International Journal of Information and Communication Technology Education
Volume 20 • Issue 1

Research on English Classroom Teaching Programs in Colleges and Universities Based on Wireless Communication Technology Support in the Context of 5G

Min Zhang, Zhengzhou Railway Vocational and Technical College, China*

ABSTRACT

The purpose of this article is to investigate how 5G and wireless communication technologies (5G+WCT) might be applied to English language classroom programs in higher education. The paper describes the complimentary roles of 5G and wireless communication technologies in English language teaching, includes student data collecting and standardization as part of the pre-processing, and optimizes the teaching system using an enhanced ant colony algorithm (BACO). Furthermore, the thesis delineates diverse approaches to verify and assess the program's efficacy. Through the creation of cutting-edge instructional strategies and data collection techniques, this study fosters innovation in English language instruction in higher education. The study offers promise for real-world application and is significant for raising student success, instructional quality, and educational efficacy. However, since 5G technology is still developing, the results of this study could not be applicable in the future or would need to be updated.

KEYWORDS:

Wireless Communication Technology, Fifth-Generation (5G), Colleges and Universities, Integrated Classroom Learning Model

As technology continues to advance, more and more people are exploring the most effective methods of teaching foreign languages. In this context, multimedia networks play an increasingly important role in researching and creating new methods of linguistics education. In order to keep up with the dynamic character of contemporary lecture halls, universities need to modify their teaching strategies according to the new standards of the Ministry of National Education (Liu et al., 2021).

In recent years, an increasing number of students are relying on their teachers' advice for effectively using computer networks and multimedia technologies in the classroom. Traditional methods of teaching English to students have heavily relied on the teacher's demonstration (Baratè et al., 2019). The Internet provides a wealth of educational resources that surpass traditional classroom teaching in both breadth and depth (Cheng & Wei, 2021). Online multimodal education increases

DOI: 10.4018/IJICTE.339202 *Corresponding Author

students' desire and ability to learn the target language by stimulating their visual and auditory senses (Huang et al., 2019). Students can reinforce their memory and increase their interest in learning the language by repeating new vocabulary they hear. Students enrolled in online English programs can review what they have previously learned and focus on strengthening weak areas at their leisure (Leung, 2020).

Online English learning programs have benefited from the rise of the Internet, the maturation of distance education commodities, and changes in student motivation. Research on online learner motivation needs to consider the characteristics of the online domain. Distance education students' lack of interest in online English programs has become a new hot topic in second language acquisition research. Mobile edge computing based architecture eliminates time and space constraints and facilitates 5G wireless LMS development (Shu, 2020).

Educational reforms have had a significant impact on teaching practices. A study surveyed university professors and students, testing them using questionnaires, computer analysis, and 5G Internet simulations. This study proposed a method for distributing learning resources that reduces energy consumption and increases the likelihood of resources reaching students. The Best Available Technology Optimization Algorithm (BOA) was used to optimize the transmission process (Sokkhey & Okazaki, 2020). The results of this study will be used to improve English language education at the university level, including increasing ESL students' access to high-quality online resources and recruiting more experienced teachers (Yi & Dan, 2020).

Literature on real-time data services reveals the intrinsic connection between data transmission, collection, management, and delivery. The selection of appropriate communication channels and protocols is crucial when transmitting wirelessly between devices connected to the 5G Internet and cloud computing centers (Cheng et al., 2021).

The purpose of this paper is to explore how 5G and wireless communication technology (5G+WCT) can be applied to English classroom teaching programs in higher education to provide higher quality teaching methods. The study includes collecting and standardizing student data as part of pre-processing, describing the role of 5G and wireless communication technologies as an English language teaching aid, and applying an improved ant colony algorithm (BACO) to optimize the teaching system. In addition, this paper proposes various methods to check and evaluate the effectiveness of the program. By developing innovative teaching methods and collection methods, it promotes the innovative development of English acquisition in higher education.

RELATED WORKS

Yusuf et al. examine the benefits of effective utilization of mobile technologies and inquiry-based teaching methods in Nigerian universities. The authors explore the techniques that guide undergraduate students to learn with digital support from mobile devices and wireless communication during their classroom activities and outside the classroom with the use of PDF and WAP technology (Yusuf et al., 2020). This research focused on blended learning and collaborative learning to develop English communication skills of the university students in an English Teaching Program. Mahawan et al. study the effect of blended learning with collaborative learning upon English communication skills of English teaching program students. The statistics employed were Means, Standard Deviation (SD), and t-test (Mahawan et. al., 2020). Its objective is to help educators use social media to customize the classroom for all students. Syafi'f studies Google Classroom as a learning platform for teaching writing. Awareness of the positive potentials of this learning style will allow Google Classroom to introduce a mixed learning approach in the classroom. The argument continues with Google Classroom presentation and the idea of mixed education using the platform (Syafi'i, 2020). Several computer-based programs and mobile-based applications can be utilized in teaching English. Alam et al. investigate the prospects of such measures in the context of BSMRSTU (Bangabandhu Sheikh Mujibur Rahman Science and Technology University). Participants were selected from the students

of foundational English courses who are taught using the traditional classroom set-up (Alam et. al., 2020). Multimedia technology and wireless communication, as an important branch of information technology, can better connect people and the network, exploding very powerful energy in the field of education (Li, 2021). This research analyzes the cultural communication function of wireless communication and multimedia network technology in university teaching, especially English teaching. The development of wireless communication technology and the widespread application of big data has accelerated the degree of globalization. Li discusses the flipped classroom English translation teaching model based on the fusion algorithm of network communication and artificial intelligence. This research proposes an Internet learning platform based on Tencent's QQ communication software and mobile terminals (Li, 2021). The adoption of updated technology represents an important advance in modern English language teaching methods. The purpose of Kamil's study is to identify the role updated technology in language classrooms undertake to nurture and support language learning (Kamil, 2021). With the rapid development of information technology, China's mobile communication has entered the 5G era and the Internet of Things technology will be more widely used and developed. Wang propose the application of the 5G-based Internet of Things technology in the physical education platform. Wang design a 5G-enabled Genetic Algorithm- (GA-) based approach for college English lectures, writing, and translation. The proposed method is further improved by incorporating 5G network-dependent English writing and interaction tools (Wang, 2022).

MATERIALS AND METHOD

Three-Dimensional Visualization Technology

In academic environments, the use of three-dimensional (3D) visualization technologies gives the impression that more authentic computer-generated graphics can be created. Because of this innovation, we can produce material that is extremely complex and challenging to replicate. Students of English can experience greater than simply textual understanding with the use of 3D virtualized technological advances. They are analogous to computerized representations of objects taken from the actual globe owing to the advent of digital techniques. This innovation is appropriate for use in intellectual classroom environments, and it has built-in assistance for modeling and visualization, which enables it to realize even the most difficult aspects of English educational material (Zhang & Bi, 2018). As a result of the many advantages that can be gained by incorporating video lessons into secondary university curricula, three-dimensional multimedia has emerged as one of the most cutting-edge technology advancements that are now being used within the English language learning process (Lin et al., 2019). The technology that enables wireless connectivity enables fast downloading and uploading rates, accessibility to 3D animations and other extraordinary instructional resources, and high-definition (HD) excellent tasks to be effectively communicated. The diverse atmospheric connection that 5G offers increases bandwidth efficiency by a factor of two. Uplink and downlink wireless communication speeds for source information may reach up to 10 and 40 gigabits per second, respectfully, when using 5G technology. It is not alone capable of achieving such information speeds, but it could also receive and transfer information, and it can also provide real streaming in full HD with English subtitles for reduced delay interaction. This application program may be helpful in the classroom for things like lecturing, authentic question-and-answer discussions, interconnection across academic institutions, and present-time information exchange (Jiao, 2021).

Cloud Computing

Technology done through the internet is referred to as "cloud computing." The institution's laptops and other gadgets get many resources, including servers, memory, and software, all of which are supplied through the network. Taking use of cloud computing technology enables users to engage in various activities from employment related to pleasure in the cloud, which is made possible by

5G and wireless communication technical support (Huang & Mai, 2021). This technology enables a variety of integrated classroom learning model-based educational academic methods to employ this service to minimize the expense of computational program maintenance, information preservation, and transmission. 5G and wireless communication technologies are responsible for this. When it comes to making the most of the benefits rendered by the 5G integrated classroom learning model, using a variety of cloud computing platforms is very necessary. The extremely dependable and high performance of the 5G response time is a driving force behind the implementation of this solution. It is feasible to bring students and professors together on a unified, common framework if cloud computing is used. This is a desirable goal for many educational institutions (Shengxue, 2019). It is not needed for educational institutions such as colleges, institutions, and universities to acquire, develop, and manage their information centers and equipment on their own. The usability and safety features of cloud storage are quite advanced, and this kind of storage may also serve as an efficient method of cooperation. One of the many benefits that educational institutions have is the ability to practice control over the individuals who may see their different papers and initiatives. Storage facilities for files should only be used for maintaining one's documents. Improved English instruction may be possible by making use of cloud computing. Employing cloud computing is made very easier with the introduction of 5G and wireless communication technology (Chen & Wang, 2021).

Virtual Reality

Users can carry out activities in combination with physiologically expressed entities through a variety of emotions including animations, tactual, and sensory feelings in surroundings that are generated by a collaborative sensory digital machine. These senses are made possible by analog devices that are linked to virtual reality. The mix of computer-generated and actual material at the constructing sites of the user's vision is what constitutes enhanced actuality (Mo & Yan, 2021). Combining the computerized environment of expanding with the technologies found in English smart classrooms is one way to accomplish the goal that has been set. The amount of accessible throughput, the frequency of the connection, and the amount of delay required to execute this technology are the primary obstacles they face. The answer is a service that is made possible by 5G and other forms of wireless communication technology. It is possible for the technology that is provided by 5G and wireless communication technologies to give significant advantages to the educational system by allowing for the creation of intelligent lessons, smart teachers, and intelligent administrative groups (Zhang & Zhu, 2018).

Smart Classroom

Courses taught in English classrooms that make use of smart technology are an integral component of the technology that makes up smart education. Online analysis of materials innovation in university instructional techniques has developed into a focal point for the education and investigation being conducted by these institutions. To communicate with learners and educators in the conventional classroom environment by standardizing, another world wide web such as knowledge collecting gadgets, cellphones, ports, PC connectors, equipment of the system, and smart classrooms have been developed. Long-distance pupils can also communicate in this smart classroom through the use of 5G and wireless communication technology (Zhao, 2018). Content can be transmitted between people and gadgets, as well as from one gadget to another human gadget, as part of the wireless communication technology that serves as the foundation for education in the intelligent classroom. Through the use of human interaction, communication to and from informational devices is possible. It is possible to feed information that has been communicated to the computing layer backward to the software layer to create tools and programs for teaching content (Zhu, 2019). Learners who are in an atmosphere that makes use of wireless communication technology can communicate to their courses at any time and from any location, which makes it easier for them to obtain instructional resources. This may make it feasible to observe a lesson from the comfort of one's own home and even "attend" it when one is

unable to physically be there, or it can provide specialized courses to those who live in more remote areas. Over the school's wireless connection, pupils can effortlessly and securely communicate papers, data, and ideas with one another. Coursework may be assigned by teachers, and students can learn the importance of working together. A significant amount of the manual labor required to manage a classroom can be completed digitally (Tan, 2019).

English Teaching Modal

The English teaching modal is administered by the teachers. English courses pertain to modern educational approaches that encourage student engagement and active learning. These models include pupils and instructors working together as "part of leadership." Educators, both in their capacity as material planners and as students, play an equally important part in the leadership role they play. Teachers are responsible for guiding students in how to study as well as organizing learning materials from the viewpoint of the learner (Cheng et al., 2021). Teachers must be well-versed in the content they teach and be able to pass on customized expertise and abilities to their learners in the teaching. In addition, teachers must know their subject areas intimately and be able to deliver to pupils with the understanding and talents necessary to advance their education.

In the technique that was suggested, we offered a model for integrated classroom learning that is based on the assistance of wireless communication technology in the environment of 5G. The goal was to produce higher-quality English classroom teaching methods in colleges and universities using this method. Figure 1 displays the proposed framework.

Data Collection

Students from 11 institutions with various educational degrees were selected from 58 courses. The study included 487 male students and 1,515 female students. The average age of the participants was 18.65 years, with a standard deviation of 1.87. The students represented over forty different academic fields, encompassing areas such as the arts (including philosophy, languages and literature, philology, economics, and the humanities), the social sciences, and the physical sciences. Throughout the research period, each student was enrolled in at least one English class, although they may have been following various English curricula at their respective universities (Xu, 2019).

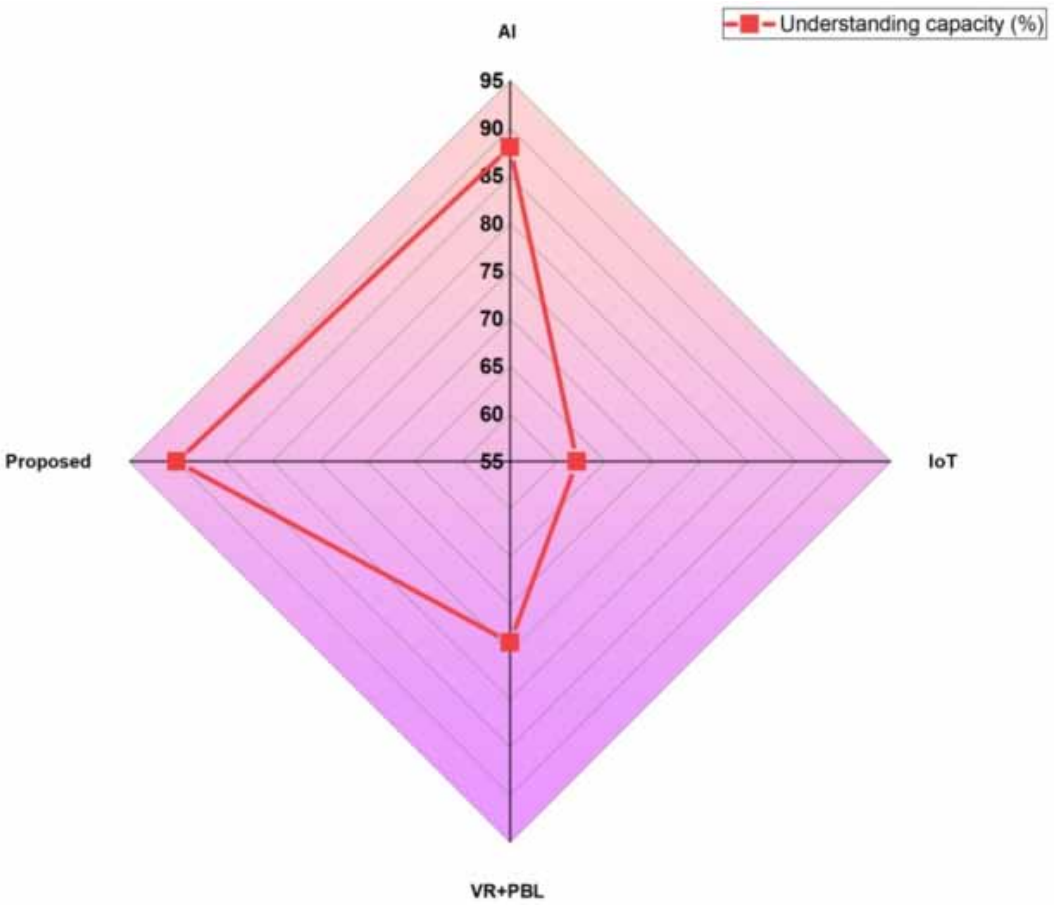
Preprocessing Using Normalization

During the cleaning and preparation phase, it is common to encounter redundant packets and empty data in the supplied dataset. To address this, any repetitive, duplicate, or missing data is typically removed. Given the vast amount of data present in academic systems, sample approaches are often employed. Due to the complexity of the data collection, researchers conducting this study need to employ feature extraction techniques to filter out irrelevant characteristics that are not essential to the project. Additionally, the normalization process is implemented to ensure all the data is placed on the same scale. The detailed process of data analysis involves several steps. Firstly, the dataset is cleaned and prepared by removing redundant packets and empty data points. Next, a feature extraction technique is applied to identify and extract the most relevant characteristics for the research project. This step helps to reduce the dimensionality of the dataset and focus on the significant features.

Once the dataset is prepared and relevant features are extracted, the normalization process is performed. This process aims to standardize the data and bring it to a common scale, ensuring that different variables with varying ranges do not dominate the analysis. Normalization allows for fair comparison and interpretation of the data.

After normalization, various statistical and analytical techniques can be applied to analyze the dataset. This may involve descriptive statistics such as mean, standard deviation, and frequency distribution to understand the central tendencies and variability of the data. Furthermore, advanced statistical methods such as regression analysis, hypothesis testing, or machine learning algorithms can be employed to uncover relationships, patterns, or make predictions based on the data.

Figure 1. Proposed Framework Modal



Overall, the data analysis process involves cleaning and preparing the dataset, performing feature extraction, normalizing the data, and applying various statistical techniques to gain insights and draw meaningful conclusions from the dataset. As a result, normalizing the data set is a necessary step. Obtaining the z-score is the initial step in the normalization process. The z-score may be calculated using equation 1, which can be seen below.

$$Z = \left[\frac{SD}{\left(sm - \sigma \right)} \right], \tag{1}$$

In this equation, σ represents the mean value, and SD stands for the standard deviation. The formula for calculating the z-score is given below as equation 2, where $\overline{sm}$ represents the sample's mean.

$$Z = \frac{m - \overline{sm}}{SD} \tag{2}$$

The sequence of equation 3 is followed by the randomized collection that was chosen, where $\in_x$ represents the errors and SSD[2] is the dependable source.

$$Z_x = \beta_0 + \beta_1 sm_x + \in_x \tag{3}$$

As a consequence of this, the inaccuracies must be independent of one another, as shown by equation 4 that is shown below, where m represents a random variable.

$$sm_x \sim \sqrt{W}\,\frac{U}{\sqrt{U^2 + w - 1}} \tag{4}$$

It is possible to determine the momentary scaled variation with the use of the following equations 5 and 6, where m represents the momentary scaling.

$$m = \frac{\lambda^m}{\gamma^m} \tag{5}$$

$$\lambda^m = A\left(sm - \sigma\right)\hat{M}, \tag{6}$$

If Y denotes a random variable and A denotes the value that is anticipated to be found, respectively, where the variable B_c represents the variability factor.

$$\gamma^m = \left(\sqrt{A\left(sm - \sigma\right)\hat{M}}\right)\hat{2} \tag{7}$$

$$B_c = \frac{m}{sm} \tag{8}$$

When all of the variables have been simultaneously adjusted to 0 or 1, the characteristic scaling operation may be considered complete. The Unison-based normalizing strategy is the term given to this particular method. The normalized equation will be represented as the following equation 9,

$$sm' = \frac{\left(sm - sm_{min}\right)}{\left(sm_{max} - sm_{min}\right)} \tag{9}$$

The data collection may be managed in this way, making it possible to maintain both its magnitude and its level of fluctuation while under control. The remaining phases of the work make utilization of the information once they have been normalized.

Integrated Classroom Learning Model Based on Wireless Communication Technology Support in the Context of 5G

The use of 5G and wireless communication technologies to help instruction and study English is referred to as technologically augmented education. Thoroughly incorporating technology with education may result in an efficient teaching strategy.

Optimization Using Boosted Ant Colony Optimization (BACO)

Boosted Ant Colony Optimization (BACO), a method that derives inspiration from nature, replicates how ants search for food. In comparison to other methods, BACO is more logical since it supports distributed processing while reducing system dependency and gives feedback on the activities of ants in the search area. BACO takes the path and intuitive data into account while doing statistical optimization. The BACO changes the pheromone level at any characteristic as they travel along a route. The probability that a character will be discovered along the short way increases as more student data travel through it and more pheromones are stored there.

$$Gt_i^j\left(S\right)=\begin{cases}\dfrac{\left[\tau_i\left(S\right)\right]^{\alpha}\left[\eta_i\right]^{\beta}}{\sum_{p\epsilon\, p_i^j}\left[\tau_p\left(s\right)\right]^{\alpha}\left[\eta_p\right]^{\beta}}, & if\ p\epsilon\ p_i^j\\ 0, & otherwise\end{cases} \tag{10}$$

The route with the highest pheromone level will be followed by both the route with the most pieces of data and the shortest distance. The pheromone quantity p = 1 is initiated at each of the n characteristics, and information is scattered broadly across a collection of optimized features with a preset greatest number of generations G. For each generation g, the options $Gq_i^j\left(S\right)$ of the jth data at the ith characteristic are shown in equation 10.

$$\tau_i\left(g+1\right)=\left(1-t\right)\tau_i\left(g\right)+\sum_{j=1}^{n}\Delta\tau_i^j\left(g\right) \tag{11}$$

The list of possible neighbors of the ith feature that the jth data does not reach is represented by p_i^j. Non-negative variables provide the pheromone level i's relevance and heuristic data (p) for the data's movements. During the next characteristics in the data, the path has been chosen, and a fitness function (FF) is utilized to assess the newest group of optimized features. The jth ant's movement is halted if the fitness value does not rise after the inclusion of any unique characteristic. If the stopping conditions are not satisfied, the amount of pheromone level at the ith feature is changed as follows for the next generation (g + 1) expressed in equation 11.

$$\Delta\tau_i^k\left(S\right)=\begin{cases}FF\dfrac{\left(G\left(S\right)\right)}{\left|G^j\left(S\right)\right|}, & if\ i\int G^k\ \left(S\right)\\ 0, & otherwise\end{cases} \tag{12}$$

If an i-th feature is on the data's shortest route, then $S^j\left(G\right)$ represents the pheromone that was accumulated by the jth ant; otherwise, it is 0. Where n is the quantity of data, Gj (G) reflects

the number of characteristics that were selected. The stopping conditions are met as soon as S reaches the predefined maximum G in equation 12. If a set of traits has the highest pheromone level and the least fitness value, it will be picked as a selected feature. Pseudocode 1 depicts the BACO's process.

```
Pseudocode 1: Boosted Ant Colony Optimization (BACO)
Step 1: Begin
Step 2: Initialize BACO parameters
Step 3: Generate the locations of randomized data
Step 4: Utilize the fitness function to assess data routes
Step 5: Update transition Matrix
Step 5: Update the pheromone level
Step 5: If S=G?
                    Stop
            Else
                    Begin from step 1
Step 6: End
```

RESULTS AND DISCUSSION

The assistance of 5G and wireless communication technology (5G+WCT) for English classroom teaching plans in colleges and universities is presented in this research. The success of the suggested strategy is reviewed in this section. The suggested system's ability to achieve English fluency, understanding capacity, cognitive skills, and student support rate justifies its use. The common approaches used for comparison include artificial intelligence (AI), the Internet of Things (IoT), virtual reality and problem-based learning (VR-PBL), and multimedia networks (MN) (Sun, 2021).

English Fluency

When training English pronunciation, the following steps and methods are used. First, the correct way of pronunciation is recorded using accurate and reliable audio-visual materials which can be provided by teachers or professionals. Second, a set of words is selected for pronunciation training according to the level and needs of the students. Beginners can choose simpler words, while advanced students can pick more complex words. Then, a model is built to map each word to a point in a two-dimensional space, and the ant colony algorithm can be used to construct the model, in which each word is regarded as a node. The distance between nodes denotes the phoneme similarity. During the training process, each student has a target word, and when the target word is spoken, the system will start the model and find the nearest "food source" that is similar to the target word. The student's pronunciation is recorded and passed on to nodes neighboring the "food source" (i.e., similar words), helping the student improve his/her pronunciation skills by receiving feedback on words similar to the target word. The system records the student's pronunciation and provides feedback, analyzes the student's pronunciation and detects errors using an ACO algorithm, provides real-time feedback that guides the student on how to improve his/her pronunciation, and provides the teacher with a report on the areas in which the student needs to improve. The learning process can also be recorded to assess the student's progress in pronunciation.

The capability to communicate English fluently is defined as the capacity to do so without pausing to consider the grammar, lexicon, or accent necessary to convey a message. It is extremely crucial while learning English. The English fluency of the suggested and conventional approaches is shown in Figure 2. The numerical values of English fluency are shown in Table 1. It demonstrates how well the suggested strategy increases fluency.

Figure 2. English Fluency

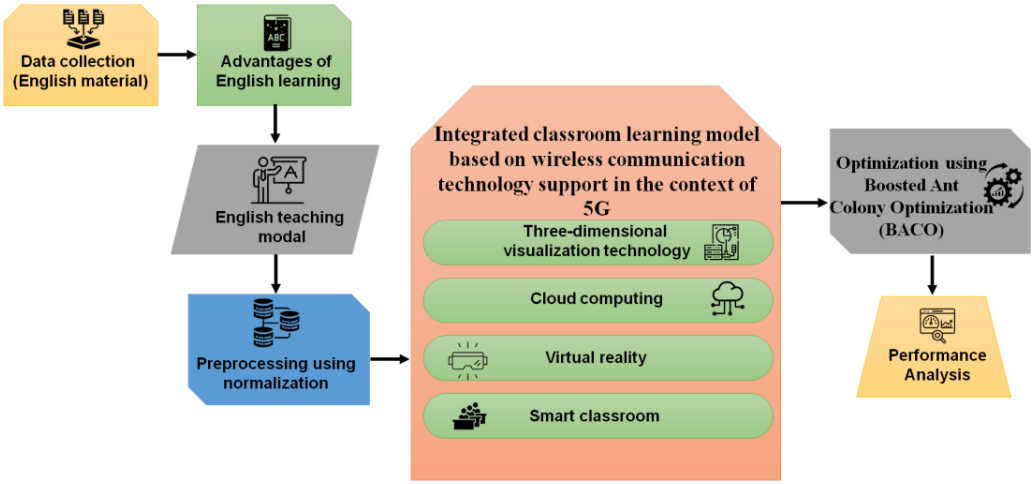


Table 1. English Fluency of Proposed and Traditional Techniques

Techniques	English fluency (%)
AI	65
IoT	74
VR+PBL	82
Proposed	95

Understanding Capacity

BACO (Binary Ant Colony Optimization) is an algorithm that draws inspiration from the behavior of ant colonies, offering a systematic approach to enhancing English comprehension skills. This algorithm can be applied by defining specific areas of English comprehension that require improvement, such as reading comprehension, listening comprehension, or understanding spoken English in various contexts. By establishing a fitness function that evaluates comprehension levels based on factors like accuracy, speed, and depth of understanding, learners can systematically practice and improve their skills. The algorithm represents English comprehension tasks or exercises as a solution space, which may include English passages, audio recordings, or other relevant materials for practice. Learners are represented as ant agents, each traversing the solution space and making decisions based on predefined rules. These rules define behaviors for the ants, such as selecting passages or listening materials, extracting key information, and answering comprehension questions. To reinforce successful behaviors and discourage unsuccessful ones, the algorithm incorporates pheromone update mechanisms. Pheromones represent the quality of comprehension achieved by the ants. Through a repetitive process of ant behavior and pheromone update cycles, the algorithm allows the ants to learn from previous experiences and adapt their strategies to achieve better comprehension results. Monitoring the convergence of the algorithm by observing improvements in comprehension scores over iterations enables evaluation of the final comprehension performance. Comparing this performance to the initial level helps assess the effectiveness of the approach. Results analysis identifies areas for further improvement, allowing adjustments to be made to parameters like the fitness function, ant behaviors, or pheromone update rules to optimize the algorithm for better English comprehension

outcomes. Overall, the BACO algorithm provides learners with a systematic and effective means of enhancing their English comprehension abilities. By selecting appropriate materials, extracting key information, and reinforcing successful comprehension strategies through pheromone updates, learners can improve their comprehension skills in a structured and iterative manner.

The character and outcome of a subject-related choice are determined by understanding capacity. This indicates that a person is capable of comprehending all the factors that must be taken into account when selecting an option on a topic, what the options are, and what the prospective outcomes and results of those options are. Figure 3 displays the understanding capacity for both the recommended and traditional ways. Table 2 displays the understanding of capacity's numerical values. It illustrates the effectiveness of the proposed technique in raising pupils' understanding capacity.

Cognitive Skills

The application of ant colony algorithms in the field of English language learning is an innovative approach to provide students with personalized learning path suggestions, develop their information

Figure 3. Understanding Capacity

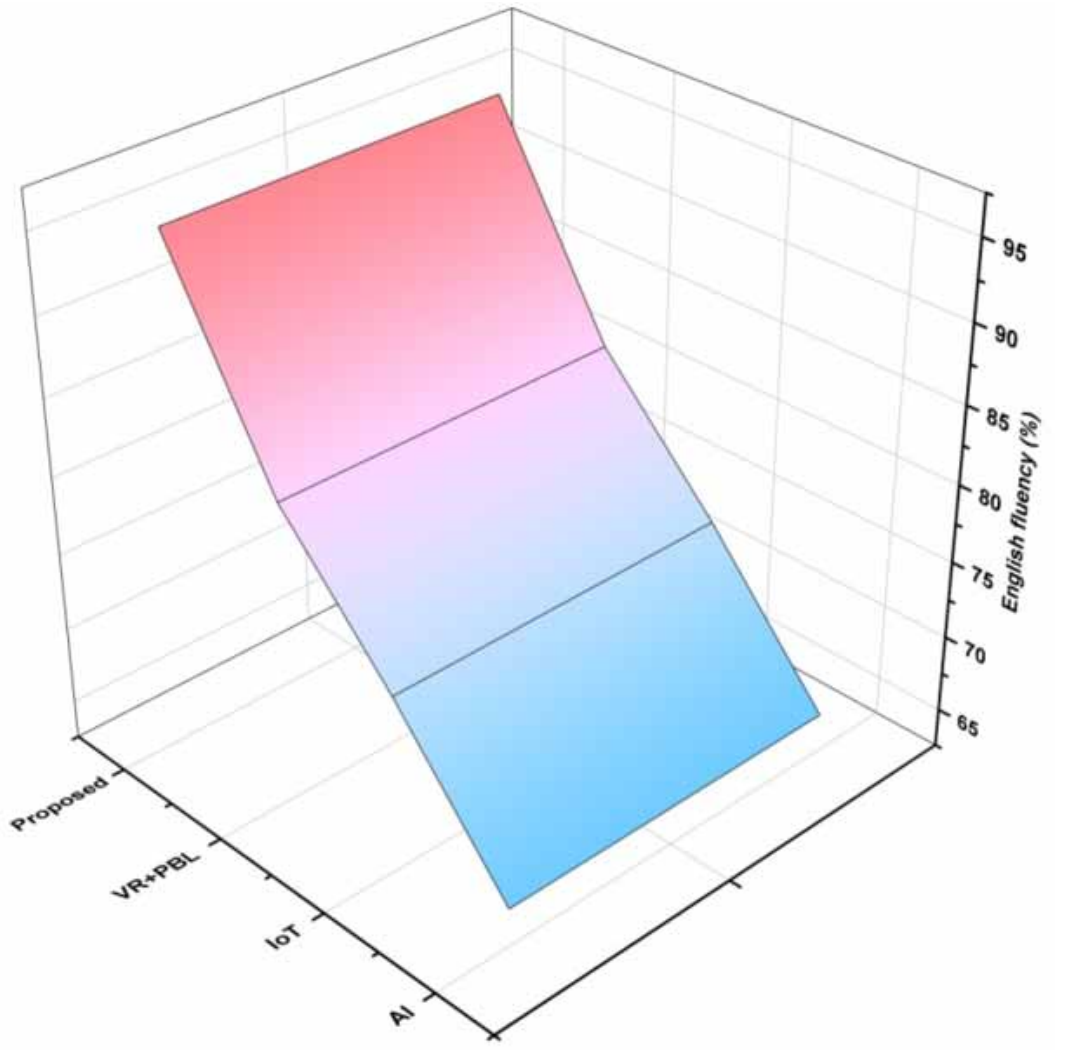


Table 2. Understanding the Capacity of Proposed and Traditional Techniques

Techniques	Understanding Capacity (%)
AI	88
IoT	62
VR+PBL	74
Proposed	90

processing and decision-making skills, and emphasize cooperative and collaborative learning modes. These applications can enrich the traditional way of learning English, provide new perspectives and methods, and promote the effectiveness and quality of students' learning.

In terms of the ant colony algorithm to optimize English learning paths, the simulated ants' path selection strategy can help students master English knowledge and skills more efficiently. Through the evaluation of learning resources and the setting of learning objectives, combined with the information processing and decision-making process of the ant colony algorithm, students can be provided with personalized learning path suggestions. Such personalized paths can be adjusted according to students' learning needs and ability levels, making them more relevant to students' actual situations and improving learning efficiency.

In terms of cultivating students' information processing and decision-making abilities, drawing on the ants' perception of the environment and information processing process in the ant colony algorithm, corresponding English learning scenarios and tasks can be designed to cultivate students' information processing and decision-making abilities. For example, by letting students perform reading comprehension, listening comprehension, or writing tasks, they are guided to extract key information from a large amount of information, conduct comprehensive analysis, and make reasonable decisions, so as to improve their English comprehensive ability. This method of developing information processing and decision-making skills can make students more confident and independent when facing complex English learning tasks and enhance their learning abilities.

In terms of the English learning model that emphasizes cooperation and collaboration, the ideas of collective collaboration and division of labor in the ant colony algorithm can be drawn upon. By introducing forms of cooperative group learning, partner dialogues, or collective discussions, interaction and cooperation among students can be promoted to solve problems in English learning together. By working with others, students can share ideas, motivate each other, and get different perspectives and feedback from them to improve their English learning. This cooperative and collaborative learning mode can develop students' teamwork and communication skills and lay a solid foundation for their future study and work.

The fundamental abilities the mind needs to compute, write, absorb, recall, explain, and pay focus are known as cognitive skills. The cognitive skills of concentration, memory, and problem-solving are a few examples. Learning is built on cognitive abilities. Figure 4 displays the cognitive skills of the proposed methodology. Table 3 displays the numerical values of cognitive skills. It proves that the proposed approach is effective in improving students' critical thinking abilities.

Student Support Rate

A questionnaire survey was conducted to find out the attitudes and opinions of students on a particular topic or issue. A total of 487 male and 1,515 female students participated in the study. The questionnaire covered a number of areas and was designed to provide a comprehensive understanding of the students' views and positions. In the questionnaire, students were asked to express their views and attitudes on specific topics or issues. By counting and analyzing the results of the questionnaire, a support rate of 98% was calculated. This means that 98% of the students who participated in the

Figure 4. Cognitive Skills

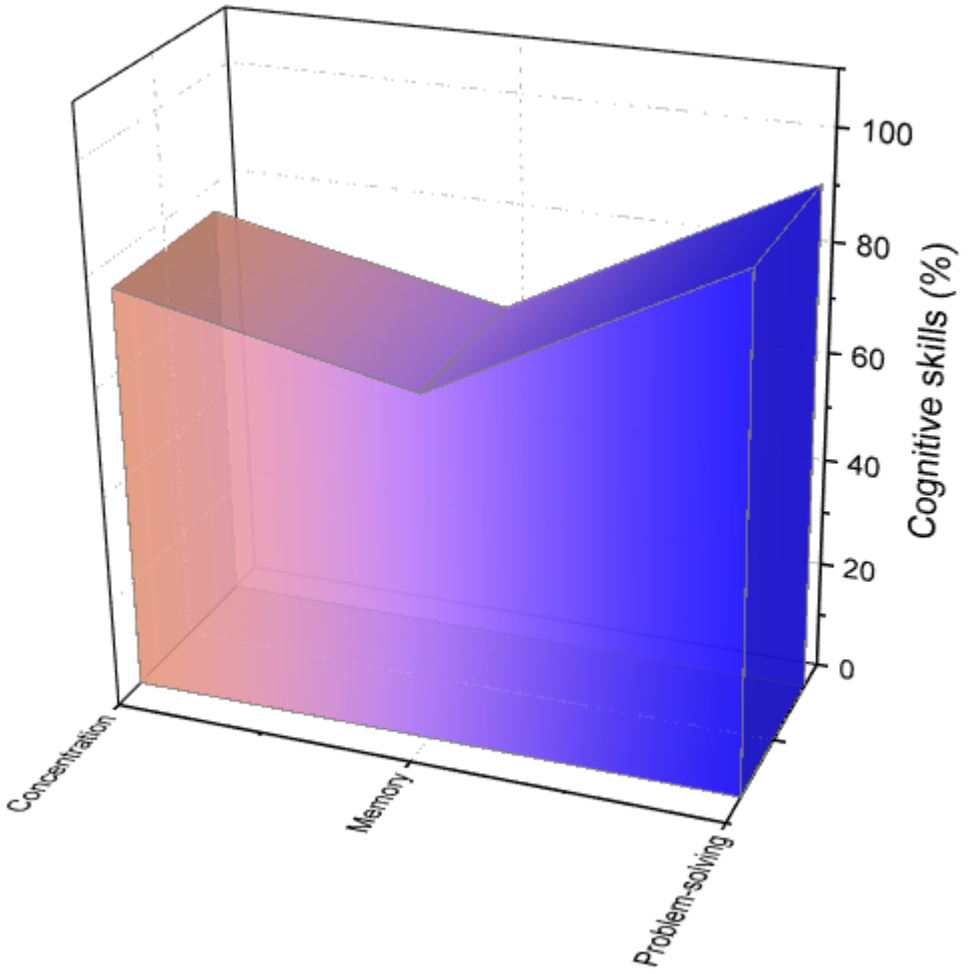


Table 3. Cognitive Skills of Proposed and Traditional Techniques

	Cognitive Skills (%)
Concentration	75
Memory	64
Problem-solving	93

survey expressed their support for that particular topic or issue. The results of the questionnaire provided important information about the views and attitudes of the students and helped to gain insight into their positions and opinions.

One of the most important aspects of teaching strategies is the student support rate. The enrollment, success and fulfillment of students are the main objectives of the suggested technique. The establishment of guidelines and strategies for the provision and advancement of English learning should be a goal of the proposed methods. Figure 5 displays the student support rate for the suggested

and conventional methods. Table 4 displays the numerical numbers of the student support rate. It indicates that the suggested strategy has a high percentage of student support rate.

CONCLUSION

5G and wireless communication technologies have significant advantages in assisting English classroom programs in higher education. With the proposed system presented in this study, we can clearly see that the proposed technology has higher benefits in comparison with traditional methods

Figure 5. Student Support Rate

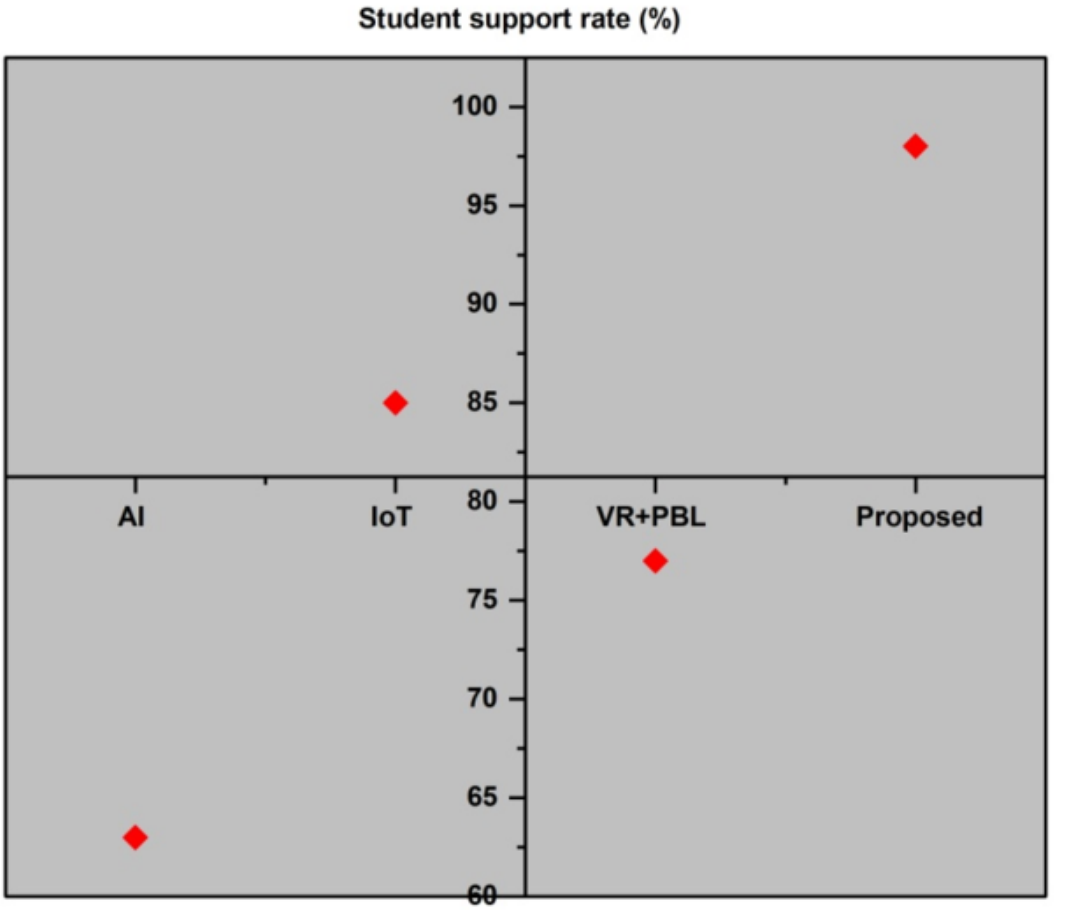


Table 4. Student Support Rate of Proposed and Traditional Techniques

Techniques	Student Support Rate (%)
AI	63
IoT	85
VR+PBL	77
Proposed	98

in terms of English fluency, comprehension, cognitive skills, and student support. Therefore, it can be inferred that the application of 5G and wireless communication technologies in English classroom teaching in higher education has great potential and is expected to bring a positive impact on teaching and learning.

This study has the following limitations: the findings may not be applicable to all universities and colleges because there are variations in the English as a Second Language (ESL) teaching and learning environments in different countries and regions. The conclusions of this study may become inapplicable or require further updating over time because the development of 5G technology is still in progress. Despite these limitations, the results of this study are still informative for the design and implementation of ELT programs. Future research could further explore these limitations and delve into their impact on instructional programs in order to improve the quality and effectiveness of educational practices.

DATA AVAILABILITY

The figures used to support the findings of this study are included in the article. All the experimental data used to support the findings of this study are included within the paper.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

FUNDING STATEMENT

This work was not supported by any funds.

ACKNOWLEDGMENT

The authors would like to show sincere thanks to those techniques who have contributed to this research.

REFERENCES

Alam, M., Islam, M. R., & Akteruzzaman, M. (2020). ICT in facilitating tertiary-level English: A note on the prospect of BSMRSTU. *Asian Journal of Education and Social Studies*, *12*(4), 1–7. doi:10.9734/ajess/2020/v12i430315

Baratè, A., Haus, G., Ludovico, L. A., Pagani, E., & Scarabottolo, N. (2019, June). 5G technology for augmented and virtual reality in education. In *Proceedings of the international conference on education and new developments* (Vol. 2019, pp. 512-516). doi:10.36315/2019v1end116

Chen, D. (2021). Retracted: An improvement in the teaching of college English writing and communication tools for fifth generation network: Comparative study. *International Journal of Communication Systems*, *34*(12), e4852. doi:10.1002/dac.4852

Chen, W., & Wang, F. (2021). Practical application of wireless communication network multimedia courseware in college basketball teaching. *EURASIP Journal on Wireless Communications and Networking*, *2021*(1), 1–21. doi:10.1186/s13638-021-01943-1 PMID:34721554

Cheng, J., & Wei, L. (2021). Individual agency and changing language education policy in China: Reactions to the new 'Guidelines on College English Teaching'. *Current Issues in Language Planning*, *22*(1-2), 117–135. doi:10.1080/14664208.2019.1700055

Cheng, Q., Li, B., & Zhou, Y. (2021, June). Research on evaluation system of classroom teaching quality in colleges and universities based on 5G environment. In *Proceedings of the 2021 1st International Conference on Control and Intelligent Robotics* (pp. 74-85). doi:10.1145/3473714.3473728

Huang, Y., & Mai, Q. (2021). Research on the construction of O2O teaching system of cross-cultural knowledge in College English based on MOOC. *Journal of Intelligent & Fuzzy Systems*, (Preprint), 1-10.

Huang, Y., Wang, Y., & Ye, F. (2019). A Study of the application of word cloud visualization in college English teaching. *International Journal of Information and Education Technology (IJIET)*, *9*(2), 119–122. doi:10.18178/ijiet.2019.9.2.1185

Jiao, T. (2021). Mobile English teaching information service platform based on edge computing. *Mobile Information Systems*, *2021*, 1–10. doi:10.1155/2021/2082282

Kamil, S. A. (2021). Exploring the role of updated technology in university English language classroom. *Psychology (Savannah, Ga.)*, *58*(1), 5647–5655. doi:10.17762/pae.v58i1.1969

Li, Y. (2021). Research on cultural communication in college English teaching based on wireless communication and multimedia network technology. *Wireless Communications and Mobile Computing*, *2021*, 1–5. doi:10.1155/2021/7264264

Liang, Q. (2020). An empirical study on the effectiveness of multimedia annotation to the news listening comprehension. *Higher Education of Social Science*, *19*(1), 70–74.

Lin, H., Xie, S., & Cai, K. (2019, August). Construction of classroom teaching model based on the 5G Communication Technology. In *2019 IEEE International Conference on Smart Internet of Things (SmartIoT)* (pp. 393-396). IEEE. doi:10.1109/SmartIoT.2019.00069

Liu, C., & Sun, X. (2022). Application of artificial intelligence combined with 5G technology in the reform of English teaching in universities. *Computational Intelligence and Neuroscience*, *2022*, 2022. doi:10.1155/2022/5203066 PMID:35665285

Mahawan, K., & Langprayoon, P. (2020, November). The effect of blended learning with collaborative learning upon English communication skills of English teaching program students. In *2020 5th International STEM Education Conference (iSTEM-Ed)* (pp. 55-58). IEEE. doi:10.1109/iSTEM-Ed50324.2020.9332775

Shengxue, Z. (2019). The transformation and strategies of college English teaching and learning in the era of artificial intelligence. *Journal of Anshun University*, *21*(6), 73–77.

Shu, Y. (2020). Experimental data analysis of college English teaching based on computer multimedia technology. *Computer-Aided Design and Applications*, *17*(S2), 46–56. doi:10.14733/cadaps.2020.S2.46-56

Sokkhey, P., & Okazaki, T. (2020). Hybrid machine learning algorithms for predicting academic performance. *International Journal of Advanced Computer Science and Applications*, *11*(1), 32–41. doi:10.14569/IJACSA.2020.0110104

Sun, X. (2021). 5G joint artificial intelligence technology in the innovation and reform of university English education. *Wireless Communications and Mobile Computing*, *2021*, 1–10. doi:10.1155/2021/2460916

Syafi'i, A. (2020). Google Classroom as learning platform in teaching writing. *British*, *9*(1), 48–64. doi:10.31314/british.9.1.48-64.2020

Tan, X. (2019). On reform of college English teaching based on the FiF smart learning platform. *Journal of Language Teaching and Research*, *10*(5), 1067–1072. doi:10.17507/jltr.1005.20

Wang, J. (2022). Application of 5G Internet of Things technology in the design of physical education platform. *Computational Intelligence and Neuroscience*, *2022*, 2022. doi:10.1155/2022/9382048 PMID:35498185

Wang, K. (2021, June). Teaching mode of mechanical manufacturing specialty based on the network teaching platform. In 2021 International Wireless Communications and Mobile Computing (IWCMC) (pp. 1620-1624). IEEE. doi:10.1109/IWCMC51323.2021.9498894

Xu, D. (2019). Research on new English mobile teaching mode under the impact of mobile Internet age. *Open Journal of Social Sciences*, *7*(5), 109–117. doi:10.4236/jss.2019.75008

Yi, Y., & Dan, W. (2020). The realization of ideological and political education in college English based on cultural confidence. *Creative Education*, *11*(11), 2193–2198. doi:10.4236/ce.2020.1111158

Yusuf, M. O., Lawal, B. I., & Oyewusi, M. B. (2020). Benefits of effective utilization of mobile technologies and inquiry-based teaching methods in University of Ilorin, Nigeria. In Mobile Devices in Education: Breakthroughs in Research and Practice (pp. 667-679). IGI Global.

Zhang, W., & Zhu, C. (2018). Comparing learning outcomes of blended learning and traditional face-to-face learning of university students in ESL courses. *International Journal on E-Learning*, *17*(2), 251–273.

Zhang, X., & Bi, J. (2018). Design of a college English mobile learning system based on CAD Model. *International Journal of Emerging Technologies in Learning*, *13*(4), 139. doi:10.3991/ijet.v13i04.8477

Zhao, X. (2018). Mobile English teaching system based on adaptive algorithm. *International Journal of Emerging Technologies in Learning*, *13*(8), 64. doi:10.3991/ijet.v13i08.9057

Zhu, X. (2019). Teaching Chinese culture in college English classes in the context of outreaching strategy. *Theory and Practice in Language Studies*, *9*(7), 870–877. doi:10.17507/tpls.0907.18