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Research on the Integration and Practice Path of English Teaching and Eco-Environmental Protection Education Under the Concept of Empowerment

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ABSTRACT

The fundamentals of solving ecological and environmental problems lie in the problems of education, awareness and quality. Strengthening environmental education for college students can enhance their environmental awareness and motivate them to protect the environment. This study outperforms GA-SVR, PSO-SVR, DE-SVR and SVR in assessing the quality of ecological environment and English teaching by establishing SSA-SVR model. The study shows that the SSA-SVR model has higher assessment precision and accuracy in assessing the quality of university English language teaching. The study provides new methods and tools for university English education and offers valuable insights and guidance for exploring the intersection of ecological conservation and English education. In addition, the study offers suggestions for improvement that can help us gain a more comprehensive and in-depth understanding of the actual effects of university students' participation in English teaching practices and provide more convincing conclusions and recommendations for practice.

KEYWORDS

Data Analysis, Ecological Environment Protection, Empowerment Concept, English Teaching, Modeling, Multi-Media, Practice Path

The destruction of the ecological environment is manifested in several ways. Firstly, the environmental damage caused by mankind's irrational exploitation of the natural environment, and secondly, the environmental pollution caused by the rapid development of urbanization and industrialization, and the resulting problems of global warming, the destruction of the ozone layer, acid rain, and freshwater ecology (Kabir et al., 2023). The earth faces prominent ecological problems such as systematic recession, marine red tides, destruction of tropical rainforests, as well as challenges such as serious land sanding, fossilization, low forest coverage, scarcity of freshwater resources, shortage of wild species, pollution of endangered environments, and serious natural disasters (Waheed et al., 2023).

Alarm bells have been sounded, and ecological protection is imperative. To address these problems, ecological and environmental protection should be based on awareness and education (Uralovich et al., 2023). In addition to fanfare in the media to publicize environmental protection policies, regulations, and the basics of a good model, there is a need to strengthen ecological and environmental protection education in all schools across the country to raise the ecological and

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environmental awareness of the entire nation (Ren & Zhao, 2023). This is especially necessary for college students in teacher training colleges and universities, as they are the future educators of society (Van Vu, 2022).

To achieve this goal, educational administrations at all levels in colleges and universities should break down professional restrictions and create an atmosphere of environmental protection. Conservation courses should be available, whether compulsory or elective. Through empowerment, the subject is given a certain ability or energy to achieve a certain goal. The teaching mode under the concept of empowerment breaks the time and space boundaries of traditional teaching and adopts the modern information technology-enabled teaching mode supported by "Internet+" both inside and outside the classroom and online and offline (Zeng et al., 2023). This teaching mode highlights the characteristics of diversified teaching empowerment, empowering the dual subjects of "teaching and learning" and the entire teaching process of technology empowerment, teacher empowerment, and self-empowerment to realize the goal of cultivating students' core competencies (Yang, 2024).

In the current situation of increasingly prominent global ecological and environmental problems, the role of education has become more and moreimportant. Especially in the practice of university English teaching, how to guide students to actively participate in ecological environment protection has become an urgent problem to be solved (Quintero-Angel et al., 2024). The integration of ecology and university English teaching is a gradual process. The integration of linguistics and ecology has resulted in the formation of linguistic ecology represented by American linguist Hogan and eco-linguists represented by British linguist Halliday (Li, 2021).

The concept of empowerment in teaching can be a powerful tool for students to participate in environmental issues. By using modern information technology and adopting innovative teaching methods, educators can transcend traditional boundaries and create dynamic learning experiences inside and outside the classroom. This method not only enables students to master their own learning but also encourages them to actively contribute to environmental protection. In addition, the combination of ecology and college English teaching represents a broader trend of interdisciplinary cooperation. By combining linguistic theory with ecological principles, educators can explore the intricate relationship between language and environment. This interdisciplinary approach not only enriches students' understanding of these two disciplines but also encourages them to consider the wider impact of environmental issues in their academic and professional pursuits. Put simply, integrating environmental education into college English teaching can not only improve students' language ability but also cultivate their understanding and appreciation of environmental issues. By making students agents of change, educators can play a vital role in promoting a more sustainable future.

However, previous studies have mainly focused on the practice of English teaching under the traditional teaching mode and lacked an in-depth discussion on the participation of college students in teaching English for ecological environment protection in a multimedia context (Moody-Marshall, 2023). Therefore, this study aims to fill the gap in this research field by exploring the practical strategies and methods of university students' participation in teaching English for ecological environmental protection in a multimedia environment to provide new perspectives and insights for university English teaching practice (Gani et al., 2023). This study not only intends to solve the problems existing in the current teaching practice but also hopes to provide feasible guidance for the related educational practice and practical solutions for the integration of ecological environmental protection education and English teaching (Johnson et al., 2022). Therefore, the significance of this study is not only to fill the gaps in academic research but also to promote the organic integration of the concept of ecological environmental protection and English teaching practice to provide useful references and lessons for educational practice and policymaking in related fields (Boeve-de Pauw et al., 2022).

RELATED CONCEPTS

Related Works

Starting from basic ecological theories, optimized ecological strategies and methods of classroom teaching have been studied. With a large amount of practices and deep study, a new model of Ecological English classroom teaching is built, which has significant meaning in the further development of English teaching (Mercer, 2023).

Using the eastern English Channel as a case study, Metcalfe et al. (2015) explored an approach to address these issues by identifying a series of marine protected area (MPA) networks using the Marxan and Marxan with Zones conservation planning software and linking them with a spatially explicit ecosystem model developed in Ecopath with Ecosim. Limited-take MPAs, which restrict the use of some fishing gears, could have positive benefits for conservation and fisheries in the eastern English Channel, even though they generally receive far less attention in research on MPA network design (Metcalfe et. al., 2015).

Jiang (2016) aim to prove the inevitable combination of massive open online courses (MOOCs) and ecological mode in English-major teaching, and then points out the profound changes of the main four ecological elements in English-major teaching after MOOCs get involved. Through comparison and analysis, the paper gives suggestions on developing ecological English-major teaching mode in MOOCs from four aspects (Jiang, 2016).

In order to widen college English teachers' ecological niche and promote their teaching ability, Tang and Chen (2016) make an empirical study on college English teachers' teaching ability and ecological niche on the basis of Ecological Niche Theory. Tang and Chen (2016) show how to take advantage of micro-lectures, make full use of 5C teaching strategies, and form multiple teaching and learning evaluation and online teaching and learning community to improve discourse power between students and teacher to change the role of students and teacher.

The Ecological class is a class in which the system of class teaching is in a state of dynamic balance and it can enhance the efficiency of class teaching. Zhou (2017) analyze the feature of English ecological class, illustrates the non-ecological class teaching problems, and explores the ways to establish English ecological class from the five aspects of: teaching environment, the relationship between the teacher and students and the relationship between students and students, teaching methods, teaching content, and teaching evaluation, so as to improve the English teaching effect and provide some reference for the English teaching in the high school (Zhou, 2017).

One of the most serious problems of the globe today is that environmental degradation and education practices should have a contribution to ecological conservation. Mete (2018) suggests using Bloom's Revised Taxonomy in an environmental education framework for fostering English language learners' skills required for critical reading of authentic texts related to ecology and increasing their environmental awareness (Mete, 2018). It is necessary to take classroom ecological coordination as the main body, better coordinate the ecologicalization of teaching as a whole, and implement the concept of ecological teaching.

Lin (2019) hope to improve the learning interest of college students in China, especially the new teaching concept of English in China. Hua and Yuanyuan (2020) first analyzes the concept of computer network environments in China, and then expounds the shortcomings in the ecological teaching mode of college English under the computer network environment. Finally, the paper analyzes the strategies of constructing the ecological teaching mode of college English under the computer network environment, including the detailed discussion and planning of diversified teaching methods, communication among subjects in the teaching process, and the connection of classroom contents. Based on the current situation of ecological college English teaching in China, Hua and Yuanyuan (2020) make full use of computer network environments to promote its application and development in ecological college English teaching mode.

Based on the changes in the college English ecological teaching model under the background of artificial intelligence, Gui (2020) analyzes what ecological linguistics is and what college English ecological teaching is. On this basis, it analyzes the current college English teaching ecology in the country and proposes artificial suggestions for smart promotion of college English ecological teaching reform (Gui, 2020).

Hou (2021) discusses the ecological teaching mode of college English based on the computer network environment. The college English classroom teaching and the network autonomous learning classroom under the computer network environment of the university public foreign language teaching and research department are selected as the objective test environment, and the qualitative and quantitative integration are combined to summarize the imbalanced performance in the integration (Hou, 2021). Mercer (2023) investigated the welfare of English language teaching (ELT) teachers working in Malta's private sector from an ecological perspective. Moreover, the research uses the rooted interpretive phenomenological analysis (IPA) method to analyze the data and present it according to the ecological point of view (Mercer, 2023).

Strengthen the Content, Goals, Approaches, and Methods of Environmental Protection Education

Ecological Balance Education

Through the study of ecosystem material, energy cycle, and ecological balance, students can understand the basic concepts of biosphere, food chain, ecosystem, and ecological balance, know how to maintain and restore ecological balance, follow the laws of nature, and act by the laws of nature. These are the prerequisites for the harmonious development of man and nature (Yahman & Setyagama, 2023). In the last century, the United States first proposed the concept of educational games (Zhou, 2020). Interest: Starting from modern pedagogical theory, to maximize the effectiveness of learning, educational activities must be carried out in a situation that fully stimulates students' interest and mobilizes students to participate independently. The most striking feature of educational games is that they are fun (Ying, 2021). The essential nature of the game arouses the interest of the learner, making the learner emotionally accept this learning mode from the very beginning. Interest is the best teacher (Abulaish et al., 2020). The relaxed and interesting game environment is different from the rigid classroom teaching atmosphere, which is conducive to stimulating and mobilizing students' initiative and enthusiasm for learning (Wu, 2024). The multimedia mode of the game also integrates a variety of entertainment methods into the teaching materials (Ghani et al., 2024). Especially in the game, this kind of teaching and entertainment is particularly rich. For example, the "recitation of words" has become"dialogue practice," becomes "role-playing,"stage quiz" becomes a "leveling game," and so on. In this way, the game is not only interesting but also adds a task to the fun, aiming at a certain task (Kupchyk & Litvinchuk, 2021). It can not only attract the interest and attention of the players so that the learners can complete the learning tasks in the process of the game but also integrates the teaching content into the process of completing the game tasks, so that according to the learning requirements of different levels and stages, the systematic and scientific arrangement of the learning progress makes the learners' autonomous learning also scientific and systematic, thereby promoting the learning efficiency and better achieving the teaching effect (Dehghanzadeh et al., 2024).

Education on the Status Quo of the Ecological Environment

Through the global, especially China's, ecological and environmental crises, various natural disasters frequently occur, and the human living environment is seriously threatened by the status quo education, which does not cultivate students' high awareness of environmental distress and environmental protection responsibility. With the development of information technology and the innovation of teaching methods, new teaching concepts such as game-based learning and entertainment are gradually being paid attention to and accepted (Kara, 2022). Among them, educational games are a new type

of teaching method. Educational games are the product of the combination of education and games, integrating the advantages of various media such as sound, animation, video, and game interaction. The effective use of educational games can create a relaxed and free learning environment for learners, which truly reflects the idea of taking the learner as the main body and is also conducive to cultivating students' comprehensive qualities such as teamwork, thinking and exploration, and courage to innovate. Therefore, this gamified way of learning is similar to the new teaching philosophy of the 21st century (Petrovych et al., 2023).

Population Control and Resource Status Education

Many environmental problems such as floods and droughts are closely related to the uneven distribution of the total forest shortage (Li & Guo, 2022). Therefore, it is important to understand the current population growth trend (Cheng et al., 2022a or b), the relationship between population and the environment (Cheng et al., 2022a or b), the relationship between human survival and development, the protection of natural resources, and sustainable utilization of renewable resources along with the cherishing and recycling of non-renewable resources.

Ideological Educations for Sustainable Development

Controlling the population, saving resources, protecting the environment, and realizing sustainable development are the strategic ideas of sustainable development in China. Through learning, students can be trained to establish the values of coordinated economic and environmental development and to establish a moral view of harmonious coexistence between man and nature. Environmental protection knowledge and sustainable development strategic ideas become one of the essential qualities of every college student. Figure 1 is a data map of environmental emergencies at the Yangtze River Sports Point from 2008 to 2018.

According to relevant surveys, many college students know little about ecological environmental problems, such as acid rain, desertification, the forest crisis, and genetic pollution, and many regard

Figure 1. Data Map of Environmental Emergencies in the Yangtze River Economic Belt From 2008 to 2018

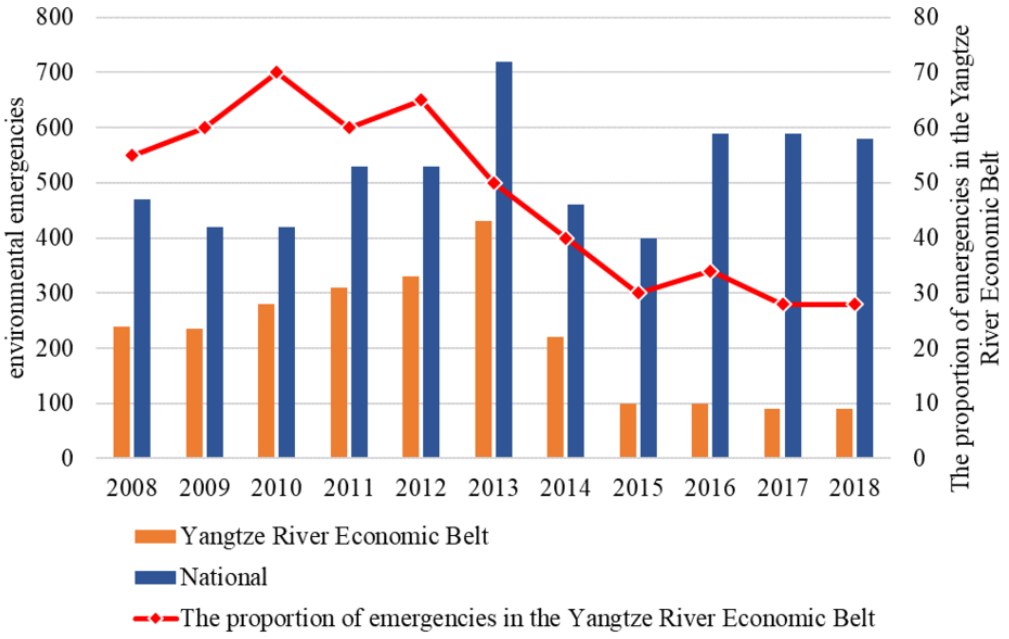
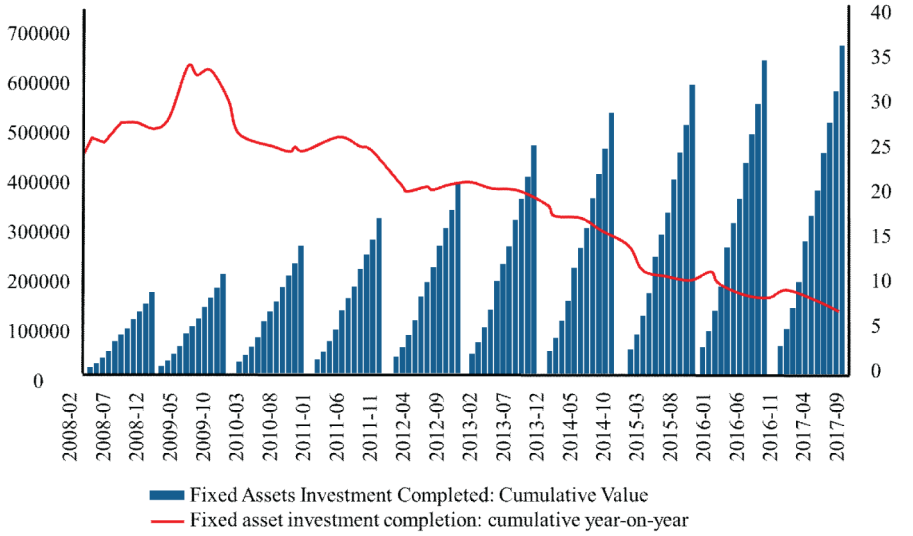


Figure 2. The Proportion of Development Assets in the Ecological Protection Industry From 2008 to 2017



ecological environment problems as local problems. A weak sense of ecological responsibility believes that the maintenance, improvement, and protection of the ecological environment is the government's business. According to this status quo, education must guide students to combine the global regional ecological environment status with the surrounding ecological environment. From the perspective of the combination of sensibility and rationality, we recognize the importance of ecosystems and stimulate a sense of responsibility to protect the ecological environment from social and global heights.

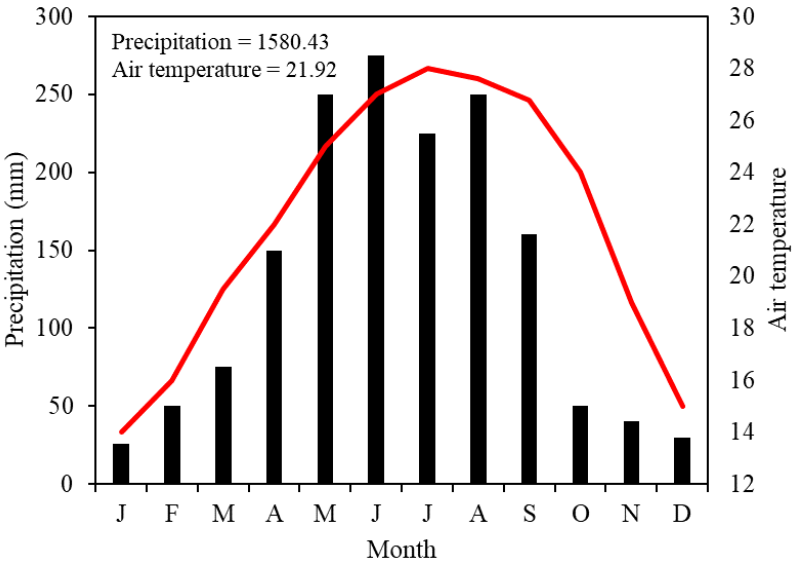
When adding courses and selecting teaching content, it is necessary to focus on the knowledge of the population and environment, natural resources and environmental protection, soil and water conservation and homeland security, waste pollution and prevention, environmental protection, and sustainable development, etc., and ensure a certain number of teaching hours and teaching effects on these subjects. Figure 2 shows the proportion of development assets in the ecological protection industry from 2008 to 2018.

Posters can be used to open an environmental protection education column to publicize environmental policies and display environmental achievements. Arbor Environment Day can be utilized to carry out various forms of environmental knowledge lectures and special lectures on environmental issues and to organize and carry out green campus volunteer labor. Build the campus into a beautiful environment with lush trees and flowers, and the ecological environment demonstration area will enable students to fully feel the atmosphere of the coordinated development of school education and the environment. The concept of natural protection, ecological balance, and sustainable development will be deeply rooted in the minds of students.

Students should be organized to carry out social surveys to understand the severe situation of desertification and dust storms and the hazards caused by various types of man-made pollution. Students' perceptual understanding of environmental crises should be enhanced through social practice activities, like visiting the achievements of forestry ecological construction and the results of various pollution control exhibitions. Rational thinking should use the living examples of environmental pollution and ecological destruction combined with the theoretical descriptions in books to leave a profound impact on students and arouse students' sense of responsibility and mission to protect the environment.

Figure 3 shows the relationship between the rainfall season and environmental changes.

Figure 3. Relationship Between the Rainfall Season and Environmental Change



MATERIALS AND METHODS

The Salps Algorithm

Salp swarm algorithm (SSA) is a swarm intelligence search algorithm proposed by Seyedali et al., (year) inspired by the group behavior of salps. If the predation search space of salps is N×D, where N is the population size of salps, and D is the dimension of the optimization problem. Search space food using Equation (1).

$$F = \left[F_1, F_2, \ldots, F_D\right]^T \tag{1}$$

The location of the ascidian is shown in Equation (2).

$$X = \left[X_{1n}, X_{2n}, \ldots, X_{nD}\right]^T, n = 1,2\ldots,N \tag{2}$$

The upper and lower limits of the search space are shown in Equations (3) and (4).

$$ub = \left[ub_1, ub_2, \ldots, ub_D\right]^T \tag{3}$$

$$lb = \left[lb_1, lb_2, \ldots, lb_D\right]^T \tag{4}$$

The random initialization result of the population is calculated using Equation (5).

$$X_{N\times D} = rand(N,D)\times(ub-lb)+lb \tag{5}$$

Since the leader of the salp group is mainly responsible for searching for food, the leader can lead the movement of the entire group of salps, so there is a high requirement for the randomness of the leader's position update. The leader's update mathematical formula is shown in Equation (6).

$$X_d^1 = \begin{cases} F_d + c_1(ub_d - lb_d)c_2 + lb_d, c_3 \geq 0.5 \\ F_d - c_1(ub_d - lb_d)c_2 + lb_d, c_3 < 0.5 \end{cases} \tag{6}$$

In the formula, c1, c2, and c3 are control parameters, among which, c2 and c3 are random numbers, c2, c3 ∈ [0,1]. The main function is to strengthen the randomness of leader position update, individual diversity, and global search ability. c1 is the convergence factor, and its expression is shown in Equation (7).

$$c_1 = 2e^{-(4t/T)^2} \tag{7}$$

In Equation (7), t is the current number of iterations, and T is the maximum number of iterations.

According to the references, the position of the follower is only related to the initial position, speed, and acceleration, and the update formulas are shown in Equations (8) and (9).

$$R = \frac{1}{2}(X_d^{m-1} - X_d^m) \tag{8}$$

$$X_d^{m'} = X_d^m + R = \frac{1}{2}(X_d^{m-1} + X_d^m) \tag{9}$$

SSA can consider multiple factors simultaneously, allowing for a holistic evaluation of English teaching quality. Parameters such as student engagement, teacher effectiveness, curriculum design, learning outcomes, and student feedback can all be taken into account by the algorithm. This comprehensive approach provides a more nuanced understanding of teaching quality compared to traditional evaluation methods that may focus on specific metrics or aspects. By using objective criteria and data-driven analysis, SSA can help mitigate biases and subjectivity inherent in traditional evaluation methods. Rather than relying solely on subjective opinions or anecdotal evidence, SSA evaluates teaching quality based on quantifiable metrics and objective measures, enhancing the credibility and reliability of the evaluation process. In short, using SSA to evaluate the quality of English teaching provides a data-driven, comprehensive, and adaptable method, which can improve the effectiveness and efficiency of the education evaluation process. By using the power of swarm intelligence, SSA can better understand the quality of teaching and support evidence-based decision-making to improve education.

Support Vector Regression (SVR) Model

For the training sample set (,) x y i i, i=1,2,...n,, xi and yi are the input and output data of SVR respectively, the support vector regression (SVR) function model is shown in Equation (10).

$$f(x) = w^T \varphi(x) + b \tag{10}$$

In the formula, f is the predicted value; w is the weight vector; φ()· is the nonlinear mapping function; and b is the bias.

w and b can be obtained from Equation (11).

$$\min J = \frac{1}{2}\|w\|^2 + C\sum_{i=1}^{n}(\xi_i^+ + \xi_i^-)$$
$$s.t.\begin{cases} y_i - w^T\varphi(x_i) - b \le \varepsilon + \xi_i^+ \\ w^T\varphi(x_i) + b - y_i \le \varepsilon + \xi_i^- \\ \xi_i^+, \xi_i^- \ge 0, i = 1,2,...,n \end{cases} \tag{11}$$

In Equation (11), C is the penalty coefficient; n is the number of samples; ζ i + and ζ i − are the relaxation coefficients; and ε is the maximum error coefficient of the insensitive loss function. By solving the quadratic optimization problem, the weight vector w of SVR is calculated using Equation (12).

$$w = \sum_{i=1}^{n}\left(\beta_i^* - \beta_i\right)\varphi(x_i) \tag{12}$$

where *βi and βi are the Lagrange coefficients, respectively. The mathematical model of SVR is shown in Equation (13).

$$f(x) = \sum_{i=1}^{n}\left(\beta_i^* - \beta_i\right)K(x_i, x_j) + b \tag{13}$$

In the formula, K (·) is the kernel function. The kernel function in this paper selects the Gauss function as shown in Equation (14).

$$K(x_i, x_j) = \exp(-\|x_i - x_j\|^2 / 2g^2) \tag{14}$$

Despite being a complex machine learning model, SVR offers interpretability and explainability through the examination of support vectors—data points that influence the placement of the decision boundary. By analyzing support vectors, educators and administrators can gain insights into the key factors that contribute to teaching effectiveness and student learning outcomes. This interpretability facilitates informed decision-making and targeted interventions to enhance English teaching quality. SVR's ability to generalize to unseen data is crucial for evaluating English teaching quality across different contexts, institutions, and student populations. By learning patterns from training data, SVR can make accurate predictions on new data, enabling the assessment of teaching quality in diverse educational settings. This generalization capability ensures the scalability and applicability of SVR-based evaluation approaches in real-world scenarios. In short, using SVR model to evaluate English teaching quality provides a data-driven, flexible, and robust method, which can adapt to the inherent complexity of educational evaluation. By using the power of machine learning, SVR can understand

the teaching effect and students' learning results more accurately, comprehensively, and operationally, and ultimately support the continuous improvement of English language education.

RESULT ANALYSIS AND DISCUSSION

Experimental Data and Environment

In order to verify the effect of sine cosine algorithm-support vector regression (SSA-SVR) on the evaluation of English teaching quality, the data from 2004 to 2018 of the ecological environment and English teaching quality evaluation of Xi'an Innovation College of Yan'an University was selected as the research object. The aim of this study is to carry out research on the evaluation of university English teaching quality based on the data of ecological environment and English teaching quality evaluation of Xi'an Innovation College of Yan'an University from 2004 to 2018. First, the scores of each teaching quality evaluation index and the comprehensive scores of ecological environment and English teaching quality evaluation are derived by expert evaluation method, and the raw data are pre-processed, such as the treatment of outliers and missing values. Next, according to the secondary indicators of English teaching quality evaluation, relevant features are extracted from the data and feature selection is performed to reduce noise interference and reduce feature dimensionality. Subsequently, the group intelligent search algorithm (SSA) is utilized to search for the optimal parameter configurations, and the SSA-SVR model is established, with the extracted and selected features as inputs, and the composite scores of the ecological environment and the quality of English teaching as outputs. The model is evaluated and optimized through cross-validation and other methods to ensure that it has good generalization ability on new data. Finally, the established SSA-SVR model is applied to predict the quality of new university English teaching, and the corresponding comprehensive evaluation scores are derived. The scores of each teaching quality evaluation index and the comprehensive score of ecological environment and English teaching quality evaluation are obtained by the expert evaluation method. To verify the method proposed in this paper, a total of 3,000 sets of data were collected, and the data came from the "Research on College English Teaching Model," a teaching reform project at a university in Sichuan. To avoid excessive data differentiation and to improve the calculation speed, preprocess the original data using Equation (15).

$$r_{ij} = \frac{U_{ij}}{\max\{U_{ij}\}}, i = 1,2,...,p; j = 1,2,...,m \tag{15}$$

Experimental Results and Analysis

Taking 20 secondary indicators of English teaching quality evaluation as the input of the SSA-SVR model, and the comprehensive score of ecological environment and English teaching quality as the output of SSA-SVR, the ecological environment and English teaching quality evaluation model of SSA-SVR is established. It can be seen from Figure 4 and Figure 5 that the evaluation results of SSA-SVR are better than GA-SVR, PSO-SVR, DE-SVR, and SVR, and the RMSE and MAPE of SSA-SVR are the smallest. The teaching quality evaluation has the best effect and the highest evaluation accuracy. SSA-SVR, GA-SVR, PSO-SVR, and DE-SVR university public English teaching quality evaluation accuracy is better than SVR, mainly because SSA, GA, PSO, and DE optimization selects the SVR model parameters to improve the accuracy of college public English teaching quality evaluation.

It can be seen from Figure 6 that it is different from GWO-ELM, PSO-ELM, GA-ELM, and DE-ELM. In comparison, GWO-ELM has faster convergence speed and lower fitness, which shows that GWO-optimized ELM has higher evaluation accuracy for college English teaching quality evaluation. It can also be seen from Figure 6 that GWO-ELM has the highest accuracy rate of college English teaching quality evaluation in this paper. The accuracy rate is as high as 95.65%, which is better than

Figure 4. Training Set Evaluation Price Result

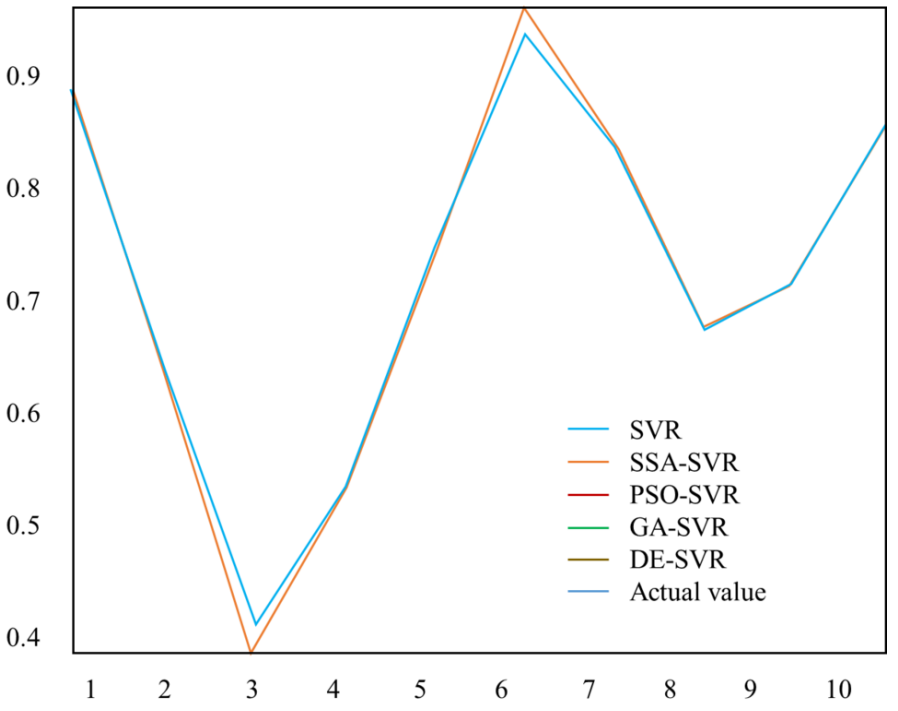


Figure 5. Test Set Evaluation Results

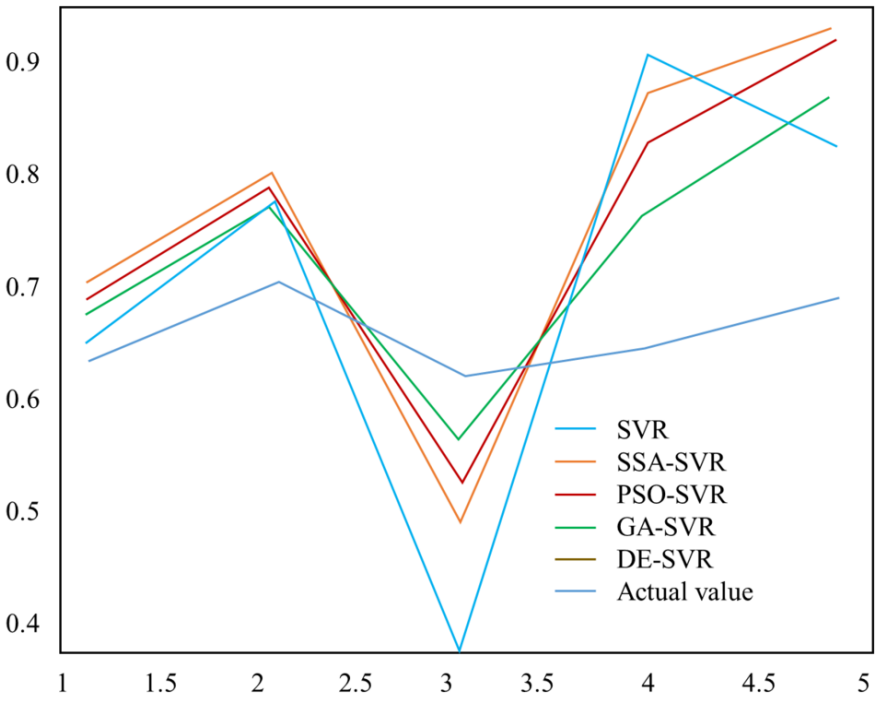
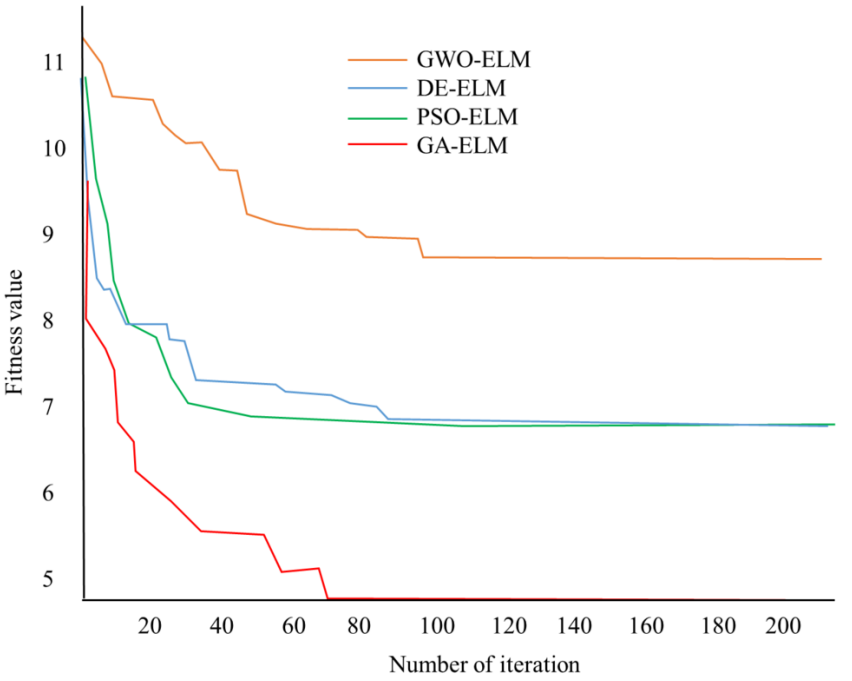


Figure 6. Comparison of Optimization Curves

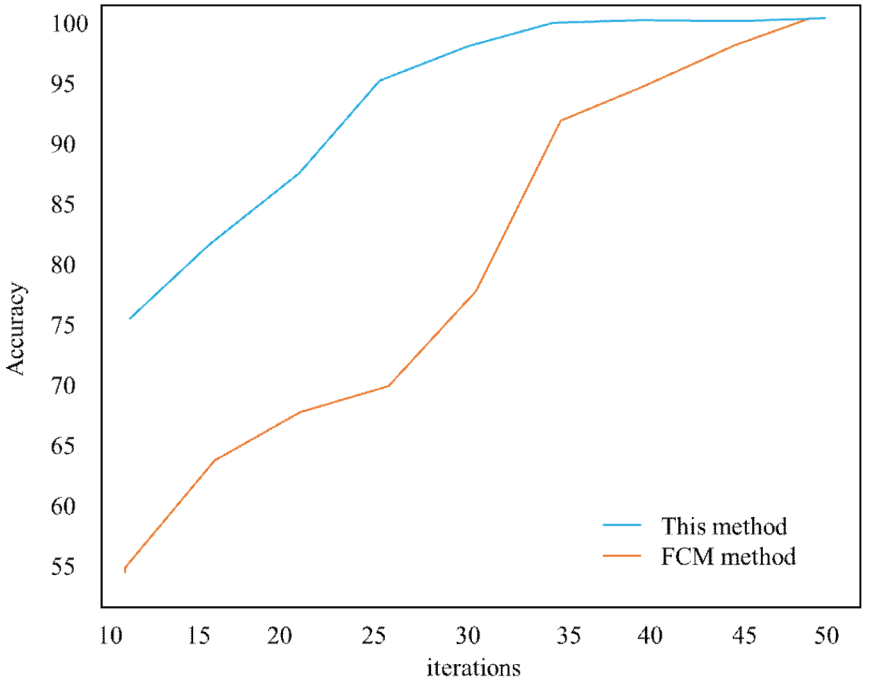


KNN's 73.13%, ELM's 80.24%, DE-ELM's 82.85%, GA-ELM's 87.84%, and 88.86% of PSO-ELM, thus proving the effectiveness and reliability of GWO-ELM, and the method can be popularized and applied in related fields.

In Figure 7, the analysis results show that the method is better than the FCM algorithm for extracting English text summaries. In detail, as the number of iterations increases, so does the accuracy. The proposed method requires only 35 iterations to achieve 100% accuracy, while the FCM algorithm requires about 50 iterations. At the same time, it can also be seen from the figure that when the number of iterations is 10, the accuracy of the proposed method is about 77%, while the accuracy of FCM is only about 58%. In addition, the accuracy of the proposed method increases steadily with the increase of the number of iterations, which is more stable than the FCM algorithm.

The trend problem addressed in this paper pertains to the evaluation of ecological environmental protection and the quality of English language teaching. Traditional evaluation methods may lack the precision and accuracy required to adequately assess these complex and multifaceted domains. Therefore, the study aims to overcome this challenge by proposing novel methodologies, namely SSA-SVR and GWO-ELM. These methods are designed to capture underlying trends and patterns within ecological conservation efforts and English language education, thereby providing more insightful and reliable evaluations. By utilizing advanced computational techniques such as SSA-SVR and GWO-ELM, the study addresses the need for improved assessment methodologies capable of accommodating diverse variables and nuances inherent in these domains. Furthermore, by comparing the performance of SSA-SVR and GWO-ELM with other established models like GA-SVR, PSO-SVR, DE-SVR, and SVR, the study demonstrates the superiority of the proposed approaches in terms of assessment accuracy and precision. This not only validates the effectiveness of SSA-SVR and GWO-ELM but also highlights the importance of leveraging cutting-edge computational techniques to address complex evaluation challenges.

Figure 7. Comparison of Accuracy



CONCLUSION

This study has contributed significant insights into the evaluation of ecological environmental protection and the quality of English language teaching, utilizing innovative methodologies such as SSA-SVR and GWO-ELM. Through rigorous comparison with other models, including GA-SVR, PSO-SVR, DE-SVR, and SVR, the SSA-SVR model has emerged as a superior method, demonstrating higher accuracy and precision in assessment metrics such as RMSE and MAPE.

The findings of this study not only underscore the effectiveness of SSA-SVR and GWO-ELM in their respective domains but also shed light on the intersection of ecological conservation and English education. While acknowledging potential limitations in generalizability due to contextual factors, the study lays a solid groundwork for future research endeavors. Furthermore, this study advocates for ongoing improvement in research methodologies, including broader scope, integration of multiple variables, and utilization of quantitative methods for long-term effects assessment. By addressing these areas, future research can deepen our understanding of university students' participation in English teaching practice and offer more robust recommendations for enhancing teaching quality and ecological awareness. Overall, the findings presented herein provide valuable guidance for practitioners and policymakers in the fields of ecological conservation and English language education, emphasizing the importance of innovative approaches and continuous improvement in educational practices and environmental stewardship.

DATA AVAILABILITY

The figures used to support the findings of this study are included in the article.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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