



Evaluating English Teaching Quality in Colleges Using Fuzzy Logic and Online Game-Based Learning

Hao Wu¹ and Xianwu Luo^{2*}

^{1,2}School of Foreign Languages, Tianjin Chengjian University, Tianjin 300384, China
wuhao_edu@outlook.com, luo_xianwu@outlook.com

Corresponding author: Xianwu Luo, luo_xianwu@outlook.com

Abstract. English teaching quality assessment is an integral measure of college teaching management and an efficient tool to enhance teaching quality and higher education operational effectiveness. Game-based learning occurs when teachers use competitive, interactive, and entertaining activities to encourage students to engage in online learning. In addition, game-based learning impacts students' emotional and personal worlds and motivates them to study, with self-realization and knowledge progress in the English language as the ultimate goals. However, students have varying requirements and learning styles; thus, designing a universally applicable adaptive learning system might be difficult. Hence, this article suggests the Improved Fuzzy Analytical Hierarchy Process (IF-AHP) to effectively assess English teaching quality using Game-based learning in Colleges. The data are taken from the English language learner dataset for analyzing the teaching quality. Based on fuzzy variables, AHP, and entropy techniques, are suggested to deal with the difficulty of the instructor's teaching quality assessment problem. Firstly, this study builds hierarchy models and calculates the weight of assessment factors by AHP, then executes the hierarchical assessment and obtains the overall assessment outcomes by FCE. The online game-based learning system with the proposed IF-AHP model helps students to learn English speedily, and the system gets a good utility evaluation in system efficiency and satisfaction. The experimental outcomes demonstrate that the suggested IF-AHP model increases the student engagement ratio of 98.5%, teacher knowledge level ratio of 97.9%, teacher performance ratio of 98.9%, accuracy ratio of 96.7%, and teacher involvement ratio of 95.5% compared to other existing approaches.

Keywords: English Teaching Quality Evaluation. Fuzzy Logic, Online Game-based Learning, Analytical Hierarchy Process.

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1 INTRODUCTION

The expansion of online education and the English teaching quality evaluation method has received extensive attention [5]. The development cycle for new computer game systems is becoming increasingly shorter as society's reliance on these systems grows [20]. The development of appropriate English teaching management systems, which have received increasing attention due to advances in computer technology, has improved English teaching efforts [6]. The inadequacy of the database's evaluation of English teaching quality, its management via slightly out-of-date query and statistical techniques, and its ineffective design and development of its defining features all contribute to the inefficient use of available resources [21]. Improving the quality of English teaching is a major priority; doing so is fundamental to everyone's ability to participate in and benefit from society [2]. As practitioners, teachers are the most crucial component in education systems because teacher quality matters in achieving education goals and society's development [6]. So, in the 21st century, preparing teachers for a changing world is crucial to success in college or university and making contributions to society [7]. Assessing the level of educational quality at colleges, the teaching manner and the overall instructional structure may be improved via the use of English classes [23]. However, evaluating a teacher's effectiveness is not simple; it requires a complex multi-level indicator system, is challenging, and yields disappointing results [14]. As a result, there is an immediate need for a suite of flexible assessment measures for the quality of English language instruction [16].

Playing a game on a computer is a common method to pass the time. Digital games (often online or mobile) are becoming more popular leisure activities for individuals of all ages. This game-based teaching policy has proven that integrating games is greatly efficient because they can encourage and facilitate learner motivation. Many digital programs for Game-Based Learning (GBL) use online board games, real-life games, puzzles, quizzes, and digital games that an educator can edit or add educational content consistent with the topic that can be played [25]. Video, animation, text, and music may all be interacted with in a computer game, making for a very engaging and interesting experience. Card games, board games, and even video games may all be used as instructional tools in a game-based learning environment. To provide another example, a teacher may develop a game like Wheel of Fortune to assist students in developing their spelling and vocabulary skills. Therefore, computer games generate excitement and positive emotions in users, which keeps them interested [17]. That is the motive for the inclination to use students and educators for English learning and teaching purposes. Therefore, computer games technology could make educational software more engaging and motivating, amusing the sore English learning process [24]. The fundamental objective of self-realization and self-improvement in English language learning is pushed by the usage of Game-Based Learning (GBL), which affects students' emotional and personal spheres and propels the studying process of learning a language [1]. Learning new words in English by repeating them without context is tedious. Therefore, one of the tactics utilized to encourage students' engagement and participation in the course is the employment of GBL [4]. Fuzzy logic with GBL is based on statistical modeling to solve or find an optimal and efficient solution to the issues [19]. The fuzzy evaluation method has evaluated college and university teachers' teaching quality [27]. Different data are generally fuzzy, crisp, or a combination of variables in evaluating an instructor's teaching quality [18]. Fuzzy logic techniques such as AHP can be utilized to enhance the performance of an educational setting since they can encounter vagueness in data about students' cognitive state and behavior [3]. The pupil's knowledge level is signified via fuzzy sets every time. Now, the game chooses the quizzes and the game's flows. The game considers every student's evolution and resolves the quizzes that must be distributed dynamically [22].

The main objective of the study is

- Designing the Improved Fuzzy Analytical Hierarchy Process (IF-AHP) to effectively assess English teaching quality using Game-based learning in Colleges.
- Evaluating the mathematical model of AHP for building a judgment matrix, index weight includes peer evaluation, student evaluation, self-evaluation, and expert evaluation.
- The experimental results demonstrate that the recommended IF-AHP model attains a higher teacher satisfaction, accuracy, and evaluation ratio than existing approaches.

The remainder of the article is prearranged as follows: section 2 defines the existing works on English teaching quality evaluation, section 3 suggests the IF-AHP model, section 4 discusses the research outcomes, and Section 5 concludes the research article.

2 RELATED WORKS

Huang Wenming et al. [11] proposed the Gaussian Process Machine Learning (GPML) for English Teaching Quality Assessment. This research enhances the basic relevance vector machine model and integrates the Gaussian process to enhance the algorithm to raise standards in English language instruction via machine learning technologies. With the help of sparse Bayesian learning and mixed Gaussian, this research suggests an active learning method that picks and labels samples strategically before building a classifier that accounts for the combined properties of the samples' distributions. In addition, a controlled experiment was developed in this work to evaluate the efficiency of the suggested model. This study model performs well compared to other models utilized to assess the quality of English instruction, offline and online. This demonstrates that the benefits of the suggested algorithm may be used in the context of an English intelligent teaching system.

Lu Qian [13] proposed Data Mining Technology (DMT) for College English Teaching And Quality Evaluation. First, the assessment index body is built using the analytic hierarchy approach based on DMT. Then, the relevant assessment indices are chosen as input to the BP neural network. The next step is to run the refined algorithm and build a model for training neural networks and assessing their performance. Experimental evidence supports the usefulness of this approach, which has the potential to enhance the precision of English instruction and assessment in higher education. Furthermore, it has been shown via experiments that using this strategy may increase both the reliability of teacher evaluations and the effectiveness of the assessment system.

Haiyuan Liu et al. [25] recommended the Grey Clustering Analysis (GCA) for assessing College English Teaching Quality. This research proposes a technique for assessing the quality of English education in colleges based on the grey clustering analysis to address the difficulties associated with such an evaluation. It begins by investigating the many causes of poor English instruction in higher education. This became the basis for a more robust methodology for assessing the quality of English teaching in higher education. To further construct an evaluation model of English teaching quality in universities and to get the necessary quantitative analysis, grey clustering analysis and the entropy weight approach were coupled. This research may serve as a useful roadmap for addressing difficult choices.

Zhixian Xie et al. [26] discussed the Triangular Fuzzy Number (TFN) for assessing college English teaching quality. A teacher's teaching quality is deemed exceptional (85.5) when using the range way of assessment and good (64.818) when utilizing the triangle fuzzy number assessment technique based on the AHP. Based on the data, it's clear that the range technique is superior for accurately gauging educators' performance in the classroom. However, the statistical analysis findings reveal differences between the two approaches when assessing the quality of classroom instruction at universities and colleges ($t = 11.197$, $P 0.0001$). The TFN evaluation approach

grounded on the AHP considers the non-linear and fuzzy properties of assessment criteria to accurately assess the quality of education provided.

Zehua Wang and Feifei Han [12] deliberated on the Digital Game-based Mobile Application (DGMA) to establish English language students' oral production. In this research, 30 English as a Second Language learners were observed using the mobile app "Liulishuo" (speaking English fluently), a DGMA-based language learning application, to increase their English complexity, correctness, and fluency monologic oral output. Furthermore, the identical narrative image description task was used for pre-and post-tests to evaluate monologic oral output. The research results show that English language learners may improve their monologist oral output's complexity, correctness, and fluency by utilizing a mobile digital game-based language learning application.

Mohamad Ahmad Saleem Khasawneh [9] suggested the Language Games-Based Electronic Programs (LGEP) for Obtaining Oral Expression Skills amongst People with Learning Complications in the English Language. 84 students were included in the research and split evenly between two groups (experimental and control) to test the program's effectiveness using an experimental design. The study's tools were the training program and a test of participants' verbal ability to express themselves. Results showed that the training program significantly improved the experimental group's ability to acquire oral expression compared to the control group.

Based on the review, there are numerous problems in existing works in realizing great accuracy, teacher satisfaction, and evaluation ratio, such as Gaussian Process Machine Learning (GPML), Data Mining Technology (DMT), Grey Clustering Analysis (GCA), Triangular Fuzzy Number (TFN), Digital Game-based Mobile Application (DGMA), Language Games-Based Electronic Program (LGEP). Hence, this article suggests the Improved Fuzzy Analytical Hierarchy Process (IF-AHP) to effectively assess English teaching quality using Game-based learning in Colleges.

3 IMPROVED FUZZY ANALYTICAL HIERARCHY PROCESS (IF-AHP)

The quality of English teaching is crucial to the continued existence and growth of educational institutions of higher learning. The assessment of the quality of teaching in higher education has thus become an essential and crucial step in ensuring and enhancing the quality of instruction at this level. However, many people are involved in assessing teaching quality and have significant responsibilities. To maintain a high standard of education, it is important to evaluate instructors on several dimensions, including their adherence to the lesson plan, the efficacy of their lessons, the effectiveness of their teams, their overall quality, and the benefits and downsides of college teacher preparation programs. This has sparked a renewed enthusiasm for the potential of video games in the classroom. To boost student motivation and interest, educational video games use gamification techniques. Nonetheless, they must provide flexibility to accommodate students with varying backgrounds and skill sets for optimal educational outcomes. Since every student has unique learning requirements and styles, it might be difficult to design an adaptive learning system that works for all of them.

Game-Based Learning (GBL) aims to improve student productivity and engagement by presenting gaming elements into the teaching approach. In GBL, game elements and rules are used in learning tasks. Learning tasks get students interested in and excited about learning. Game-based learning includes point systems, awards, leaderboards, discussion boards, tests, and classroom reaction systems. Card games, board games, and computer games are all kinds of games that can be used to learn. A teacher could make a game like "Wheel of Fortune" to help students with writing and language. Using the principles of motivating psychology, game-based learning encourages students to interact actively and creatively with course content. Developing games for students to play is just part of game-based learning; just as important is constructing learning actions that may gradually teach ideas and steer users toward a goal. Points, competitions, feedback loops, and

rewards are all elements that may be encompassed in traditional games. These ideas are gaining popularity in academic institutions and libraries to attract and retain students. Gamification strategies, like integrating virtual scavenger hunts and digital badges, can deliver a way for learners to get visible recognition for knowledge and skills and potentially strengthen participation and engagement.

Fuzzy logic is an approach that can deal with vague or incomplete information. Learning is a convoluted process, and the concept of "knowledge level" cannot be reduced to a quantitative variable with discrete values. Therefore, the learner's knowledge may be more accurately represented using fuzzy sets and logic. Furthermore, if there is ambiguity in the data that educators access on their student's mental health and behavioral patterns, then fuzzy logic approaches may help smooth things over. Hence, this article suggests the Improved Fuzzy Analytical Hierarchy Process (IF-AHP) to effectively assess English teaching quality using Game-based learning in Colleges. College English instructors may evaluate their effectiveness in the classroom using a quality assessment approach. A scientific and acceptable quality assessment index system for university-level English instruction has been developed to mitigate the inherent subjectivity and consequent lack of accuracy in the standard way of assessing instructors. Before deciding how to evaluate all aspects of a teacher's performance, one must establish a system. This involves creating a set of factors to use in determining a teacher's performance evaluation, determining the relative importance of those factors, settling on a grade for that evaluation, and so on. The assessment findings from five distinct categories of experts are then used as inputs into the FCE calculation and the AHP technique to arrive at an overall rating of the quality of teaching.

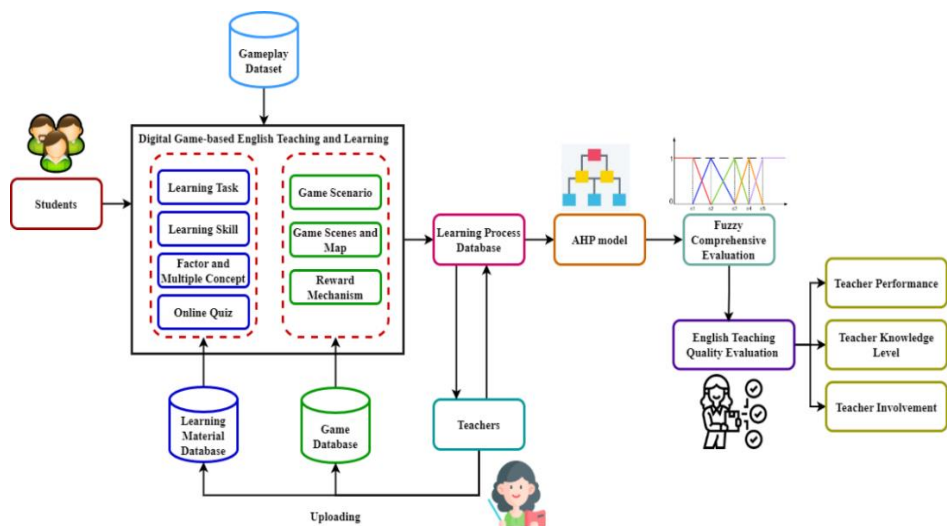


Figure 1: Proposed IF-AHP model.

Figure 1 shows the proposed IF-AHP model. The data are collected from Kaggle student performance from the gameplay dataset [10] for designing the digital game-based English teaching and learning. Card games, board games, and video games are all great examples of game-based learning. Teachers may get creative by making versions of Wheel of Fortune-style games to reinforce English spelling and vocabulary. The objective of the game competition is to use time series data generated by an online educational game to determine whether players will answer questions correctly. There are three question checkpoints (level 4, level 12, and level 22), each with several questions. Students will have access to all previous test data for that section at each checkpoint. Based on the IF-AHP

model, a new game-based learning is suggested, containing educator, student, and learning process. The educator model has standard answers, which can be inferred from the IF-AHP. The student model is built and modified consistently with the instructor's effectiveness, which reflects the student's learning process. The learning process calculates the variance between the outputs of the educator model and the student models' outputs and controls the whole game learning progression in line with the dissimilarity. Based on the recommended model, an automated learning system is established to prove its efficacy. The model comprises many databases: an input dataset, a database of factor and multiple learning materials, a database of games, and a database of the learning process itself. Misconceptions about factors and multiples, a specification table, questions, and immediate feedback are all part of the test database. Mathematical ideas, questions, assignments, and proficiency levels may all be found in the database of educational resources. An instructional designer drew on information from standard primary school textbooks to create the items' content. Scenes and maps from the games, as well as storylines and their outcomes, were all stored in the database. The situations were designed to be fully immersive for kids in upper elementary grades. The student's actions in the learning process database were recorded. The instructor created codes to track the most important aspects of student conduct in the classroom. From a constructivist viewpoint, gaming as a learning strategy may help students focus on the material they should be learning while enjoying themselves. A place where students may work together and compete to improve their English skills via games. The research indicated that the suggested learning environment may lead to improved peer-to-peer learning interactions and a narrowing of the performance gap for students from disadvantaged backgrounds. A course in English taught in a game-based, pervasive learning environment, focusing on contextualized listening and speaking exercises relevant to the classroom setting (Campus Life). It was discovered that there was a favorable association between the student's learning success and their learning drive. The AHP approach may help facilitate more adaptive decision-making in improving English teaching quality in higher education. Employing the fuzzy AHP in group decision-making facilitated decision-makers consensus and reduced uncertainty. A fuzzy comprehensive evaluation is then employed to evaluate teaching performance. IF-AHP combines hierarchy analysis methods for an optimal path selection model in evaluating English teaching quality. To better understand the physical meaning of university English teaching quality assessment, a fuzzy assessment model is constructed based on the AHP technique and grey system theory, allowing for easy and accurate computation. This gives a framework for quantitatively studying English instruction in higher education. Teachers' performance, knowledge level, and involvement in teaching have been assessed using the suggested IF-AHP model.

This study considers AHP, which can well settle weight coefficients of the experimental teaching quality assessment system, and the FCE technique, which can resolve the ambiguity of remarks in the assessment process due to the systematic, hierarchical, fuzzy features of the trial teaching quality assessment. This research used AHP and FCE models to assess teacher instruction via experimentation. It combined the AHP and the FCE approaches. It began by constructing an AHP-based hierarchy assessment index and determining the relative importance of each layer's indication. Second, it evaluated students at all the FCE levels. The final assessment findings have been provided. This combination makes the most of two qualitative and one quantitative methodology, which can measure fuzziness attributes.

This study compares the two assessment index and builds judgment matrices considering the association between various factors. If the number of indicators sets in the evaluation index system is m , that is, $Y = \{Y_1, \dots, Y_m\}$, two indicators of Y_j and Y_i are randomly chosen to compare the influence factors Z degree. The impact of the two indicators on Z is signified by v_{ji} , and the comparison outcome of every indicator is denoted by $V = [v_{ji}]_{m \times m}$ matrices, where U is judgment matrices in this assessment system.

Based on the frequently utilized analysis technique, during the comparison, the period of AHP. This study used to reflect the comparison results of the significance of every indices. The greater the v_{ji} value, the more significant the influence of the two indicators, Y_j and Y_i , on Z . This study constructs the $V = [v_{ji}]_{m \times m}$ judgment matrices based on the scaling process. The noticeable features of v_{ji} is that v_{ji} is > 0 , $v_{ji} = (1/v_{ji})$, and the values of v_{ji} is one.

This article selects four secondary assessment indicators, specifically peer evaluation (Y_1), student evaluation (Y_2), self-evaluation (Y_3), and expert evaluation (Y_4), to study the assessment of university English teaching quality. Based on the AHP principle, each indices weight is computed according to the subsequent progression. To normalize every indexed column on the V matrices and add the weight of every row to get the B matrices.

$$B_j = \frac{\sum_{i=1}^m v_{ji}}{\sum_{j=1}^m \sum_{i=1}^m v_{ji}} \quad (1)$$

As shown in equation (1), where $j = 1,2,3$, and the value of m is 4. Normalization is denoted as φ . Every element in the matrices give weights S_i to every indicator as in equation (2):

$$S_i = \frac{B_j}{\sum_{j=1}^m B_j} \quad (2)$$

Judgment matrices are created by comparing elements pairwise; the significance order of elements connected to the element in the preceding layer must be determined. This technique is often known as single hierarchical ordering. A single-level evaluation is used to compute the eigenvalues and eigenvectors of the pairwise judgment matrix. To determine the eigenvalues and eigenvectors.

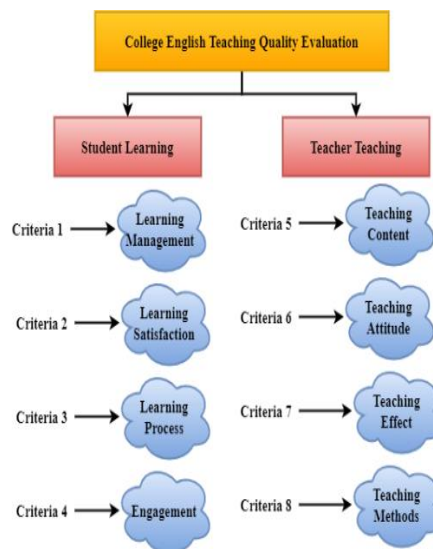


Figure 2: AHP model for English Teaching Quality Evaluation using Game-based Learning.

Figure 2 shows the AHP model for English teaching quality evaluation using game-based learning. By analyzing the link between the goal, criteria, and program levels, AHP is an easy-to-understand approach to decision-making that considers both quantitative and qualitative considerations. This approach is used to choose the best candidate mathematical method among those impacted by various variables, and it is frequently employed in multi-objective comprehensive decision-making. The AHP is considered a system that spans from the impact factor to the overall decision-making

objective, with the goal broken down into many criteria and then into index levels. First, the eigenvector judgment matrix is generated by comparing pairs of target components on the same level to determine their relative relevance. Next, this study builds the feature vector's judgment matrix and computes the importance of this level's components relative to the previous level's. Next, this study uses weights to determine how much emphasis should be placed on certain parts of the final target layer. The plan with the highest ultimate weight ratio is often the best option. Quality assessment in the English classroom may benefit from AHP since it is a practical option for quantifying subjective comparisons and solving complicated decision-making challenges. The core components of AHP may represent the mutual impact between elements thanks to the hierarchical structure. Each criteria layer element has varying relative importance in the opinions of various decision-makers. Because people have various opinions on how much weight to give to different aspects when making pairwise comparisons, it's important to build a pairwise judgment matrix to accurately weigh all relevant considerations.

The FCE model comprises the indices set O , the assessment sets P , and judgment matrices R . Determining the evaluation index set is expressed in equation (3),

$$O = \{o_1, o_2, \dots, o_n\} \quad (3)$$

As inferred in equation (3), where $o_j (j = 1, 2, \dots, n)$ denotes the assessment indices of the same levels. Then, determining the evaluation outcomes set is expressed in equation (4)

$$P = \{p_1, p_2, \dots, p_m\} \quad (4)$$

As discussed in equation (4), where $p_i (i = 1, 2, \dots, m)$ specifies the assessment outcome, and m denotes the number of grades. This setting requires an assortment range of assessment outcomes for assessment factors. The grade of the outcome set can be quantifiable or qualitative values.

Suppose that the evaluation indices o_j is assessed to acquire fuzzy vectors $C_j = (c_{j1}, c_{j2}, \dots, c_{jn})$ for the relative evaluation sets P . c_{ji} denotes degree of p_i for the indices o_i , and $0 \leq c_{ji} \leq 1$. If the number of the index (m) is assessed, and the matrices C with n row and m column are determined, termed the membership matrices. In these matrices, every row is an assessment outcome for every index, and the whole matrices consist of all the data determined by the assessment outcome sets P for the assessment index sets O .

$$A = W \circ C = [w_1, w_2, \dots, w_n] \circ \begin{bmatrix} c_{11} & c_{12} & \dots & c_{1m} \\ c_{21} & c_{22} & \dots & c_{2m} \\ \dots & \dots & \dots & \dots \\ c_{n1} & c_{n2} & \dots & c_{nm} \end{bmatrix} = (a_1, a_2, \dots, a_n) \quad (5)$$

As shown in equation (5), where \circ denotes the generalized fuzzy composition operator.

The composition vector a_i is expressed in equation (6)

$$a_i = \sum_{j=1}^m w_j c_{ji} (i = 1, 2, 3, \dots, n) \quad (6)$$

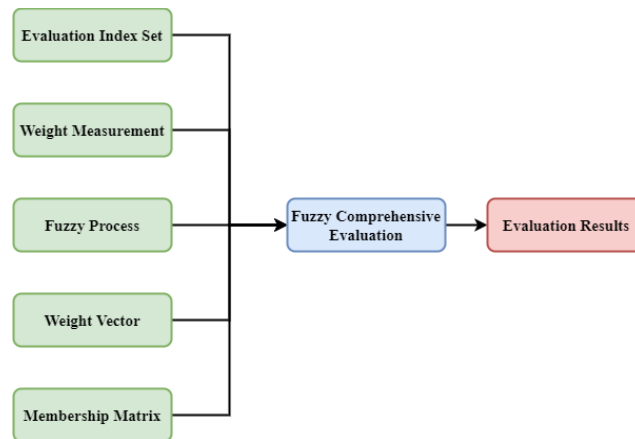


Figure 3: FCE Model for English Teaching Quality Assessment.

Figure 3 shows the FCE model for English Teaching Quality Assessment. The FCE approach is a comprehensive evaluation strategy that utilizes the principles of fuzzy mathematics. Using the principle of membership degrees in fuzzy mathematics, this method converts qualitative assessments to quantitative ones. It may address vague, hard-to-quantify issues and produce very accurate findings. It works well for resolving a wide range of issues whose answers are not fixed in before. The FCE technique is a popular multi-level, multi-objective assessment tool. It may represent the respondents' positives and negatives and provide an in-depth overview of the assessment components' viewpoints while objectively assessing the standard of English teaching at higher education institutions; an effective technique based on enhanced multi-level FCE models has been developed. The fuzzy evaluation result is calculated using the fuzzy composition of weight vectors and membership matrices. The quality of college English teachers may be largely evaluated by the assessment methods they use in the classroom. A scientific and acceptable quality assessment index system is developed to address the shortcomings of the conventional approach to evaluating the quality of instruction in the English language classroom at the university level. As a result, education science techniques are used to conduct a thorough, reasonable, and effective evaluation of a complex, dynamic college English classroom teaching system to provide identification, guidance, and encouragement functions and to build an assessment index system. Therefore, it has a positive implication in promoting teachers' teaching level and the quality of universities. The suggested IF-AHP model increases the student engagement ratio, teacher knowledge level ratio, teacher performance ratio, accuracy ratio, and teacher involvement ratio compared to other approaches.

4 RESULTS AND DISCUSSION

This study proposes the IF-AHP model for English teaching quality evaluation using game-based learning. The data are taken from the dataset of [27]. Marks, grades, or percentages are all forms of evaluation used to show how effectively students have grasped the material covered in class using game-based learning such as card games, board games, and video games. The results of an evaluation may assist a teacher in determining whether their first impressions of the students were correct and if their subsequent efforts to reinforce important subjects were effective. Thus, evidence regarding development or growth must be collected to use that data for decision-making. 100 teachers' teaching data has been collected for teaching quality evaluation. Despite the growing popularity of gaming as a tool for education, there is a lack of studies on how digital games could aid English language learning. This scoping study examines the existing practices of the Improved

Fuzzy Analytical Hierarchy Process (IF-AHP) to assist English language acquisition, looking at the characteristics of players, the features of the methodology, the features of the games themselves, and the relationship between the availability of games and the features of the games themselves. Our research shows that (1) gamers mostly practice vocabulary; (2) most techniques used are quantitative, with researchers creating their own assessments; (3) commercial games have the most features of a good game; and (4) excellent gaming aspects are used inconsistently throughout digital games. Therefore, to increase learning effectiveness and offer positive feedback on learning motivation, an Improved Fuzzy Analytical Hierarchy Process (IF-AHP) was implemented for students. In addition, English instructors can boost students' interest in learning by selecting resources tailored to their own characteristics, expertise, and cultural background

i. Student Engagement Ratio (%)

Greater learning and engagement on the part of students, as well as their dedication to meeting the high expectations of instructors and their dedication to academic success, are all factors that contribute to the increasingly widespread usage of fuzzy variables. A significant body of data suggests that a well-conceived IF-AHP may improve learning outcomes. However, there is a relatively low interest in multimedia's function in shaping primary motivating factors such as student involvement. The interaction of students in different classrooms, each of which utilizes an increasing amount of instructor-specific digital features, reveals opposing realities. Although qualitative student feedback indicated that increased interest is attributable to instructor-generated multimedia supplements, quantitative data showed no significant differences in levels of engagement or learning across the various degrees of multimedia inclusion. From equation (6), the student engagement ratio has been calculated. Figure 4 shows the student engagement ratio.

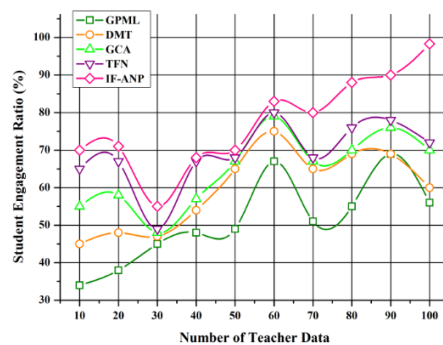


Figure 4: Student Engagement Ratio.

ii. Teacher Performance Ratio (%)

The entropy method, fuzzy variables, and an AHP are new English teaching methods that have gradually supplanted online courses at most universities. Compared to online education, the use of Fuzzy Logic in the study of English offers superior returns, lower costs, and more sophisticated learning modalities. Utilizing an enhanced version of the IF-AHP to assess the quality of English instruction in the classroom creates an environment where students are completely immersed in the material being taught. Interactive education employs tools that are similarly optimized for student success. Online game-based learning systems include card, board, puzzle, quiz, and video games designed to help students learn by encouraging visual clues and pedagogical concepts. Using

dynamic settings aims to foster empathy between the audience and the people in the story. This method of education is distinguished by its efficiency in terms of time, effort, and money spent, as it provides students with the information they need as quickly as possible in a format that allows for easy tracking and regulation of the learning process, as well as for the assessment and evaluation of student performance and the improvement of educational attainment as a whole. In equation (5), the teacher performance ratio has been calculated. Figure 5 shows the teacher performance ratio

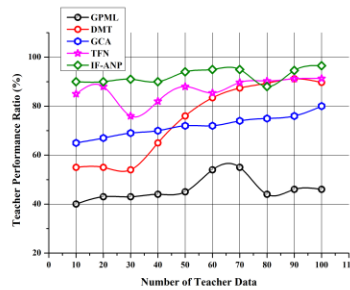


Figure 5: Teacher Performance Ratio.

iii. Learning Motivation Ratio (%)

Using games as an English teaching tool has several benefits, including increasing students' learning motivation. These advantages include presentation; fun; engagement; objectives; outcomes and input; win states; competition; challenge; problem-solving; mission; plot; and win states. The game's difficulty directly ties to the difficulty of the course, making the material and the skills it teaches accessible via a gaming medium. In conclusion, students may learn from activities from a system analysis course in an online game-based learning system, including card, board, puzzle, quiz, and video games. To accomplish individualized education, engaging in entertaining and fun activities is necessary. Education, with the goal of education in mind. A new kind of engagement, video games are the most common form of computer use among students since they cater to their individual interests and demands. Games are a valuable educational resource because they engage students, provide variety, improve the learning environment, and keep students focused on the work at hand. Students who use gaming mechanics to study might have a deeper understanding of course topics. The result is a greater sense of dedication among the student body. Based on equation (4), the learning motivation ratio has been computed. Figure 6 demonstrates the learning motivation ratio.

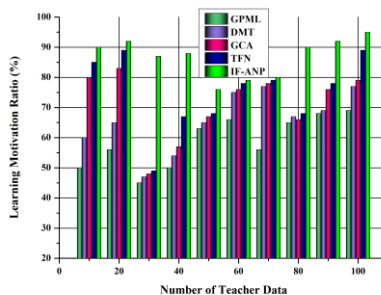


Figure 6: Learning Motivation Ratio.

iv. Teacher Knowledge Level Ratio (%)

Traditional methods of teaching English are predicated, to a considerable extent, on the premise of the cognitive load involved in information processing. The IF-AHP experiments that have been suggested center on the investigation of material assistance for learning inspiration and related game features. According to inspiration, volition, and success theory, knowledge level, and learning motivation are thought to affect performance concurrently. Collecting data using an instructional content motivation questionnaire, a cognitive workload scale, and a test of performance scale enabled effective management of learning quality to be ensured. This IF-AHP-based English teaching quality assessment is accomplished by understanding the underlying link between knowledge level, motivation, and performance. According to the conclusions of the analysis of the data, success may be seen to have a significant hierarchical link with both motivation and cognitive load. This early finding suggests that designers of IF-AHP may enhance both the incentive and the cognitive load to get maximum results in learning performance. From equation (3), the teacher knowledge level ratio has been calculated. Figure 7 illustrates the teacher knowledge level ratio.

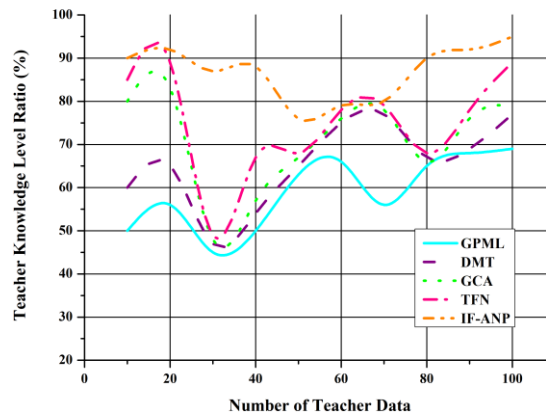


Figure 7: Teacher Knowledge Level Ratio.

v. Accuracy Ratio (%)

The evaluation accuracy of the English teaching quality analysis is insufficient to fulfill practical application demands, preventing its widespread implementation. Especially compared to other models, FCE's study of English teaching quality has a greater degree of accuracy. This methodology requires numerous indicators for quality teaching analysis; however, this increases the probability of interference between the indicators and hence biased assessment findings. As a novel approach to evaluating teacher ability in English, the AHP model has the potential to significantly improve the reliability of assessments and teacher training. The particular component of bettering education denotes the circumstance and dynamics of an essential element of content expansion. This is accomplished by extending the learning space via digital technologies, in correlation with integrating an IF-AHP and virtual communication to enable students to acquire information sources. Based on equation (2), the accuracy ratio has been computed. Figure 8 signifies the accuracy ratio.

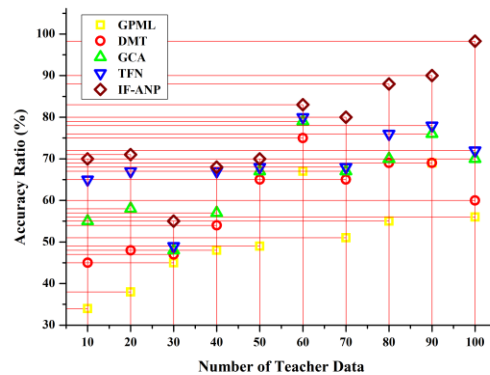


Figure 8: Accuracy Ratio.

By the way, attempting to consider immersive practice by online game-based learning systems such as card, board, puzzle, quiz, and video games to provide creative fundamentals and encourage student configurations within designing is essential for establishing innovative learning surroundings, a valuable tool for ethical advancement and professional involvement. In this regard, improving digital technologies and incorporating learning skills to acquire the tools will make the learning process functional and autonomous.

5 CONCLUSION

This study presents the Improved Fuzzy Analytical Hierarchy Process (IF-AHP) to assess English teaching quality using Game-based learning in Colleges. The game's adaptive features allow for a customized education for each player, regardless of their prior expertise. Card games, board games, and video games are all great examples of game-based learning. Teachers may get creative by making versions of Wheel of Fortune-style games to reinforce English spelling and vocabulary. The goals and principles of college-level English education provide the basis for assessing teachers' effectiveness in the classroom. It serves an undeniably crucial role in evaluating and guiding college English teaching since it employs practical technology to analyze the teaching process in a college classroom and identify the impact on value. The FCE strategy is often used in situations involving several indices and ambiguity. The analytic hierarchy process, on the other hand, is a multi-level decision-making approach that is simple, flexible, and beneficial. As a result, the game level of logic, systematization, conciseness, and practicality will increase student engagement in English learning. AHP is a decision technique merging quantitative and qualitative analysis to resolve the issues of the hierarchy of English teaching quality assessment. In line with the features of each level's factors, AHP expresses each level's relative importance quantitatively and then builds up the statistical model. From the ranking results, teachers can easily perceive their class's merits and inadequacies, which is helpful for them to continue enhancing. The experimental outcomes prove that the suggested IF-AHP model increases the student engagement ratio of 98.5%, teacher knowledge level ratio of 97.9%, teacher performance ratio of 98.9%, accuracy ratio of 96.7%, and teacher involvement ratio of 95.5% compared to other existing approaches. However, the research is limited by the small sample size, which has to be expanded in subsequent studies to ensure the generalizability of the results. In the future, this study will plan to benefit from the game in learning

additional cognitive areas and can be oriented to developing realistic prototypes that would increase the game's difficulty and introduce and utilize soft computing based on Fuzzy Cognitive Map (FCM).

Hao Wu, <https://orcid.org/0009-0006-5523-5124>

Xianwu Luo, <https://orcid.org/0009-0003-8656-1879>

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