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*Research Article*

# Application of Auxiliary and Alternative Communication System Based on Big Data Analysis in English Teaching

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In order to improve the teaching effect of modern English, this paper combines the auxiliary and alternative communication systems based on big data analysis to improve English teaching, improve the effect of English teaching, and change the traditional English teaching mode. Moreover, this paper applies the Internet of Things and big data technology to English classroom teaching, and proposes a clustering routing protocol suitable for high dynamic environments. The LEACH algorithm is used for cluster head election and maintenance to ensure the stability of the network. In addition, this paper uses a driver protocol for business transmission between clusters, constructs an auxiliary and alternative communication system based on big data analysis, and evaluates the system in combination with teaching evaluation experiments. According to the teaching evaluation research, the auxiliary and alternative communication system based on big data analysis proposed in this paper has good application effect in English teaching, and can effectively improve the effect of English teaching.

## 1. Introduction

With the continuous development of human society, the amount of human knowledge is also growing rapidly, and human society has entered the era of knowledge. In this age, the amount of human knowledge is growing and expanding at an unimaginable rate, and it is unimaginable that the amount of information generated in a few hours in modern society may exceed the amount of information generated in an entire era in past human history. With the exponential growth of the total amount of knowledge in the knowledge age, new science and technology and new research results are emerging one after another. While the exponential growth of knowledge contributes to the progress of human society, it also puts forward higher requirements for its own dissemination. The development of visualization technology enables people to improve the efficiency of knowledge dissemination and innovation by means of visual diagrams, so as to successfully cope with the explosive growth of information faced by the image age and the knowledge age. Therefore, the social development and the progress of the times provide the premise and possibility for the research of knowledge visualization and the exertion of its application value.

The application of knowledge visualization to subject teaching can "clearly" present complex and abstract knowledge to learners in a graphical way, which is helpful for the presentation and transmission of teaching information. Through the use of a variety of visual representation tools, such as concept maps, mind maps, semantic networks and other tools, complex and cumbersome content can be clearly and intuitively reorganized and expressed [1]. In addition, the fragmented knowledge is integrated into a complete knowledge system in a visual and structured form, so as to help learners connect new knowledge with the original knowledge and experience in their minds, organize and construct new knowledge networks, promote learners' understanding and reorganization of knowledge, and guide learners to memorize and apply new knowledge. Knowledge visualization emphasizes interpersonal interaction and pays attention to knowledge dissemination and sharing between groups [2], so the application of knowledge visualization in the teaching field can make collaborative learning easier [3]. Based on the current problems in English teaching and the many roles played by knowledge visualization in teaching, how can teachers can better design their own teaching so that students can receive and understand the knowledge imparted by teachers more efficiently has become a problem that every educator should think about and seek to solve. Based on this, we believe that it is a good attempt and research topic to apply knowledge visualization visual representation to English teaching.

This paper combines the auxiliary and alternative communication systems based on big data analysis to improve English teaching, improve the effect of English teaching, change the traditional English teaching mode, and promote the effect of visual English teaching.

## 2. Related Work

The theoretical research on knowledge visualization includes research on the definition, theoretical basis, framework, and model of knowledge visualization. Literature [4] summarizes the development process of knowledge visualization, discusses the relevant theoretical basis of knowledge visualization, and looks forward to the future development and application of knowledge visualization in its research. Reference [5] defines the concept of knowledge visualization and distinguishes similar concepts, and also introduces the application of existing knowledge visualization in knowledge management. This article has become a guide for future research scholars in various fields to study knowledge visualization. Secondly, in the research on visual representation tools for knowledge visualization, Professors April and Burckhardt summarized the visual representation of knowledge visualization into six types, namely Heuristic Sketches, ConceptualDiagrams, and visual metaphors. VisualMetaphors), Knowledge Animations (KnowledgeAnimations), Knowledge Maps (KnowledgeMaps), Scientific Diagrams (ScientificDiagrams). Literature [6] integrates various existing forms of visual representation, and develops the "Periodic Table of Elements for Visualization Methods", which aims to intuitively reveal the connections and distinctions of different forms of visual representation to improve learning. Visual literacy of learners, and provide guidance for learners to use visual representation tools for learning, which can be better applied to subject teaching. In addition, some other scholars have studied the visual representation methods of knowledge visualization. Literature [7] summarizes five common visualization methods of cognitive tools: concept maps, mind maps, cognitive maps, and semantic networks., mind map.

Information processing theory regards learning as a process of continuous processing of information. Learners are active processors of information. They first select information related to organization and interpret the information according to their own knowledge reserves, so as to achieve understanding and memory of new knowledge information. The whole learning process is the process of receiving, encoding, manipulating, extracting and utilizing information [8]. Information processing theory regards memory as the process of encoding, manipulating and retrieving information, and divides the whole process into three different stages, namely sensory memory, short-term memory and long-term memory. Sensory memory is very short-lived. When knowledge stimulates the sensory organs of students, most of the knowledge disappears before entering the student's conscious field. This requires teachers to further process the stimulation, that is, redesign the knowledge information., so that it can be converted into a new form, so that it can continuously stimulate students' visual senses, so that students can remember knowledge for a long time [9]. Since the presentation of knowledge is rich and colorful, while historical knowledge has its unique disciplinary characteristics, its presentation methods include text, images, videos, imitations, cultural relics, etc. Further processing provides the possibility [10]. Teachers can use the dual presentation method to deepen students' understanding of knowledge, that is, the combination of text description and image data. Teachers carefully select and design words and images in teaching, which is also a process of encoding knowledge information. The information coding of knowledge is to classify the received stimulus information, not only for students' understanding and memory, but also for students to quickly extract information when needed. When students understand and memorize knowledge, they consciously encode it to form meaningful "knowledge blocks", which conform to their own memory laws, and can also extract information in blocks when needed [11].

In educational technology, knowledge visualization refers to a variety of graphical means. The function of knowledge visualization can be realized through various graphical means. The visual representation of knowledge visualization uses graphic symbols and text symbols as the information carrier, but the visual representation of knowledge visualization is a whole system composed of graphic conformity and text symbols combined with each other and generate substantial connections, rather than the superposition of isolated symbols [12]. The types of knowledge visualization visual representations are diverse, and with the advancement of information technology and the development of knowledge visualization practices in various fields, the types of knowledge visualization visual representations will become increasingly rich and innovative. Different scholars have different generalizations on the form of visual representation of knowledge visualization: Jonathan et al. describe five visualization methods: concept map, mind map, cognitive map, semantic network and mind map [13]. Knowledge visualization technology also includes visual representations such as visual metaphors, heuristic sketches, and knowledge animations. In this paper, only the form of visual representation of knowledge visualization is described in detail by Jonassen's classification. With the development of modern information technology and various visual visual representation technologies, the forms of visual representation that can be applied to the field of education and teaching are becoming more and more diverse, and visual representation of knowledge is becoming an important way to promote efficient knowledge dissemination and innovation [14] . In the continuous development of knowledge visualization, the number or classification of existing visual representation types will not be fixed. People will

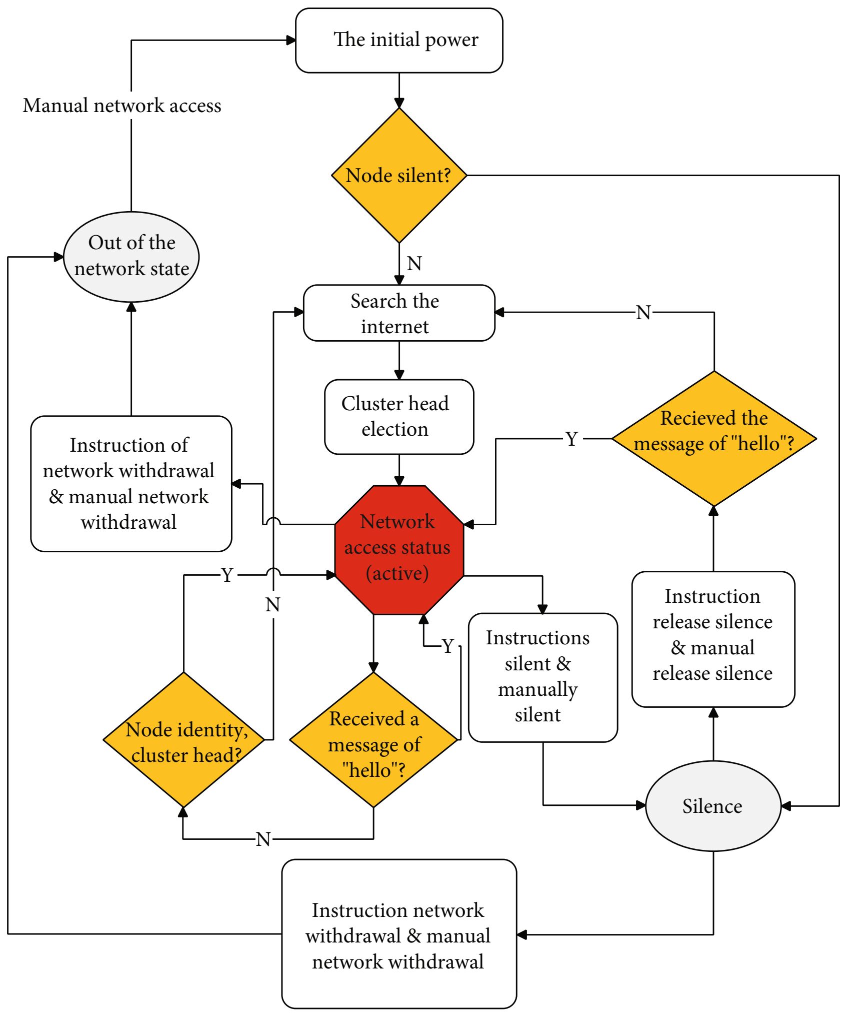


Figure 1: Network operation process.

not only focus on traditional visual representation forms such as concept maps and mind maps, but also on emerging visual representations. Forms of visual representation of emerging knowledge visualization such as virtual reality and video conferencing. Knowledge visualization and its forms of visual representation will also continue to develop and evolve in practice. The following describes several commonly used visual representations of knowledge visualization from the perspectives of definition, meaning, features and applications [15].

## 3. Auxiliary and Alternative Communication Systems Based on Big Data Analysis

When performing operations such as node access and topology maintenance, the network usually automatically determines the cluster head based on the corresponding standard. For details, see Figure 1.

From the content of the above figure, it can be concluded that based on the different network operation conditions, the nodes can be divided into the following types, namely:

(1) Member nodes: that is, ordinary network nodes

(2) Nodes that have not yet been defined: that is, nodes with no clear information when initially accessing the network

(3) Cluster head node: it specifically refers to a node that is randomly determined under dynamic conditions, and its functions are as follows: to ensure that the routing relationship between clusters remains normal, while maintaining the routing table within the cluster

(4) Gateway node: it specifically refers to a node determined based on certain selection criteria

After the network operation starts, the next step is the cluster formation process. Any cluster is composed of multiple nodes. The cluster formation process is shown in Figure 2.

To a certain extent, the operation process of LEACH can be regarded as an uninterrupted cycle of cluster reconstruction in essence, and this process can be explained with the help of the concept of round. Usually, each round can be divided into two stages: cluster formation and service transmission. In order to reduce resource overhead as much as

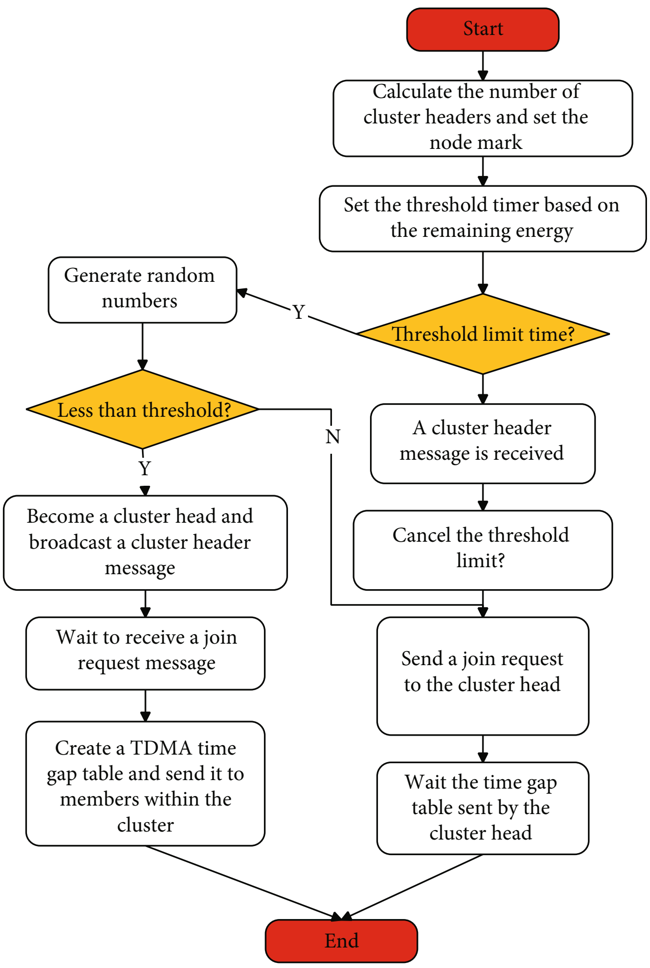


Figure 2: Cluster head selection process.

possible, it is usually stipulated that the time spent in the first stage should not be longer than the time spent in the second stage.

As far as the cluster construction process is concerned, the selection of the cluster head node is usually determined by the total number of nodes in the network and the number of times each node has become the cluster head node. The detailed process is as follows: The sensor node randomly generates a floating point number between 0-1. If its value does not exceed the specified threshold T(n), the node will be elected as the cluster head. Usually, it can be obtained by the following formula (1) [16]:

$$T(n) = \begin{cases} \dfrac{P}{1 - P \cdot (\mathrm{r} \bmod (1/P))} \, if\, n \in G \\ 0 \text{ otherwise} \end{cases} \quad (1)$$

The meaning represented by G is the set of nodes that did not become the cluster head in the 1/p round. After the cluster head node is determined, with the help of corresponding tools or lines, the news that it has become the cluster head will be announced to the outside world. After receiving the information, other network members will select the corresponding subordinate cluster according to their signal strength, and will feed back the result to the cluster head node, and finally realize the construction of the cluster.

In the simulation, the range is a square with a side length of 400 km. In this paper, the number of nodes is set as 200, and each node moves randomly with a speed of 250 m/s. Initially, in the experiment, all network links were set to be completely unobstructed, the bandwidth was large enough, and the node transmission rate was adjusted to 4Mbit/s. It is mainly aimed at the cluster head election, network stability, scientific analysis and evaluation of data transmission delay status and network management overhead and other indicators. The topology of the clustering protocol as shown in Figure 3.

It can be seen from Figure 4 that according to the criterion of maximum number of neighbors, each node can choose to access the cluster network composed of its nearest cluster head. The topology map is not static, and with the entry and exit of nodes and the change of rounds, the clusters and cluster heads will change dynamically.

In the experiments, we observe the relationship between the total number of surviving nodes and the number of cluster heads and rounds. Moreover, we found that with the

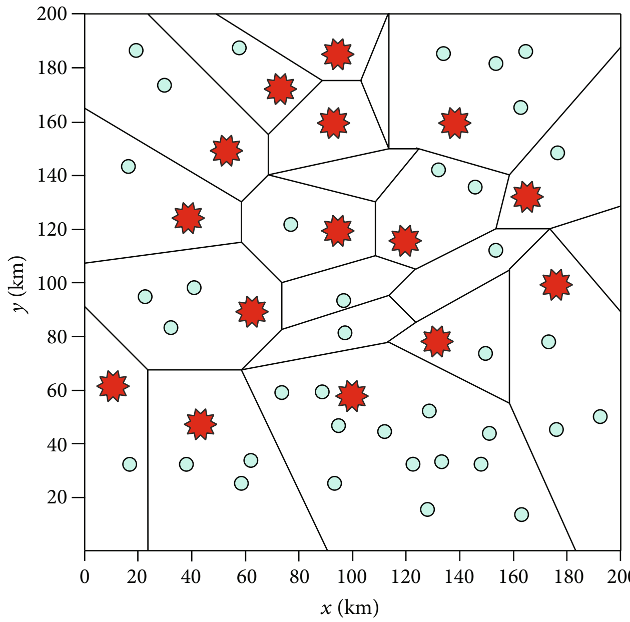


Figure 3: The topology of the clustering protocol.

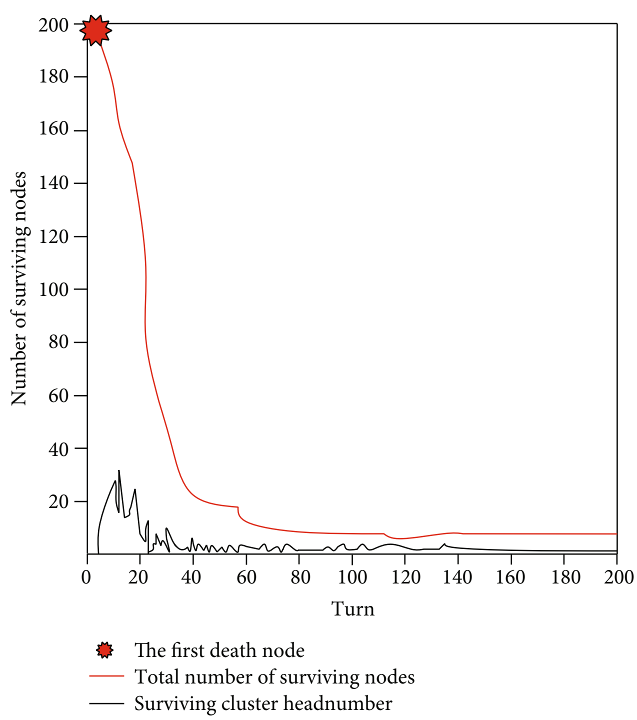


Figure 4: The relationship between the number of cluster heads and the total number of surviving nodes with the number of rounds.

increase of rounds, the node energy is gradually exhausted, the number of surviving nodes is less and less, and the number of cluster heads is also less and less, but the number of cluster heads is always about 1/10 of the number of nodes.

It can be seen from Figure 5 that compared with the end-to-end delay between clusters, the end-to-end within a cluster is obviously smaller. The reason is that the latter uses an

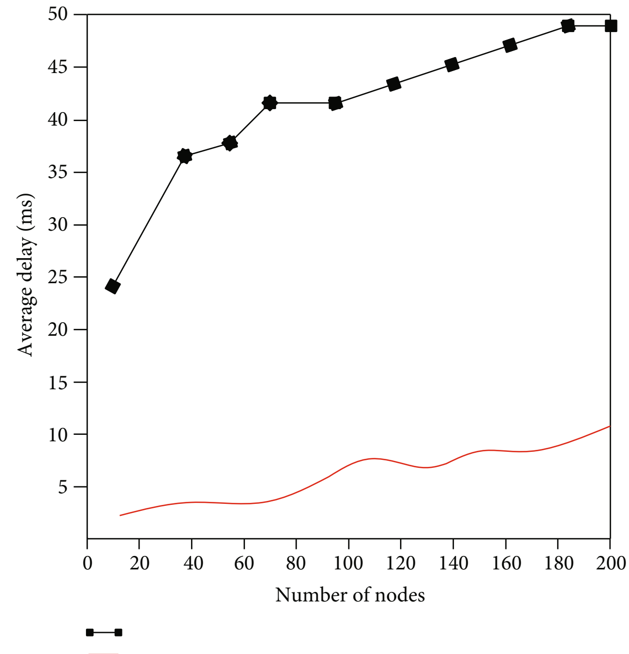


Figure 5: Communication delay characteristics under highly dynamic routing protocols.

active routing protocol and performs related operations by periodically maintaining the routing table in the cluster, which greatly reduces the delay. In terms of the end-to-end delay between clusters, it is usually closely related to the number of network members. In general, the more network members, the more hops, which usually leads to frequent changes of inter-cluster gateway nodes and long delay. When the number of nodes reaches 200, the inter-cluster transmission delay is still not higher than 50 ms, and the delay of live TV and online live broadcasts with strong real-time performance is generally more than 5 s. Therefore, the highly dynamic network delay is in a range of excellent performance.

In terms of business overhead, it usually refers to the ratio between the sum of routing and management information in the network and the total data volume. In order to simplify the calculation, we can use the following formula to calculate it:

$$\text{Cost} = 1 - \frac{LEN_{\text{Data}} \cdot Num_{\text{arrival}}}{LEN_{\text{total}} \cdot Num_{\text{send}}} \tag{2}$$

In the formula, $LEN_{\text{Data}}$ is the length of the data in the transmitted packet, $Num_{\text{arrival}}$ is the number of packets received, $LEN_{\text{total}}$ is the total length of the packet, and $Num_{\text{send}}$ is the total number of packets sent. Except for the useful data actually received by each node, the others are classified as business overhead.

Explore the network overhead covering 200 nodes with the help of a simulation model. Among them, the node still obtains the best parameter values by adjusting the relevant parameters, and finally ensures that the overhead meets the

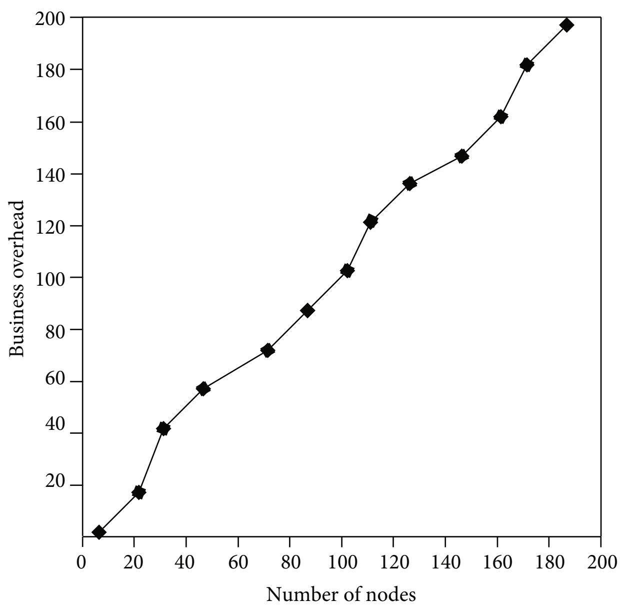


Figure 6: Business overhead.

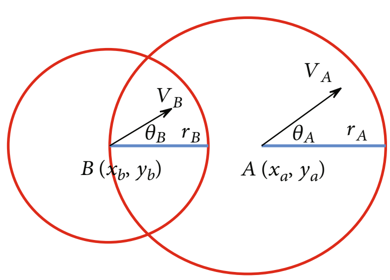


Figure 7: Schematic diagram of the movement of adjacent nodes in the networking.

network design standards. The simulation results are shown in Figure 6.

It can be seen from Figure 6 that there is a very close relationship between network overhead and the number of nodes, and the two have a significant positive correlation. As the number of network nodes increases, the packet loss rate increases, and the maintenance cost of the cluster topology table increases, which will increase the routing cost. However, it can be found from the figure that when the number of nodes is 200, and the network management overhead still does not exceed 4%.

As far as the comprehensive statistical delay is concerned, it is mainly composed of the following parts: node processing delay, queuing delay, and transmission delay. In order to improve the stability of delay statistics, it is generally updated according to formula (3) [17].

$$D_{\text{count}}(t) = k_1 \cdot D_{\text{count}}(t - \Delta t) + (1 - k_1) \cdot D_{\text{count}}(t) \tag{3}$$

As far as the above formula is concerned, the meaning of $D_{\text{count}}(t)$ is the comprehensive statistical delay at time t. $k_1$ is the memory adjustment coefficient. The larger the value, the stronger the memory. $D_{\text{count}}(t - \Delta t)$ represents the comprehensive statistical delay that has not yet been updated in this round.

Furthermore, the end-to-end delay with n-hop paths can be represented by the following formula, namely [18]:

$$D_{\text{end-end}}(t) = \sum_{i}^{n} D_{\text{count}}(i, t) \tag{4}$$

As far as the above formula is concerned, the meaning of $D_{\text{count}}(i, t)$ is the delay of the i-th hop node of this path.

$$\begin{cases} QD_i = 0 & D_{\text{end-end}} \geq D_{TH} \\ QD_i = \dfrac{D_{TH} - D_{\text{end-end}}}{D_{TH}} & D_{\text{end-end}} < D_{TH} \end{cases} \tag{5}$$

Among them, $QD_i$ is the normalized end-to-end delay, the delay is greater than the threshold $D_{TH}$, the value is 0, and this link is regarded as an invalid link.

Usually, for the node motion state, which prediction method is selected is generally subject to the node motion characteristics, and the prediction value is updated according to the following formula (6) [19].

$$V(t) = k_2 \cdot V(t - 1) + (1 - k_2) \cdot VC(t) \tag{6}$$

As far as the above formula is concerned, $k_2$ is (0,1), which means the memory adjustment coefficient. The larger the value, the stronger the memory.

It is stipulated that the current node student coordinates obtained based on the Internet of Things nodes in the teaching area are (x, y), the position of the node is $(x_D, y_D)$, and the prediction direction can be obtained with the help of the following formula (7) [20].

$$\begin{cases} \theta = \pi/2 & x_D = x \& y_D > y \\ \theta = 3/4\pi & x_D = x \& y_D < y \\ \theta = \arctan\left(\dfrac{y_D - y}{x_D - x}\right) & x_D > x \\ \theta = \arctan\left(\dfrac{y_D - y}{x_D - x}\right) + \pi & x_D < x \end{cases} \tag{7}$$

We assume that there is node A and node B. With the help of the prediction algorithm, the short-term velocities of the two nodes in the subsequent motion are obtained as $V_{\text{A}}$ and $V_{\text{B}}$ in turn. Without considering the height information of the nodes, the spatial motion relationship of the two nodes can be obtained, as shown in Figure 7.

When $V_A$ and $V_B$ are not equal, the uninterrupted time of the link formed by these two nodes can be estimated by the following formula (8).

$$TLD_i = \frac{\sqrt{(\text{a}^2 + c^2)r^2 - (ad - bc)^2} - (ab + cd)}{\text{a}^2 + c^2} \tag{8}$$

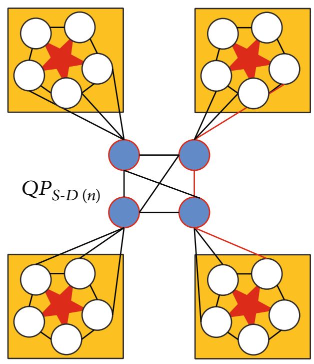


FIGURE 8: Schematic diagram of the revised network topology.

Among them,

$$\begin{aligned} a &= V_A \cos\theta_A - V_B \cos\theta_B \\ b &= x_A - x_B \\ c &= V_A \sin\theta_A - V_B \sin\theta_B \\ d &= y_A - y_B \end{aligned} \tag{9}$$

When $V_A$ equals $V_B$, $TLD_i$ tends to infinity.

In order to facilitate subsequent calculations, the link duration can be normalized. A link duration normalized threshold $T_{TH}$ is constructed. If the duration is longer than this threshold $T_{TH}$, it means that the link is extremely stable. Then, according to the simulation environment of civil aviation ad hoc network, the link duration is counted [21].

$$\begin{cases} QLD_i = 1 & TLD_i \geq T_{TH} \\ QLD_i = TLD_i/T_{TH} & TLD_i < T_{TH} \end{cases} \tag{10}$$

After the link duration prediction operation is completed, the path duration needs to be determined next. Generally, the minimum value of the above prediction results can be taken.

This design finally determined a method to predict the remaining bandwidth based on parameters such as queuing delay and link data traffic. Then, the remaining bandwidth can be calculated by the following formula (11).

$$\begin{cases} CR_i = 0 & D_{\text{queue}} \geq D_{TH} \\ CR_i = \dfrac{C_i - R_i}{C_i} \cdot \dfrac{D_{TH} - D_{\text{queue}}}{D_{TH}} & D_{\text{queue}} < D_{TH} \end{cases} \tag{11}$$

As far as the above formula is concerned, the meaning represented by $C_i$ is the theoretical total bandwidth of this link, which is obtained by combining with the MAC layer. The meaning of $D_{TH}$ is the queuing delay threshold. If its value is greater than the relevant standard threshold, it means that the link is congested. Then, through real-time

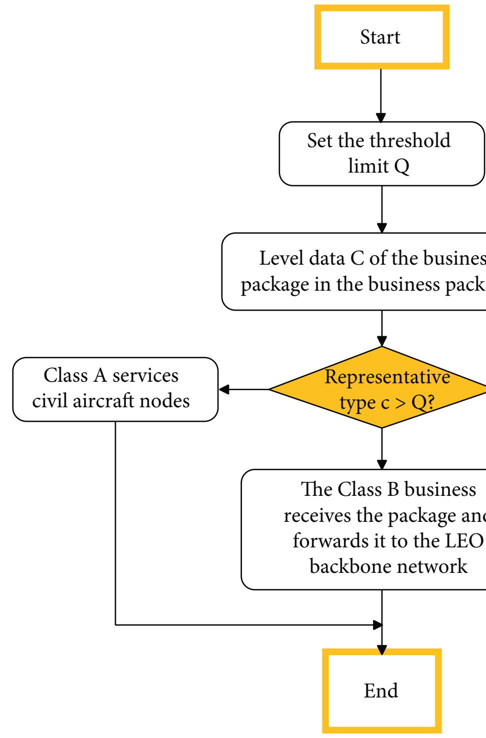


FIGURE 9: Node selection method based on service delay sensitivity.

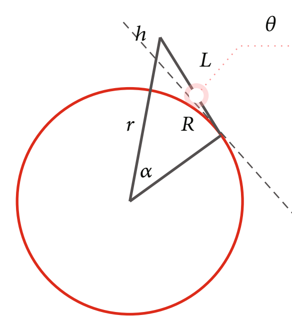


FIGURE 10: Schematic diagram of communication distance and coverage of low-orbit communication nodes.

node statistics, the transmission rate $R_i$ of the link and the queuing delay $D_{\text{queue}}$ of the link can be obtained. It is now stipulated that the update of the comprehensive statistical delay is performed every time $\Delta t$ elapses. In order to ensure the specific and good real-time performance of delay statistics, $\Delta t$ takes the value of the route maintenance period. In order to improve the stability as much as possible, the following formula (12) can be used to update:

$$R_i(t) = k_3 \cdot R_i(t - \Delta t) + (1 - k_3) \cdot R_i(t) \tag{12}$$

As far as the above formula is concerned, the meaning of $R_i(t)$ represents the actual statistical link transmission speed at time t. The meaning of $k_3$ is the memory adjustment coefficient, the larger the value, the stronger the memory. $R_i(t - \Delta t)$ is the link transmission speed at the last update time.

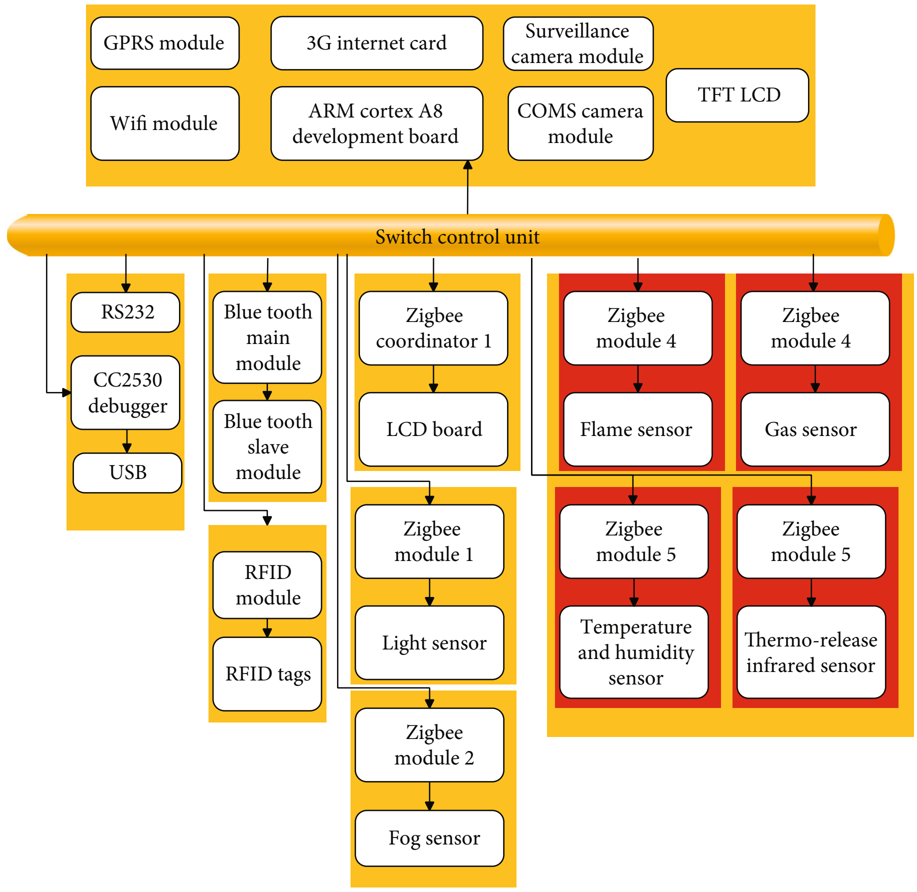


FIGURE 11: Hardware system block diagram.

$D_{queue}$ can be obtained by statistics based on the queuing delay of data packets transmitted by the link. Similar to $R_i(t)$, the update methods for $D_{queue}$ are:

$$D_{queue}(t) = k_4 \cdot D_{queue}(t - \Delta t) + (1 - k_4) \cdot D_{queue}(t) \quad (13)$$

After the previous calculation, the remaining bandwidth of the link obtained is already normalized, so in the following comprehensive link quality calculation, the remaining bandwidth component of the link can be directly obtained according to formula (14).

$$QCR_i = CR_i \quad (14)$$

Synthesizing link delay and link duration, this paper proposes link comprehensive quality $QL_i$.

$$QL_i = \alpha_1 \cdot QLD_i + \alpha_2 \cdot QD_i + \alpha_3 QCR_i \quad (15)$$

Among them, $\alpha_1, \alpha_2, \alpha_3$ is the weight factor and is 1. The meaning of $QLD_i$ is the normalized link duration, $QD_i$ is the normalized delay, and $QCR_i$ is the normalized remaining bandwidth of the link.

When the process of link quality parameter calculation and evaluation is completed, it also means that the calculation of path quality parameters has also been determined. It is usually performed during route maintenance. Not only that, it can also use the corresponding calculation method to obtain the information from the node to the link, and then input the obtained result into the route maintenance message, so as to carry out the calculation of the node later. At the same time, all nodes will calculate the link node delay and link duration during the neighbor maintenance process. Therefore, when the comprehensive link quality of each hop on the path is accurately known, the comprehensive quality of the path can be calculated. For the path $P_{S-D}$, this paper proposes to calculate its QP with formula (16).

$$QP_{S-D}(n) = d^n \prod_{i=1}^{n} QL_i \quad (16)$$

Among them, d is the attenuation factor whose value is in the range of (0,1). The route quality evaluation model constructed covers almost all the factors that may affect the route quality. In addition, parameters such as memory factor k and weight factor $\alpha$ are added to the model, which increase the flexibility of the quality assessment model. For example, if the link quality between nodes in the network is fast over time, the value of the memory factor k should be appropriately reduced. For another example, if the network bandwidth is sufficient, the weight factor $\alpha_3$ should be 0,

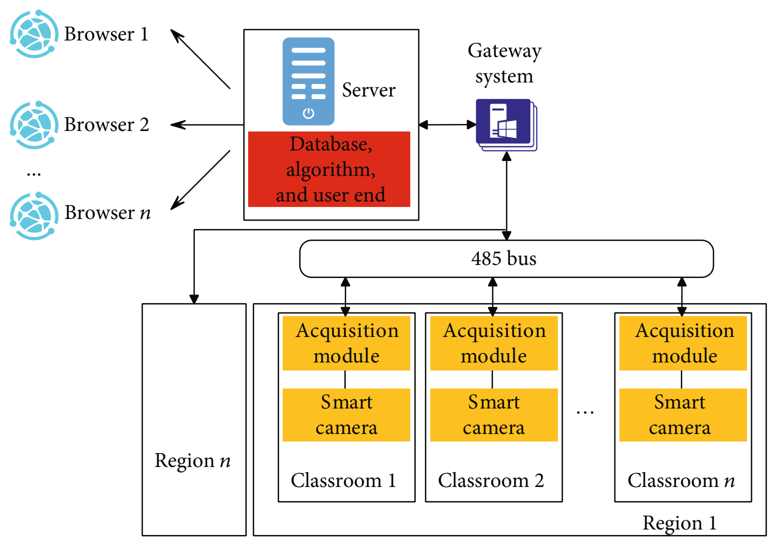


Figure 12: Architecture of English teaching information system based on Internet of Things technology.

Table 1: Statistical table of teaching evaluation data.

| Num | Teaching evaluation | Num | Teaching evaluation | Num | Teaching evaluation | Num | Teaching evaluation |
|---|---|---|---|---|---|---|---|
| 1 | 84.1 | 20 | 83.8 | 39 | 91.4 | 58 | 89.0 |
| 2 | 88.8 | 21 | 85.0 | 40 | 80.7 | 59 | 90.0 |
| 3 | 84.3 | 22 | 80.7 | 41 | 87.2 | 60 | 80.9 |
| 4 | 90.7 | 23 | 88.7 | 42 | 83.1 | 61 | 89.1 |
| 5 | 90.8 | 24 | 78.4 | 43 | 90.2 | 62 | 82.2 |
| 6 | 83.7 | 25 | 91.5 | 44 | 80.5 | 63 | 85.2 |
| 7 | 80.1 | 26 | 84.5 | 45 | 88.5 | 64 | 89.8 |
| 8 | 84.4 | 27 | 88.5 | 46 | 83.1 | 65 | 79.3 |
| 9 | 86.9 | 28 | 87.9 | 47 | 88.2 | 66 | 78.5 |
| 10 | 88.2 | 29 | 80.6 | 48 | 88.6 | 67 | 87.0 |
| 11 | 80.5 | 30 | 79.2 | 49 | 90.1 | 68 | 88.3 |
| 12 | 91.1 | 31 | 82.4 | 50 | 89.4 | 69 | 78.1 |
| 13 | 85.6 | 32 | 78.7 | 51 | 90.6 | 70 | 91.9 |
| 14 | 85.7 | 33 | 81.5 | 52 | 78.4 | 71 | 88.3 |
| 15 | 78.8 | 34 | 78.1 | 53 | 82.3 | 72 | 88.4 |
| 16 | 91.6 | 35 | 79.6 | 54 | 84.7 | 73 | 91.5 |
| 17 | 86.8 | 36 | 89.1 | 55 | 90.3 | 74 | 88.1 |
| 18 | 87.4 | 37 | 90.1 | 56 | 90.0 | 75 | 79.1 |
| 19 | 90.2 | 38 | 84.2 | 57 | 79.0 | | |

because the remaining bandwidth of the link does not affect the link volume. When the quality evaluation model is used in the actual scene, the factors irrelevant to the scene need to be eliminated in advance, and then the route selection can fully select the appropriate nodes and links for service transmission based on the $QP$ value on the link.

After the quality evaluation model is revised, a more complex clustering network topology model can be obtained, as shown in Figure 8. When the network link cannot be guaranteed to be smooth in real time, we need to calculate the node communication path on the new topology model.

In the figure, each path has its own QP value. When communicating, nodes can determine the minimum value they need according to the transmission content. Paths smaller than the QP value will be eliminated. Based on this, a suitable path can be found.

The previous transmission delay can be replaced by the sum of the queuing delay and the transmission delay. The meaning represented by B(u, v) is bandwidth measurement. The route can be obtained with the help of the following formula (17):

$$D_{\min}(p(V_1, V_n)) = \min\left(D(V_1, V_2) + D(V_2, V_3) + \cdots + D(V_{n-1}, V_n)\right)$$
$$(B(V_1, V_2) \geq B_i) \wedge (B(V_2, V_3) \geq B_i) \wedge \cdots \wedge (B(V_{n-1}, V_n) \geq B_i) \quad (17)$$

In the above formula, $p(V_1, V_n)$ represents the path from $V_1$ to $V_n$ calculated by service i, $D_{\min}(p(V_1, V_n))$ is the minimum cost of the path, and each link in the path must meet the bandwidth condition of service i. After the time delay is calculated, it can be used to determine which type of network node the service selects according to the set threshold. The specific process is shown in Figure 9.

The subsequent work is to obtain the threshold value Q and normalize it into the quality evaluation model, so that the two correction strategies can be unified in the standard. As mentioned above, the advantages of communication nodes are wide coverage and strong stability, but the disadvantages are high latency and small bandwidth.

The ground is regarded as an approximate sphere (as shown in Figure 10), h is the height of the low-orbit communication node, $\theta$ is the elevation angle, r is the radius of the earth, R is the radius of communication coverage, and L is the maximum communication distance, the following formula can be obtained from the mathematical relationship:

$$\frac{\sin\alpha}{L} = \frac{\sin(\pi/2+\theta)}{r+h} = \frac{\sin(\pi/2-\alpha-\theta)}{r} \qquad (18)$$
$$R = r\cdot\alpha$$

From formula (13), it can be known that $QL_i = \alpha_1 \cdot QLD_i + \alpha_2 \cdot QD_i + \alpha_3 QCR_i$, where $QLD_i$ is the quality factor affected by the link duration, this part is the strength of the communication node, and the link of the communication node is continuously stable, so $QLD_i$ is 1. In order to eliminate its influence on the real-time sensitivity judgment of the business, it is more appropriate for $\alpha_1$ to be 0. $QD_i$ is the average time delay, which has the greatest impact on the decision threshold, so the value of $\alpha_2$ should be close to 1. The selection of the $QD_i$ value is also involved in the value of $D_{TH}$. In order to simplify the calculation, $D_{TH}$ can go to the mean value of the delay of the teaching area-teaching area link and the teaching area-communication node link. Under the same other conditions, only the transmission delay is different, the delay of the teaching area-communication node link is about 32.5 ms higher than that of the teaching area-teaching area link. Therefore, the delay threshold $D_{TH}$ can take the median value of the two link delays, and $D_{TH} = D_{\text{end-end}} + 16.25$. $QCR_i$ is the influence of the remaining bandwidth of the link on the quality of the link. Due to the real-time change of the service flow, the size of the remaining bandwidth of the link has a considerable chance. The remaining bandwidth of the link in the teaching area is 0, which leads to the temporary "stealth" of the link in the topology. Therefore, the value of $\alpha_3$ should be very small in this instance. Finally, we get:

$$Q = \alpha_2 \cdot QD_i + \alpha_3 QCR_i \qquad (19)$$

In this way, the link between the teaching area and the communication node can be regarded as a path with very "bad" conditions in real-time business, but it can indeed be passed through. In essence, the node strategy based on the real-time sensitivity of business can be regarded as an application example of the quality assessment model.

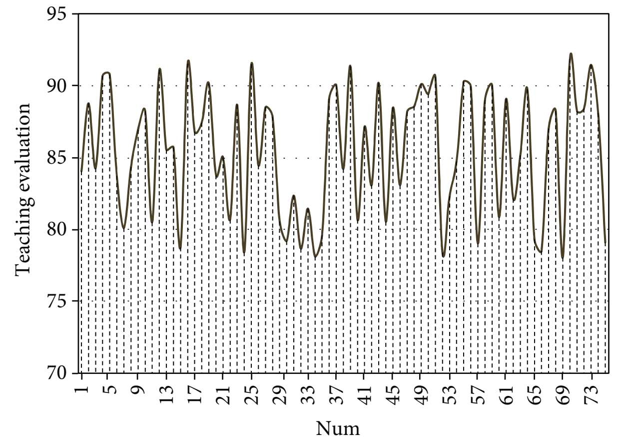


Figure 13: The application effect of auxiliary and alternative communication systems based on big data analysis in English teaching.

## 4. Application of Auxiliary and Alternative Communication System Based on Big Data Analysis in English Teaching

The hardware system of the Internet of Things teaching experiment platform should ensure that it can meet the needs of teaching experiments and scientific research and development, and at the same time ensure the compatibility, reliability and economy of the hardware system. The hardware system mainly includes processors, memory, storage, display, communication modules, I/O devices, nodes, controlled devices, etc. The hardware block diagram is shown in Figure 11.

The overall architecture design of the English teaching information mining system based on the Internet of Things technology is shown in Figure 12.

This paper verifies the application effect of the auxiliary and alternative communication system based on big data analysis in English teaching by means of teaching evaluation, conducts experiments through multiple groups of teaching evaluation, and counts the evaluation data. The final results are shown in Table 1 and Figure 13.

From the above research, it can be seen that the auxiliary and alternative communication system based on big data analysis proposed in this paper has a good application effect in English teaching, and can effectively improve the effect of English teaching.

## 5. Conclusion

In the field of education, the advent of a new era has brought new challenges to teaching. Moreover, new teaching strategies and learning strategies have been adopted, such as the application of knowledge visualization visual representation tools such as mind maps to the teaching of different subjects such as English and geography. At the same time, integrating the advantages of visual representation into modern classrooms can promote learners' cognition and construction of knowledge, and also provide new ideas for educational informatization and teaching reform. This paper combines the auxiliary and alternative communication systems of big data analysis to improve English teaching, improve the effect of English teaching, and change the traditional English teaching mode. According to the teaching evaluation research, the auxiliary and alternative communication system based on big data analysis proposed in this paper has good application effect in English teaching, and can effectively improve the effect of English teaching.

## Data Availability

The labeled dataset used to support the findings of this study are available from the corresponding author upon request.

## Conflicts of Interest

The author declares no competing interests.

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## References

[1] L. Susanty, Z. Hartati, R. Sholihin, A. Syahid, and F. Y. Liriwati, "Why English teaching truth on digital trends as an effort for effective learning and evaluation: opportunities and challenges: analysis of teaching English," *Linguistics and Culture Review*, vol. 5, no. S1, pp. 303–316, 2021.

[2] A. S. Fatimah, S. Santiana, and Y. Saputra, "Digital comic: an innovation of using Toondoo as media technology for teaching English short story," *English Review: Journal of English Education*, vol. 7, no. 2, pp. 101–108, 2019.

[3] B. Ayçiçek and T. Yanpar Yelken, "The effect of flipped classroom model on Students' classroom engagement in teaching English," *International Journal of Instruction*, vol. 11, no. 2, pp. 385–398, 2018.

[4] N. Guzachchova, "Zoom technology as an effective tool for distance learning in teaching english to medical students," *Bulletin of Science and Practice*, vol. 6, no. 5, pp. 457–460, 2020.

[5] M. S. Hadi, "The use of song in teaching English for junior high school student," *English Language in Focus (ELIF)*, vol. 1, no. 2, pp. 107–112, 2019.

[6] Y. Li and L. Wang, "An ethnography of Chinese college English teachers' transition from teaching English for general purposes to teaching English for academic purposes," *ESP Today*, vol. 6, no. 1, pp. 107–124, 2018.

[7] A. Mahboob, "Beyond global Englishes: teaching English as a dynamic language," *RELC Journal*, vol. 49, no. 1, pp. 36–57, 2018.

[8] H. Sundari, "Classroom interaction in teaching English as foreign language at lower secondary schools in Indonesia," *Advances in language and Literary Studies*, vol. 8, no. 6, pp. 147–154, 2017.

[9] A. Gupta, "Principles and practices of teaching English language learners," *International Education Studies*, vol. 12, no. 7, pp. 49–57, 2019.

[10] B. S. Abdelshaheed, "Using flipped learning model in teaching English language among female English majors in Majmaah University," *English Language Teaching*, vol. 10, no. 11, pp. 96–110, 2017.

[11] T. A. Ashraf, "Teaching English as a foreign language in Saudi Arabia: struggles and strategies," *International Journal of English Language Education*, vol. 6, no. 1, pp. 133–154, 2017.

[12] O. Tarnopolsky, "Principled pragmatism, or well-grounded eclecticism: a new paradigm in teaching English as a foreign language at Ukrainian tertiary schools," *Advanced Education*, vol. 5, no. 10, pp. 5–11, 2018.

[13] N. I. Sayakhan and D. H. Bradley, "A nursery rhymes as a vehicle for teaching English as a foreign language," *Journal of University of Raparin*, vol. 6, no. 1, pp. 44–55, 2019.

[14] D. A. W. Nurhayati, "Students' perspective on innovative teaching model using Edmodo in teaching English phonology:" a virtual class development"," *Dinamika Ilmu*, vol. 19, no. 1, pp. 13–35, 2019.

[15] A. B. Rinekso and A. B. Muslim, "Synchronous online discussion: teaching English in higher education amidst the covid-19 pandemic," *JEES (Journal of English Educators Society)*, vol. 5, no. 2, pp. 155–162, 2020.

[16] A. S. N. Agung, "Current challenges in teaching English in least-developed region in Indonesia," *SOSHUM: Jurnal Sosial Dan Humaniora*, vol. 9, no. 3, pp. 266–271, 2019.

[17] M. A. Saydaliyeva, E. B. Atamirzayeva, and F. X. Dadaboyeva, "Modern methods of teaching English in Namangan state university," *International Journal on Integrated Education*, vol. 3, no. 1, pp. 8-9, 2020.

[18] L. B. Kelly, "Preservice teachers' developing conceptions of teaching English learners," *TESOL Quarterly*, vol. 52, no. 1, pp. 110–136, 2018.

[19] A. Coşkun, "The application of lesson study in teaching English as a foreign language," *Inonu University Journal of the Faculty of Education*, vol. 18, no. 1, pp. 151–162, 2017.

[20] N. Sadat-Tehrani, "Teaching English stress: a case study," *TESOL Journal*, vol. 8, no. 4, pp. 943–968, 2017.

[21] M. Siregar, "The Use of Pedagogical translation in Teaching English by scientific approach," *Budapest International Research and Criticsin Linguistics and Education (BirLE) Journal*, vol. 2, no. 4, pp. 111–119, 2019.