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An Optimization-Based Artificial Intelligence Framework for Teaching English at College Level Under Tribhuvan University

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Abstract

Learning and computing breakthroughs among students are beginning to converge due to the rapid growth of digital technology. Artificial Intelligence (AI) has made an impact on the way we teach English at the college level. It has an enormous potential of providing digitalized and completely personalized learning to each English language teacher. This quantitative quasi-experimental research offers a strategy for incorporating Artificial Intelligence (AI) in English language teaching at the college level. The participants consisted of 100 bachelor-level students studying at a constituent college of Tribhuvan University, Nepal. The participants were selected using simple random sampling and divided into two groups: the study group and the control group. The researcher employed questionnaires and tests as the instruments to collect the data. The collected data was analyzed using SPSS 2.0 which is a tool for analyzing quantitatively challenging data. The findings were presented descriptively and the researcher assessed the model's criteria, designed a comparison test, and conducted a survey questionnaire to check the reliability and effectiveness of the prediction. The evidence shows that Enhanced Whale Hyper-Tuned Artificial Neural Network (EWH-ANN) EWH-ANN can be employed to optimize English instruction at the college level in general and verbal improvement in particular. It can make English teaching more efficient and customized to fulfill individual students' necessities. The study concluded that The Whale Optimization Algorithm (WOA) can be used to tune the hyper-parameters of Artificial Neural Network (ANN) to improve the accuracy of the operation.

Keywords: *teaching English, digital technology, artificial intelligence, enhanced whale hyper-tuned artificial neural network, verbal improvement*

1. Introduction

AI technology is becoming more significant in education as big data and cloud computing continue to expand (Xianmin, 2014). According to Cuibo (2017), the customized, creative, and collaborative learning styles of students cannot be met by conventional foreign language instruction. The growth of AI has significantly altered many traditional models of language teaching. A time of rapid development for the big data industry has led to a gradual decline in traditional English teaching techniques (Knox, 2020). Great difficulties are being faced by traditional English education, which is simultaneously in crisis and being tested. Nowadays, computerized deep learning (DL) has developed the ability to imitate the brain's learning process and acquire the intrinsic qualities and essential guidelines of data that may be used in every aspect of living. The Ministry of Education has established the college syllabus, which has increased the demands on non-English majors and placed new demands on college English teaching due to the constant improvement of both the freshmen's English level and the quality of English teaching in colleges (Chassignol et al., 2018). With the support of network technology and multimedia technology, computer-assisted college English teaching is currently undergoing rapid growth. This instructional approach aims to improve the advantages of both online courses and conventional classroom training by fusing them with modern AI technologies (Hang, 2018).

Various types of issues with the existing computer-assisted instruction in English exist, including. We must raise the standard of instruction and use targeted instruction if we are to effectively address this issue. It is important that help learners in integrating their foundational knowledge to enhance the quality of instruction, (Fok et al., 2018). Finally, there is an inability to recognize the importance of self-education. In order for students to achieve their learning goals via self-reflection, feedback, and regulation, instructors should use strategic and competent means of regulating their progress. Learning and teaching can both be improved by AI, and the educational community contributes to finding the optimum benefits for both students and teachers. The way that people learn has been altered by AI. Internet college English teaching practices incorporate AI technology and online sources. Analyses and recordings are made of the entire practice teaching process. A teaching practice analysis' findings indicate that under the College English educational information technique (Zang et al., 2022). The design of College English, powered by AI technology, dramatically improves students' ability to learn and their success in learning English.

Teachers must devote a lot of time and effort to finding solutions, grading pupils, and calculating data analysis scores. It has a variety of drawbacks and necessitates effort and time. Exams are a crucial component in assessing a student's overall aptitude and the efficacy of a teacher's education. Because of computer science and technology, exams must adapt (Wei et al., 2019). The adaptation and assessment of verbal English are normally carried out using the associated intelligent techniques, and in order to improve recognition rates, the identification and adaptation of "English grammar" has also begun to be carried out using the associated neural network. The associated English application scenarios are also examined, and the relevant applications are carried out using the curriculum features. In light of this, the purpose of this research is to provide more conclusive findings on the causes of the relationships between the variables in a study hypothesis than what can be obtained via correlational research. This research mainly focuses on investigating the need for AI in English language teaching and exploring the characteristics of AI in the education framework.

2. Literature Review

Sun & Li's (2020) examined the characteristics of English training in a big data environment in great depth. The development of a new English-learning Eco-environment then employs big data technologies to improve educational standards. The findings of the experiments show that the Eco-environment for teaching English produces good learning effects and application skills in contrast to traditional techniques. The ANN algorithms have been extensively studied and researched over the last several years, and they have been effectively used in a broad variety of industrial domains, giving enough

play to their own special characteristics and application value. The difference between what the ANN predicts and the actual Label of the data is measured by the error. Organizing information rarely do instructors and students seek the library for any readings (Liu (2022)). The whale optimization algorithm is used to formatively assess the autonomous learning of collegiate English (Guo et al., 2019). It is essential to comprehend formative assessment in light of the study of the whale optimization algorithm, the features of network autonomous learning, the purposes of formative evaluation, and the formative evaluation instruments. A class of students from a certain institution is chosen as the study object for the application impact of college English network autonomous learning, and three months of network autonomous learning are conducted in this class.

The lack of a network self-learning assessment mechanism has become more apparent, which has had an impact on the development of teaching materials and the enhancement of learning outcomes for students (Chi (2022)). The university English teaching platform uses a hierarchical teaching approach and artificial intelligence to identify the requirements of university students and learn more about their level of mastery. Utilizing the whale optimization algorithm (WOA), the evaluation system is improved. Traditional university English instruction fails to take into consideration individuals' unique learning styles and evaluations, which results in students not understanding the language well enough and losing interest in it (Zhang and Ji (2022)). Zhai et al., (2021) analyzed the content of works that attempted to highlight AI's applications in education and investigate the field's possible future research trends and problems. The findings provide insight into the big picture of AI in education, which may be utilized to strengthen the program's theoretical background and open up a productive avenue for further joint study between educators and AI developers. There are a number of limitations to this assessment, despite the fact that it does present several helpful patterns and new research avenues for AI in education. To begin, the articles analyzed in this research were culled from the Social Science Citation Index; however, additional databases on natural science and sources might be included to provide a more all-encompassing overview of this field. Hwang et al., (2020) define Artificial Intelligence in Education (AIED) research and its function within the context of classroom requirements. They present a framework to illustrate the factors to be considered while introducing AIED into various classroom settings. At last, they detail the submission process and the types of articles they constantly seek. Cantú-Ortiz et al., (2020) propose a case study and strategy for a state-of-the-art evaluation of AI in education, with the goal of providing today's students with the knowledge and skills they'll need to achieve in the current and coming digital transformation to Industry.

Finally, they discussed the components of an institutional strategy that could be helpful for universities and colleges that are interested in participating in the digital transformation phenomenon and educating the next generation of students and engineers with the aid and advantages of AI technologies. Based on the ARM and SA algorithm, Yang, (2021) proposed a prologue language and music-assisted learning system; this work involves extensive research into the principles and processes of music automatic recording technology, as well as the interpretation and analysis of data from an AI system's internal database in order to establish the rules by which such a system should be implemented. In order to improve the usefulness of the AI helper system in music education. After extensive testing, it was discovered that artificial intelligence auxiliary technology is being used at a rate of 56.81 percent in the piano performance and music-automated notation algorithm instruction system, and that this number is continually increasing. However, most robot training takes place through extensive hands-on activities, which presents a number of challenges.

To improve graduation results and student learning characteristics, Deo et al., (2020) propose for the creation of teaching and learning intervention techniques and course physical exams. They also encourage the rapid implementation of an effective AI technique for investigating links between various aspects of students' academic progress. Its drawbacks include the necessity for repetitive hyper-parameter tweaking, a lengthy reaction time based on the gradient learning process, and a relatively lower accuracy when compared to other current AI systems. Moreno-Guerrero et al., (2020) analyzed Web of Sciences topic headings related to education to evaluate the impact and potential of AI in the

academic literature. The time range is broad, ranging from 1956 to 2006, which is a 50-year span with a very small number of terms. The nature of the research also made it possible to illustrate how the study's theme developed theoretically, with a focus on the "artificial intelligence" concept. Due to a lack of keywords that contained the study's most salient features, the findings of the first studies were not presented in scientific research articles or other scientific materials. The data of incoming college students is examined by Xiao & Yi, (2021). They go on to suggest a method for collecting modeling features from student data. Secondly, they suggest using AI to create a one-of-a-kind teaching approach. Third, they provide a technique for foreseeing students' future growth based on the individual educational model. In addition, they use AI to put their plan into action. In order to give a comprehensive overview of AIED for its future development and application, Chen et al., (2020) provide multiple perspectives on its development in terms of important grants, conferences, journals, software tools, article trends, top topics, institutions, and researchers.

In conclusion, the results and conclusions corroborate and underline the rising popularity and usefulness of AI applications for educational purposes. In order to summarize and emphasize the function of AI in teaching and student assessment, Malik et al., (2019) offered an in-depth examination of the many research developments that were carried out throughout the world relating to artificial intelligence approaches used to the education sector. This research proves that NLP-enabled intelligent tutor systems absolutely cannot stand by themselves without AI.

3. Research Methods

The study is based on a quantitative quasi-experimental study design. The participants consisted of 150 Bachelor's level students who studied compulsory English subjects in various faculties at the Mahendra Multiple Campus Nepalgunj under Tribhuvan. The researcher employed simple random sampling to select the sample of the study. After conducting a survey of 150 students, 100 students were selected using simple random sampling for intervention. The researcher used a questionnaire and tests as techniques to collect the data. The samples were divided into two groups, the study group, and the control group. The control group, which had 50 participants was instructed to employ traditional instruction whereas the study group, which also had 50 participants, was instructed to use EWH-ANN to conduct AI-based instruction.

The ANN approach with backpropagation is utilized for data predictions. Forward propagation in a neural network is used during the training phase. The output layer nodes produce a value after the forward pass. During the forward pass, the entire input to the node is first determined, and then the output of the node is determined using the activation function. This formula is used to compute the total input received by each neuron in a feed-forward neural network.

$$Total\ Input = e_1 * m_1 + e_2 * m_2 + \cdots + e_v * m_v + 1 * m_n \quad (1)$$

$Where: e_1, e2, \ldots\ldots, ee - Input\ neurons$

$m1, m2, \ldots\ldots, mv$ – Weights associated with input neurons

m_n – Weight associated with bias Output of neuron is calculated using the activation function

To determine the neuron's output, the activation function is used.

$$Activationfunction = 1/\left(1 + x^{(-TotalInput)}\right) \quad (2)$$

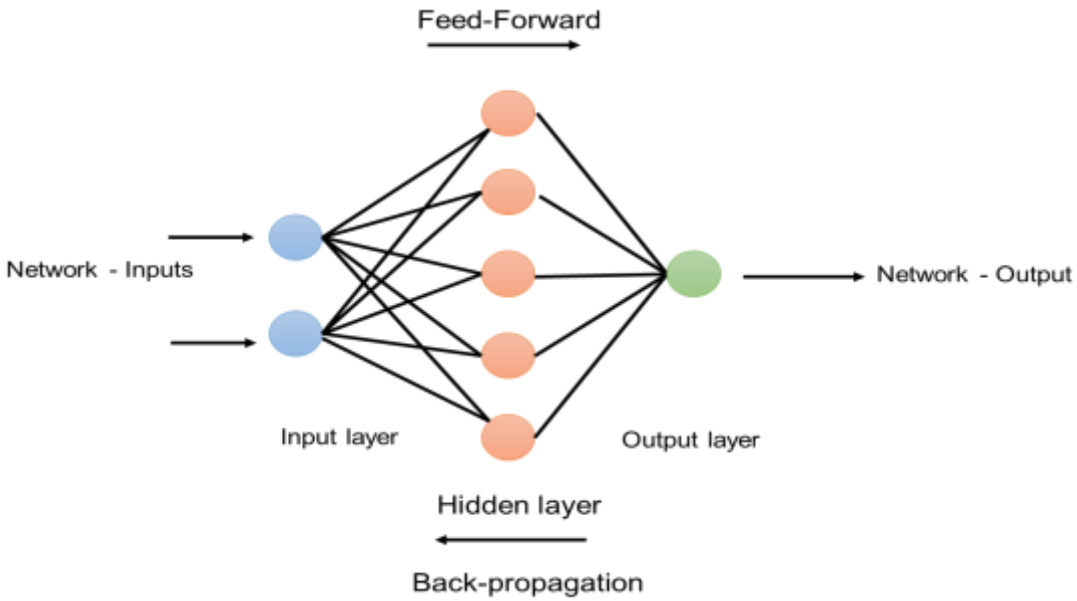
Where:

Total Input – The total input to the neuron

Training artificial neural networks using a technique known as backpropagation, in combination with an optimization approach such as gradient descent, is widespread. Propagation and weight updates are the two phases of the algorithm's two-step cycle. Link weights are adjusted once the forward pass output is compared to the predicted output during the back-propagation phase. Figure 1 represents the architecture of ANN.

Figure 1

Architecture of ANN



Note. The architecture of ANN presented in this figure.

The EWOA algorithm's sluggish convergence, propensity to slip into the local optimum, and limited convergence accuracy are disadvantages when compared to those of more advanced algorithms.

Introduce Inertial Weight to Improve Local Search Ability: Adaptive WOA adds a component for the number of iterations as well as a humpback whale clustering factor λ to improve local search by introducing inertial weight. Where we are in terms of the whole set of iterations is represented by γ. To get the iteration factor λ, use the following formula:

$$\lambda = \sqrt{\exp[(q/T)^{y}]} \tag{3}$$

In this equation, Y is a constant higher than 1, t is the current iteration number, T is the maximum number of iterations, and t is the current iteration. So, γ the formula for determining:

$$g_{avg} = \frac{\sum_{y=1}^{v} g(S_y)}{N} \tag{4}$$

$$M = \frac{1}{V-1}\sum_{y=1}^{V}\left[g(S_y) - g_{avg}\right]^2 \tag{5}$$

$$K = \sin\left(art\tan M\right) \tag{6}$$

In (4)–(6), "g_{avg} is the average value of the adaptive value, $g(S_y)$ indicates the adaptive value of the humpback whale y, M is the variance of the adaptive function value, and V is the total number of humpback whales". Consequently, this is the formula for adaptive weights:

$$x = x_{min} + (x_{max} - x_{min}) \times \lambda \times \gamma, \tag{7}$$

Where x_{max} and x_{min} values of the adaptive weights are indicated by w max and w min. For this research, the values x_{max}= 0.9 and x_{min} = 0.2 were used.

$$\overrightarrow{W}(q+1) = x \times \overrightarrow{W'} \times m^{uo} \times \cos(2\pi l) + \overrightarrow{W^*} \tag{8}$$

Incorporating operators to increase the number of people in the clustering facilitates the exchange of new information on existing optimal individuals, which may be used to curb greed and reduce the cluster's overall diversity.

$$v_{inc} = sp \times (SP_{max} - sp)^2 \times SP_{max}^{-2} \tag{9}$$

Where ps indicates the individuals of current clustering.

$$\triangle r(D) = \begin{cases} (L_r - U_r)\left(2d^2 + \frac{U_r}{L_r - U_r}\right) & 0 < D < 0.5, \\ (L_r - U_r)\left(1 - 2(D-1)^2 + \frac{U_r}{L_r - U_r}\right) & 0.5 \le D \le 1, \end{cases} \tag{10}$$

where $w = w_{best} + \triangle r(D)$, in which$w_{best}$ is "the optimal individual in the current cluster"; $v_{inc} - [v_{inc}/2]$ the creation of individuals constitutes S3. We create the parental special combination S = $P_1 \cup P_2 \cup P_3$. Randomly selected twoindividuals w_1 and w_2 from S according to the following method

$$w_{new} = \alpha^{0.5} w_1 + (1 - \alpha) w_2 \tag{11}$$

Design of Delete Operator: Algorithm performance may be enhanced by designing the delete factor to remove superfluous nodes.

$$v_{inc} = sp^2 \times (SP_{max} - sp) \times SP_{max}^{-2} \tag{12}$$

Since it is hard to add additional members to boost variety after the cluster reaches its maximum size, this suggests that throughout the evolution phase, the group may have entered the optimum solution.

The SPSS 2.0 tool is used for experimental analysis. The software program SPSS (Statistical Package for the Social Sciences), generally known as IBM SPSS Statistics, is used to analyze statistical data. Although SPSS 2.0 name refers to its first use in the social sciences, other data markets have now adopted it. Utilizing statistical methodologies, experimental design methods enable the investigator to comprehend and assess the influences on a given system. Such methods combine a practical understanding of the specific issues to be researched with theoretical knowledge of experimental design. Initial experimental planning is crucial, even if the final experimental design decision will rely on the study's goals and the number of components being looked at.

4. Discussion

The use of AI in college English teaching can benefit students in a number of ways, as shown in Table 1 and 2. It can increase their passion for studying the language, enable them to comprehend it better, strengthen their reading skills in simple English, explain unhealthy habits and activities, and support students become more focused and straightforward when studying the language. The student progress scores might evaluate a variety of abilities, including speaking, listening, reading, and writing. The study group outperforms the control group in every ability. To evaluate a student's fluency, pay attention to a variety of factors as they speak, including how at ease they seem, how rapidly they can

switch topics, and how effortlessly they can create ideas and thoughts. A questionnaire is an effective, affordable approach to collect a significant number of replies. Since digital surveys often contain closed questions like multiple choice and scales, they may be scaled up with little additional resource (if you need to ask open questions consider interviews instead).

Table 1 *Summary of Students' Progress Scores*

Features	Groups splitting	Minimum value	Maximum value	Average value
Listening skill	Control group	85	68	71.25
	Study group	94	86	89.07
Speaking skill	Control group	80	64	71.02
	Study group	96	83	88.64
Reading skill	Control group	76	62	77.91
	Study group	92	80	89.11
Writing skill	Control group	72	52	67.52
	Study group	89	77	87.20

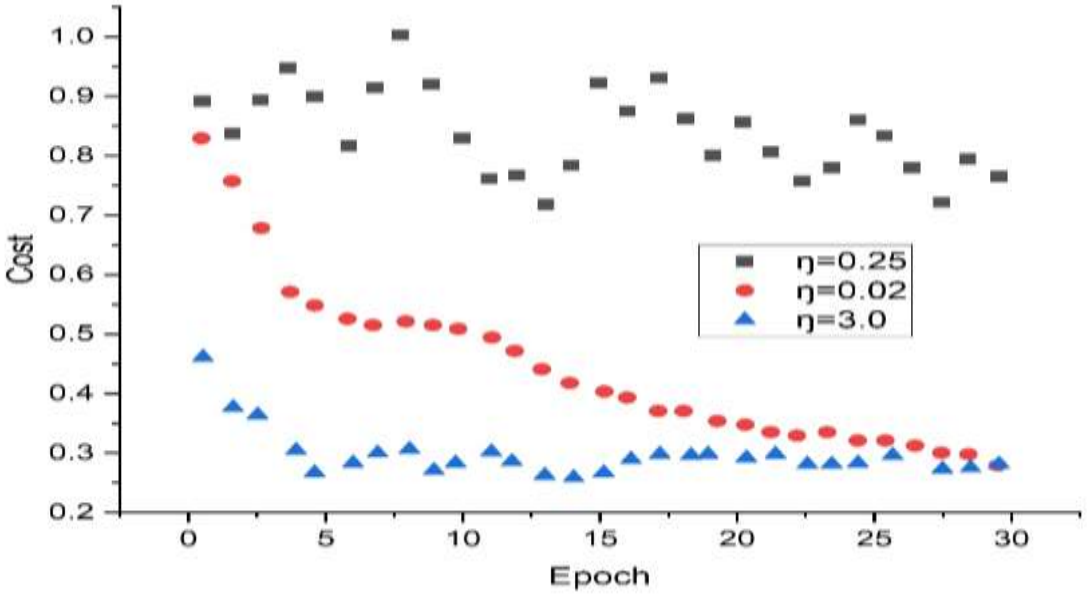
Table 2 *Outcomes of Questionnaires*

Questionnaire survey	Groups	Satisfaction level (%)
Is the international society connected to a modern perception of the world?	Control group	58
	Study group	75
A feeling of satisfaction following the study of conversational English as well as listening skill, reading skill, and writing skill	Control group	77
	Study group	86
Do you feel you fully comprehend the tasks you have to learn?	Control group	68
	Study group	89
Pleased with the complexity of the English language	Control group	63
	Study group	83

- Influence characteristic: The gradient variations of training of both perceptron and ANN are contrasted in the data.
- To contrast the research findings in the validation set and dataset, CNN (Ding et al., 2021), MLP (Yahaya et al., 2020), DNN (Zeng, 2021), and ANN models are employed in the gradient variation graph during the training phase of perceptron network.
- ANN network's gradient variation graph in training.

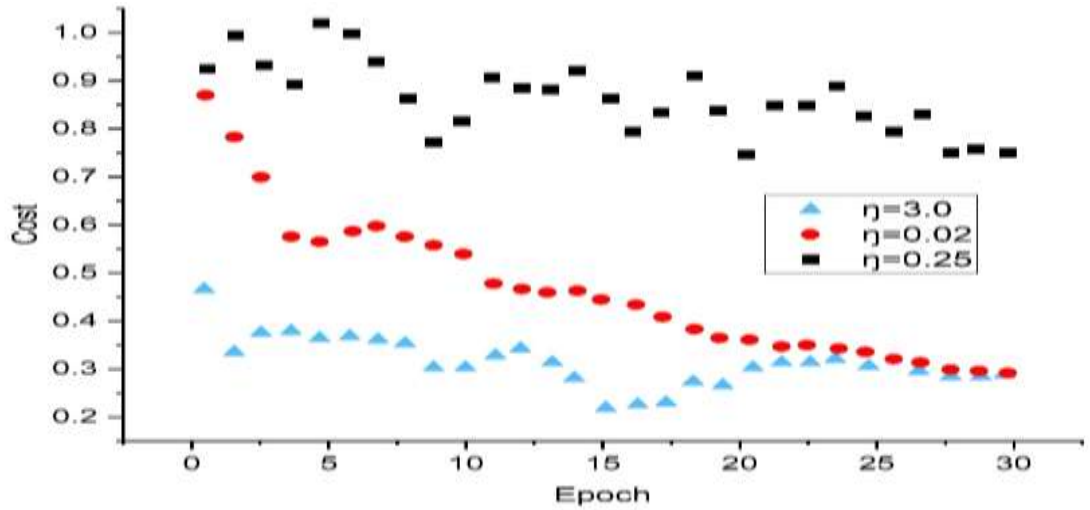
The analysis and discussion of the CNN, MLP, DNN, and ANN prediction outcomes on the sets of training and testing follows.

Figure 2. *First Test's Evaluation Diagram*



Note. Cost vs. Epoch

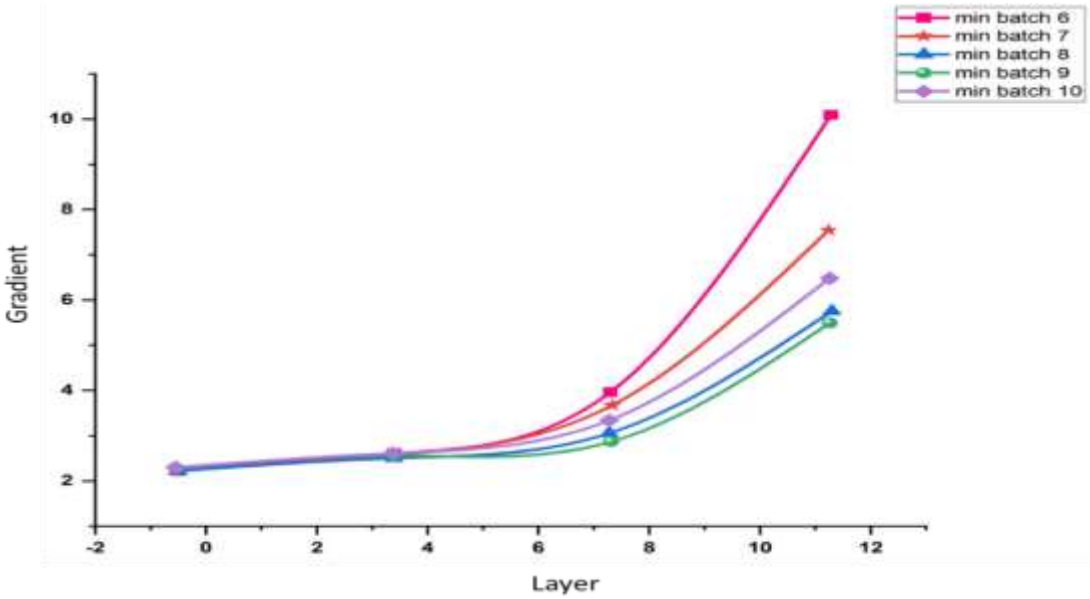
Figure 3. *Second Test's Evaluation Diagram*



Note. Cost vs. Epoch

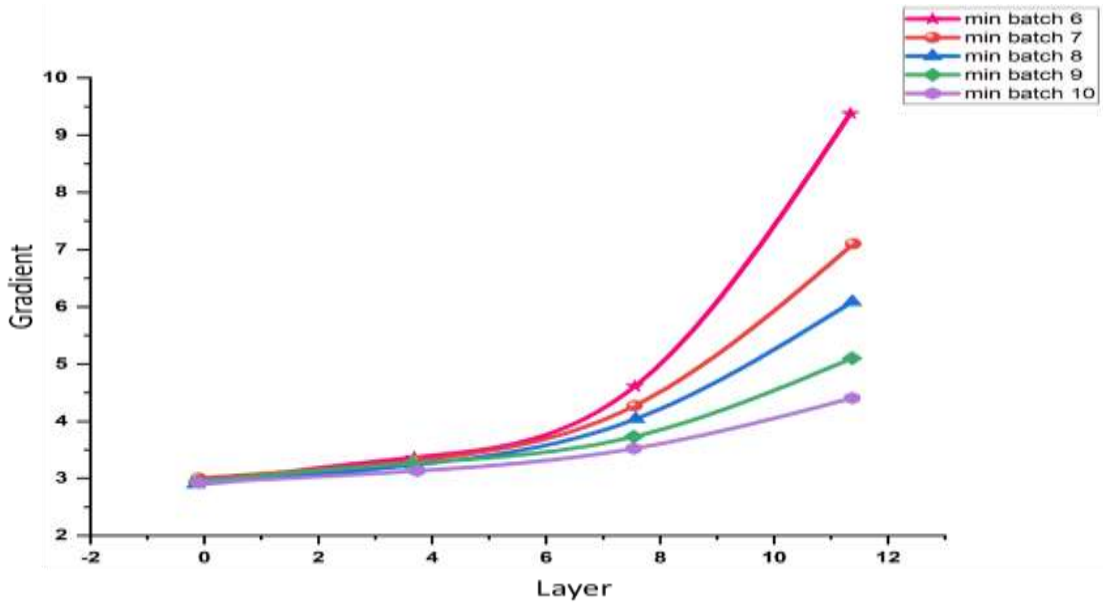
With both little and huge data input, MLP performs effectively. Unfortunately, one of its shortcomings is that the computation procedure is challenging and time-consuming. The three main difficulties encountered while model training with CNN are overfitting, rising gradients, and class imbalances. These factors can reduce the model's ability to perform. DNN needs quite a lot of information in order to function well than other methods. Because of complex data structures, training is very costly.

Figure 4. *Gradient Variation in ANN Training Phase*



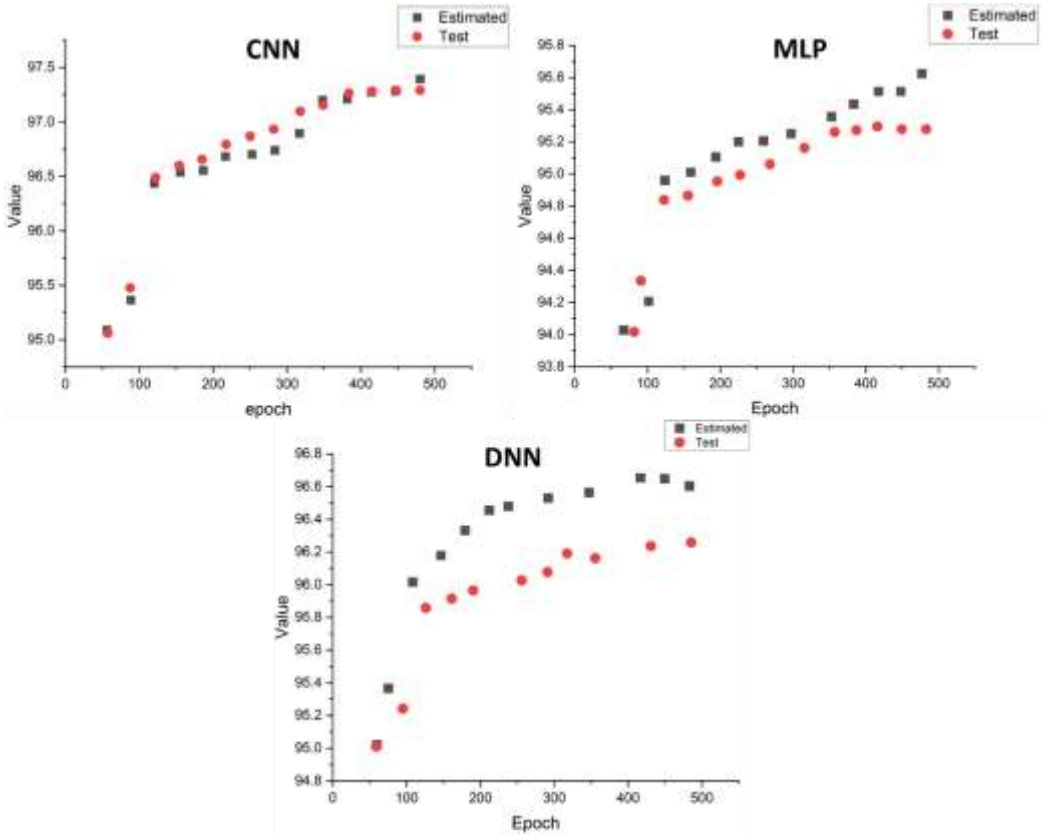
Note. Gradient vs. Layer

Figure 5. *Gradient Variation in Perception Network's Training Phase*



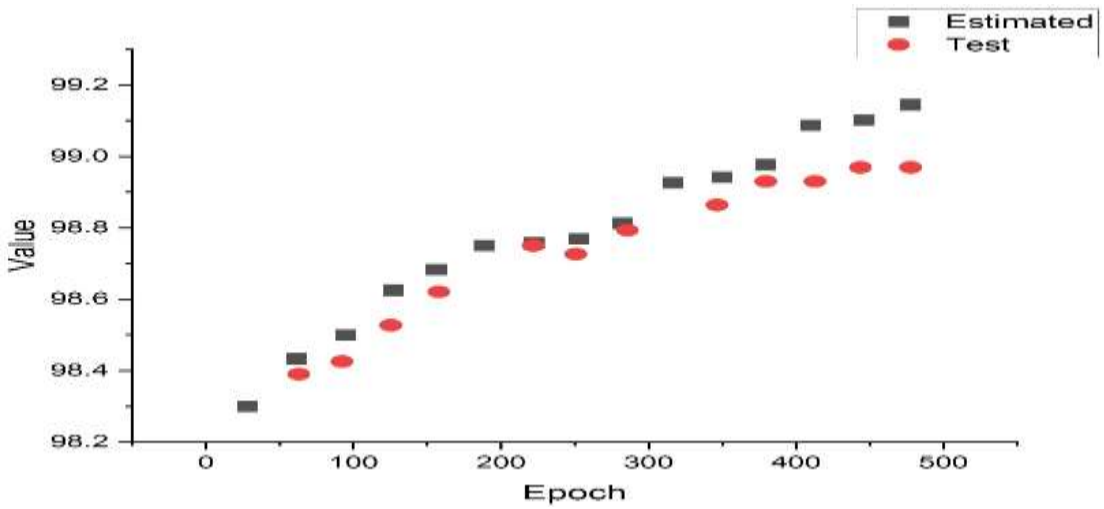
Note. Gradient vs. Layer

Figure 6. *Gradient variation in CNN, DNN, and MLP*



Note. Value vs. epoch

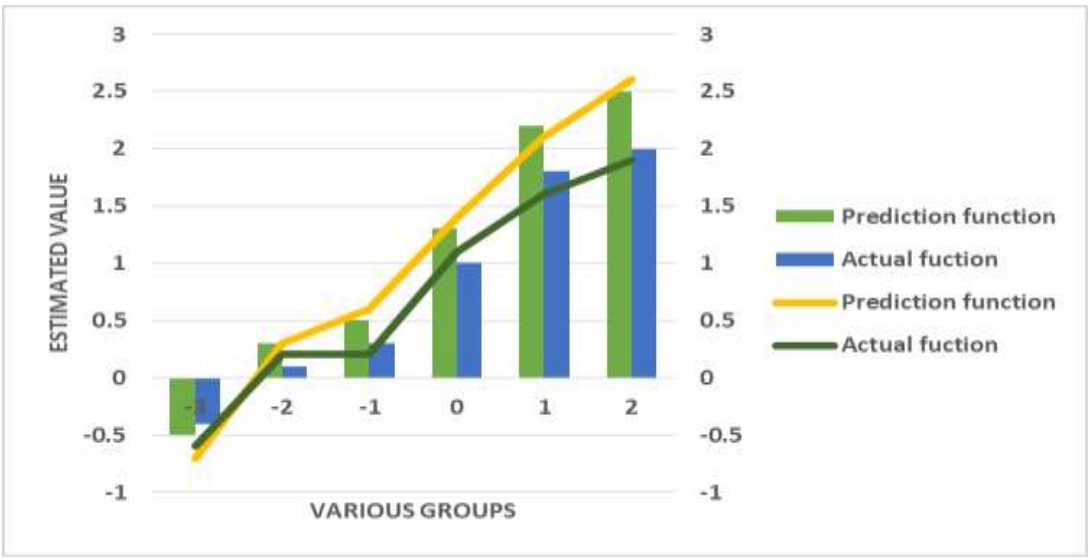
Figure7. *Gradient Variation in ANN*



Note. Value vs. epoch

The results in Figures 2-7 demonstrates the value of enhancing the English learning models for college students and applying functionalities to Deep Learning (DL). Functionalities play an important role in education and are useful for integrating AI into college English teaching. In qualitative research, the researcher is interested in the meaning, process, and understanding revealed via words or images. Because the researcher constructs abstractions, ideas, hypotheses, and theories from specifics, qualitative research is an inductive process.

Figure 8. *Effect of WOA*



Note. Estimated value vs. various groups

WOA is utilized to accomplish exact continued flow by adjusting the hyper parameters of the ANN. The weight matrix is used to forecast the variation in function value. Figure 8 shows that this function's trend is steadily upward, suggesting that the operation of a gradient process based on WOA is more efficient. So, by improving the effectiveness of ANN, we successfully complete the procedure with WOA.

5. Conclusion

This research suggests that AI algorithm is effective and it can be use in teaching English at college level. A very accurate uninterrupted operation was performed by applying ANN and WOA, and the EWH-ANN method in the verbal English correction system was enhanced. It was built and assessed to be a NN framework. Moreover, comparison analyses of different NNs, including CNN, MLP, and DNN, were carried out. Experimental verification was created to create a more comprehensive learning method and make college English instruction more accessible for learners. The study's weakness is the small size of the datasets that were gathered. Large data collections will eventually benefit from this work.

The AI-based verbal English correction has a good level of validity and reliability, which will help with teaching, evaluating, and learning English, particularly with regard to EFL writing. Even while the AI-based spoken English correction isn't as effective as evaluators in spotting every form of error, it could still be a useful tool when teaching, studying, and even evaluating English. The system's use could aid in preventing preservation in the example of EFL students. EFL instructors could accomplish this by using AI to identify the verbal mistakes that students frequently make and applying the feedback's recommendations. This method of teaching EFL students may offer a fresh approach to spoken instruction.

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