilized to develop an English teaching evaluation model which can assist in assessing the effectiveness of the teaching methods, materials and strategies used in the classroom. The model considers different criteria and sub-criteria, including the learners' satisfaction, the quality of instruction, the relevance of classroom activities, among others, enabling educators to adequately evaluate the teaching process. Additionally, the model is flexible, customizable and applicable in a variety of contexts, helping educators to identify issues and make relevant improvements to their teaching. The model provides a comprehensive framework for educators to systematically evaluate and improve English language teaching practices, ultimately

aiding in better student outcomes, higher satisfaction levels and a more efficient and effective teaching process.

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