

Mobile Learning Mode of College English Writing Based on Wireless Network

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ABSTRACT

The popularity of the Internet and mobile smart terminals has changed many forms of learning, and the mobile learning model was born in this environment. As a new learning mode, mobile learning has brought certain development opportunities for college English writing teaching. In the current educational environment, many students hold various mobile devices, which also motivates them to have a strong willingness to learn on mobile. It can be said that the application of mobile learning to English writing is quite suitable. At present, the application of mobile learning in college English writing is not mature enough, and there are often a series of problems such as shortage of resources and network freezes, which also reduces students' enthusiasm for learning. In order to further improve the fluency and maturity of the mobile learning mode, this paper has combined the wireless network to study the new mobile learning mode of college English writing. By building a mobile learning framework based on wireless network, innovating mobile learning writing content and computing learning resource categories, a new mobile learning mode of college English writing has been finally formed. The experimental results have shown that the new model has mobilized students' enthusiasm for learning and further improved the writing efficiency. Compared with the old model, the efficiency has increased by 6.73%.

Keywords: Mobile Learning, English Writing, Learning Mode, Wireless Network

1. Introduction

In modern society, major innovations in information technology will change and improve people's way of life and learning to a great extent. With the rise of mobile Internet, mobile learning has gradually become an important development trend of online learning [1]. College students are one of the important groups of mobile learning, most of them use smart phones, tablet PCs and other

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mobile devices, and they have a great demand for the content displayed on the mobile Internet, and mobile devices have penetrated deeply into their daily learning life [2-4]. Mobile learning occupies an important position in students' learning and can be an effective supplement to classroom learning, especially with the continuous popularization of the mobile Internet in China and the increasing number of users of various mobile terminals, which further creates favorable conditions for the wide application of mobile learning [5-7]. Therefore, it is of great theoretical and practical significance to actively explore the combination of mobile learning and the teaching and learning of college English.

As one of the means to test the comprehensive application ability of college students in English language, the quality and quantity of writing output is always a yardstick for judging the level of students' language proficiency, and it occupies a place in any form of language test [8-11]. Compared to the assessment of knowledge points by multiple-choice and judgmental questions, or the immediacy and possibility of error tolerance and correction during oral practice, writing skills are non-overnight achievements, and once formed, writing output can be saved for repeated corrections and comments [12-14]. Combining the mobile writing training method with independent learning in college English courses conforms to the teaching requirements of college English courses and is also in line with the trend of the development of modern educational technology [15-17].

The emergence of mobile learning mode not only provides reference for the reform of teaching mode, but also allows many learning modules to see the prospect of change, which is an attempt and an innovation to apply mobile learning to college English writing. This paper uses wireless network technology to build a mobile learning framework, and fills in the content of the mobile learning mode in combination with English writing requirements. The sorting and optimization of learning resources are completed through text classification. Finally, the validity of the mobile learning mode of college English writing combined with wireless network is verified by experiments.

2. Concept and Application of Wireless Network

2.1. Definition and composition of wireless network

Wireless network refers to a computer network that uses wireless channels as the main data transmission medium. It can make Internet access devices mobile, and can quickly deal with network channel connection problems that cannot be completed by traditional wired methods. Figure 1 shows a simple framework for a wireless network, including the Internet, gateways, switches, and routers. Its main implementation process is to first obtain signals through Internet technology, and then transmit signals to routers through gateways, switches and various network protocols, and finally network signals are emitted from routers for users to use.

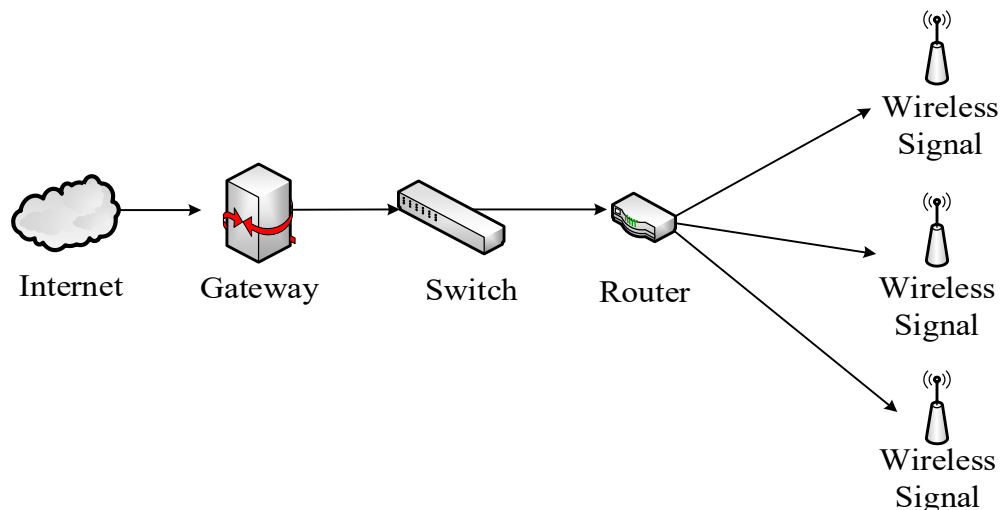
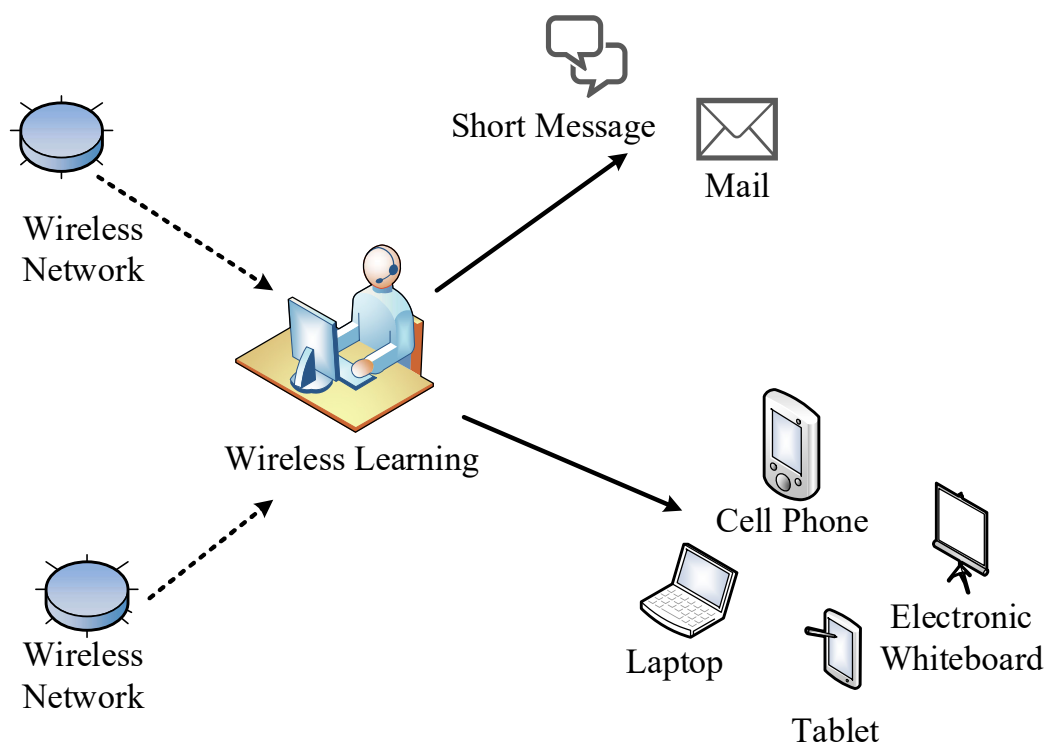


Fig. 1. The composition of a wireless network

2.2. Main application fields of wireless network

Common application areas of wireless networks include shopping, finance, enterprise, and education. In the field of shopping, people can use their mobile devices to connect to wireless networks to achieve a shopping experience where they can buy goods without leaving home. In the financial field, wireless networks are mainly used for economic situation assessment, economic risk prediction and so on. In the enterprise field, wireless networks are used in enterprise information management systems and various enterprise recruitment platforms.

The field of education is the field of wireless network application and research the most, specifically in the application of infinite learning. There are many existing schemes of wireless learning, the most common ones are mobile learning based on short message and wireless learning based on wireless local area network. Figure 2 is a specific example of two wireless learning methods. The short message-based learning method is suitable for teaching activities with less communication data and single learning content, whose learning method is usually limited. For wireless learning based on wireless local area network, users can use various mobile devices such as mobile phones, notebooks, tablets, and electronic whiteboards to access, browse, search and interact in real time on the teaching server.

**Fig. 2.** Specific examples of two wireless learning methods

3. Construction of Mobile Learning Mode of College English Writing Based on Wireless Network

3.1. Mobile learning arrangement structure combined with wireless network

As shown in Figure 3, first of all, reasonably arrange several wireless base stations in the university. These base stations must be able to connect to the campus network. Students can access the campus network wirelessly as long as they are within the coverage of the base stations. Then in each teaching building, the line network interface is reserved and the base station is connected to this interface, so

that as long as there is a wireless network card on each student's computer, wireless connection can be achieved. The mobile devices for wireless connection can be various wireless devices, such as notebooks, mobile phones, tablet computers, smart whiteboards, and the like.

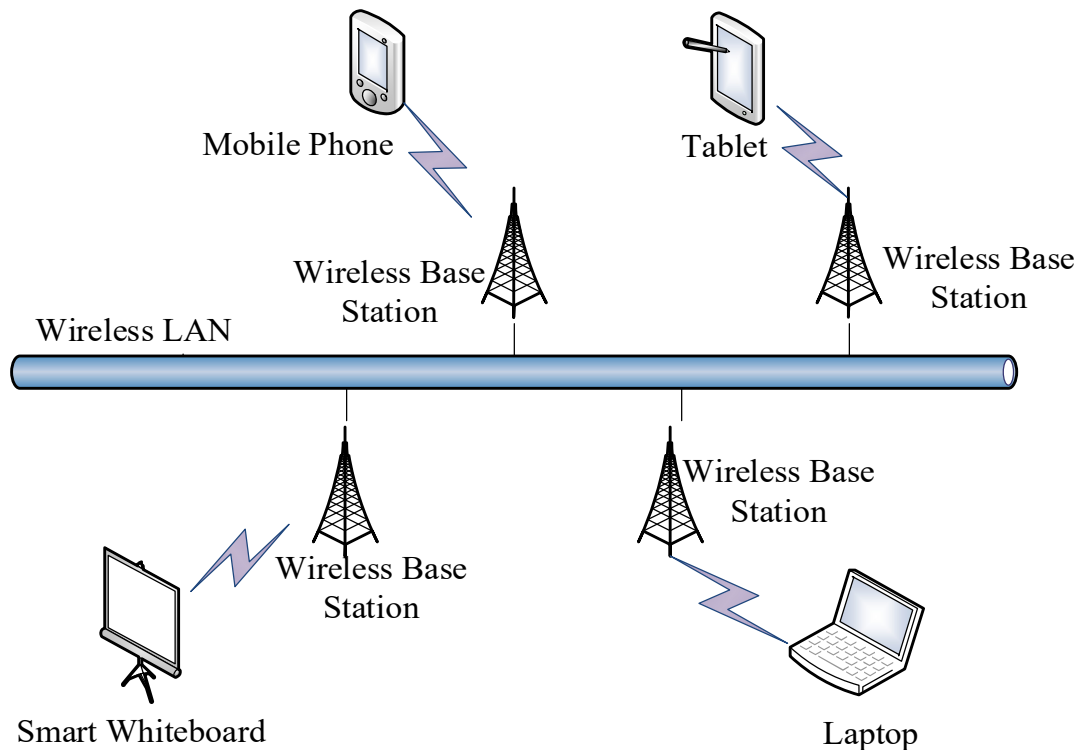


Fig. 3. Mobile learning arrangement structure combined with wireless network

3.2. Conditions for realizing mobile writing class

Figure 4 shows the conditions and steps for forming a mobile writing class, including four parts: writing requirements, online resources, wireless network and mobile learning platform. The first is the issuance of writing requirements, that is, teachers give specific requirements for English writing content. Then students connect to the wireless network to search for online learning resources and display them through the mobile learning platform. Finally, the students entered the writing class using mobile terminal devices and successfully completed the writing task.

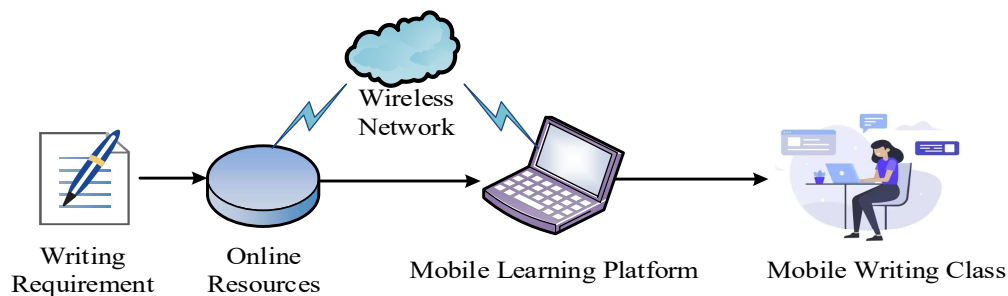


Fig. 4. Conditions and steps for forming a mobile writing class

3.3. The specific content of the new mobile learning mode of college English writing

Figure 5 shows the specific content of the new mode. The new learning mode is three-dimensional and interactive. It includes one-way and two-way learning, online and offline learning, English vocabulary, classic sentence patterns, writing skills and appreciation of sample essays. The specific

application process can be divided into three parts, including writing part, writing part and feedback modification part.

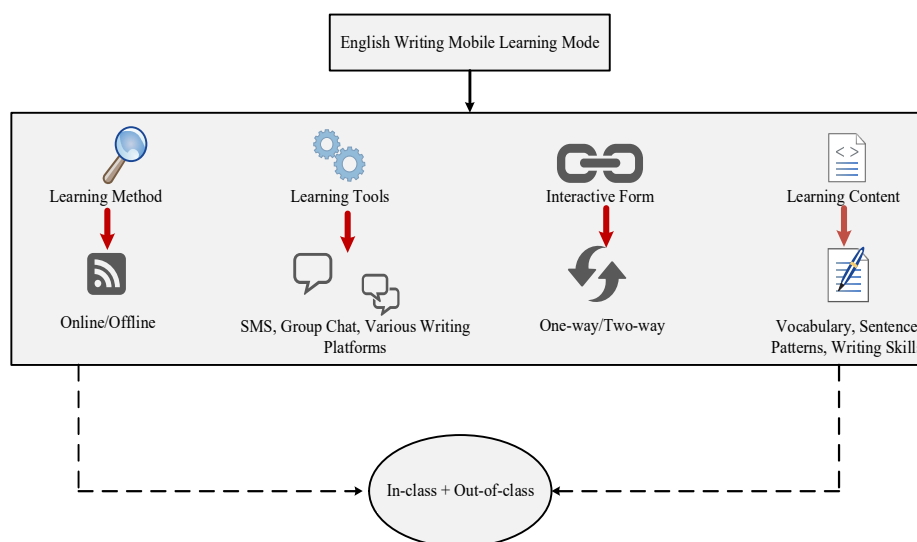


Fig. 5. The specific content of the new mobile learning mode of college English writing

1) Writing preparation section. This part mainly includes the accumulation of vocabulary and sentence patterns, the appreciation of fine model essays and the cultivation of writing skills. Regarding word accumulation, students can either use the corresponding dictionary application to complete vocabulary memory offline, or use the application's challenge system to complete online word competition and memory; regarding the accumulation of sentence patterns, students can copy the classic sentence patterns recommended by the teacher, or use the recommended sentence patterns on the English writing website; regarding the appreciation of fine sample essays, students can download the reading application and read by searching for excellent works; regarding the cultivation of writing skills, students can record the teacher's micro-lecture video for offline learning, or they can go to the web page for online learning according to the video theme.

2) Writing practice section. This part requires students to use mobile devices such as mobile phones to conduct two-way interactive learning on online writing platforms such as text messages, group chats, and micro-classes. Talking about writing topics, language expressions, chapter layout, etc. through group chat allows learners to determine the writing topic and writing structure before starting the writing process.

3) Feedback Modifications section. The improvement of writing ability is inseparable from timely and effective writing feedback. Students can send completed writing tasks to group chats or various communication platforms for other students to comment. After getting the evaluation opinions of the students, the online feedback system is used for secondary editing, and then sent to the teacher for evaluation, so as to obtain the final evaluation score.

4. Application of Text Classification in the Mobile Learning Mode of English Writing

Both vocabulary and sentences are an important part of writing. In order to better write English in the mobile learning mode, it is necessary to classify the learning resources in the learning mode. This paper analyzes the classification of learning resources based on relevant mathematical models. In general, the most common problems in text classification are feature selection and similarity calculation.

4.1. Feature selection

Commonly used methods for text feature selection are: document frequency, document frequency-inverse document frequency feature, mutual information, information gain, expected cross entropy, correlation coefficient, text evidence weight, odds ratio, etc.

1) Document Frequency (DF). DF mainly represents the number of texts containing feature words in the text training set. Usually in feature selection, features with document frequency values higher than a certain threshold will be retained, and features below this threshold will be deleted. The specific calculation formula of document frequency is:

$$DF_{(t_k)} = \frac{\text{the number of documents in which the feature } t_k \text{ appears}}{\text{Total number of documents}} \quad (1)$$

2) Document Frequency - Inverse Document Frequency Feature (TF-IDF). It means that if a certain word only appears frequently in one text, but has a low frequency in other texts, it means that the word classification performance is better. The specific form is:

$$TF_{(i,j)k} = \frac{num_{i,j}}{\sum_k num_{k,j}} \quad (2)$$

$$IDF_i = \log(N / df_i) \quad (3)$$

$$TFIDF_i = TF_{(i,j)k} * IDF_i \quad (4)$$

In the formula, $TF_{(i,j)}$ is the frequency of feature item i appearing in text j , and IDF_i is an index to measure the universality of entry i . $num_{i,j}$ is the number of occurrences of feature item i in document j , and $\sum_k num_{k,j}$ is the sum of the number of occurrences of all feature items in document j . N is the number of documents in the training set, and df_i is the number of documents that contain feature item i .

3) Mutual Information (MI). MI is usually used to represent the relationship between information, and in text classification, it is used to represent the relationship between feature items and classification categories. $MI(t_k, c_i)$ represents the mutual information between feature item t_k and category c_i , and $MI(t_k)$ represents the total mutual information value of t_k in all categories. The calculation formula is:

$$MI(t_k, c_i) = \log \frac{p(t_k | c_i)}{p(t_k)} \quad (5)$$

$$MI(t_k) = \sum_i p(c_i) * MI(t_k, c_i) \quad (6)$$

In the formula, $p(t_k | c_i)$ is the number of times t_k appears in c_i , and $p(t_k)$ is the number of times t_k appears in the training set.

4) Information Gain (IG). The model judges the importance of the feature word to the classification result according to the degree of change of the feature item t_k to the text classification result. The representation in this article is:

$$IG(t_k, c) = p(t_k) \sum_i p(c_i | t_k) \log \frac{p(c_i | t_k)}{p(c_i)} + p(\hat{t}_k) \sum_i p(c_i | \hat{t}_k) \log \frac{p(c_i | \hat{t}_k)}{p(c_i)} \quad (7)$$

Among them, $p(c_i | t_k)$ represents the probability that a text containing t_k belongs to class c_i , and $p(\hat{t}_k)$ represents the probability that the training set does not contain t_k . $p(c_i | \hat{t}_k)$ is the probability that a text that does not contain t_k belongs to category c_i , and $p(c_i)$ is the probability that category c_i occurs.

5) Expected Cross Entropy (ECE). The main idea of this model is to calculate the distance between the probability distribution value of the text category and the distribution value of feature item t_k . The larger the ECE value, the greater the influence of the feature item t_k on the classification result. The formula is:

$$ECE(t_k, c) = p(t_k) \sum_i p(c_i | t_k) \log \frac{p(c_i | t_k)}{p(c_i)} \quad (8)$$

Among them, $p(t_k)$ is the number of occurrences of t_k in the training set, $p(c_i | t_k)$ is the probability that a text containing t_k belongs to category c_i , and $p(c_i)$ is the number of occurrences of category c_i .

6) X^2 Statistics (CHI). The idea of this model is: if the X^2 statistic between the feature item and the category is higher, it means that the category information entrained by the feature item is more, and the relationship with the category is greater. The calculation method is:

$$X^2(t_k, c_i) = \frac{N * (AD - CB)^2}{(A + C) * (B + D) * (A + B) * (C + D)} \quad (9)$$

In the formula, N is the total number of documents in the training set A is the number of texts that contain t_k in category c_i . B is the number of texts in category c_i that do not contain t_k . C is the number of texts except category c_i that contains t_k . D is the number of texts that do not contain t_k except in category c_i .

7) Odds Ratio (OR). OR is also called the odds ratio method. Since it only targets the target category, it makes the binary classification problem simpler. Its expression is as follows:

$$OR(t_k) = \log \frac{p(t_k | c_i) * (1 - p(t_k | \hat{c}_i))}{p(t_k | \hat{c}_i) * (1 - p(t_k | c_i))} \quad (10)$$

In the formula, $p(t_k | c_i)$ is the number of times t_k appears in c_i , and $p(t_k | \hat{c}_i)$ is the number of times t_k appears in categories other than c_i .

4.2. Similarity calculation

Text similarity is usually calculated using similarity and distance functions.

1) Cosine similarity: measure the similarity between texts by calculating the angle between two vectors, that is, for high-dimensional vectors $A(A_1, A_2, \dots, A_n)$, $B(B_1, B_2, \dots, B_n)$, there are

$$\cos \theta = \frac{\sum_{i=1}^n (A_i * B_i)}{\sum_{i=1}^n A_i^2 * \sum_{i=1}^n B_i^2} \quad (11)$$

2) Jaccard (Jaccard) coefficient: It is a probability coefficient used to compare the similarity and dispersion in a sample set. It is equal to the ratio of the intersection of the sample set and the sample set, that is

$$J = \frac{|A \cap B|}{|A \cup B|} \quad (12)$$

3) Euclidean distance (EM): It refers to the true distance between two points in the Z-dimensional space, that is, for $X = (x_1, x_2, \dots, x_n)$, $Y = (y_1, y_2, \dots, y_n)$, there are

$$D(X, Y) = \sqrt{(x_1 - y_1)^2 + (x_2 - y_2)^2 + \dots + (x_n - y_n)^2} = \sqrt{\sum_{i=1}^n (x_i - y_i)^2} \quad (13)$$

4.3. Text representation model

Boolean models are text representation models for information retrieval. Suppose the user query is $Q = (q_1, q_2, \dots, q_n)$, q_i is the contribution of the i -th feature word to the query content, and $q_i \in (0, 1)$. The text is represented as $D = (d_1, d_2, \dots, d_n)$, d_i is the contribution of the i -th feature word to the document content, and $d_i \in (0, 1)$, then the model's calculation of the document similarity can be expressed as:

$$\text{sim}(D, Q) = 1 - \sqrt[p]{\frac{q_1^p(1-d_1)^p + q_2^p(1-d_2)^p + \dots + q_n^p(1-d_n)^p}{q_1^p + q_2^p + \dots + q_n^p}} \quad (14)$$

In the formula, $p \in [1, +\infty]$, $p \rightarrow +\infty$ is easily obtained by calculation, and the model performed the best at that time.

The Bernoulli model in Naive Bayes is also based on document frequency. Combined with the Boolean model above, its algorithmic decision can be expressed as: for documents $d_i \{t_1, t_2, \dots, t_m\}$, categories $c_j = \{c_1, c_2, \dots, c_n\}$, there are

$$C = \arg \max_{c_j} (p(c_j | d_i)) = \arg \max_{c_j} \left(\frac{p(c_j) * p(d_i | c_j)}{p(d_i)} \right) \quad (15)$$

In the formula, $p(c_j) = \frac{N_j}{n}$, N is the total number of texts in the training set, and N_j is the number of texts in category N_j .

$$p(d_i | c_j) = \prod_{k=1}^m p(t_k | c_j) \quad (16)$$

In the formula, $p(t_k | c_j)$ represents the number of times that t_k appears in c_j , and N_{jk} represents the number of texts in which the feature word t_k appears in category c_j .

$$p(d_i) = \sum_{j=1}^m p(c_j) * p(d_i | c_j) \quad (17)$$

$p(d_j)$ in the formula is the probability of category d_j appearing.

Support vector machine is a relatively common algorithm in machine learning, and it also has a good performance in the field of text classification. This paper uses the quadratic programming problem in the support vector machine to solve the text classification problem. The calculation form of the quadratic programming is:

$$\vec{\alpha}^* = \arg \min \left\{ -\sum_{i=1}^n \alpha_i + \sum_{i=1}^n \sum_{j=1}^n \alpha_i \alpha_j y_i y_j \vec{x}_i \vec{x}_j \right\} \quad (18)$$

The restrictions are:

$$\sum_{j=1}^n \alpha_j y_j = 0; 0 \leq \alpha_i \leq C \quad (19)$$

The algorithmic decision is:

$$f(x) = \vec{w} \cdot \vec{x} + b \quad (20)$$

In the formula, $\vec{w} = \sum_{i=1}^n \alpha_i y_i \vec{x}_i$, b is the threshold obtained by using the support vector model.

Comparing several mathematical models, the classification process of SVM is relatively simple, the training speed is faster, and it performs better in the classification of learning resource texts.

5. Experimental Results of the New Mobile Learning Mode of College English Writing

The emergence of new things will have a process from learning to adapt. As a new learning mode, mobile learning must allow teachers and students to have a full understanding in order to make better use of English writing. In order to analyze whether the mobile learning model can be effective in college English writing, this paper firstly investigates the understanding of the mobile learning model among 400 teachers and students in a certain institution. The degree of understanding is divided into no understanding, heard of, understanding and very understanding. The survey results are shown in Table 1.

Table 1. Teachers and students' understanding of the mobile learning model

degree of understanding	teacher		student	
	number of people	proportion	number of people	proportion
don't understand	6	1.5%	11	2.75%
heard about it	15	3.75%	16	4%
understand	77	19.25%	83	20.75%
know very well	101	25.25%	91	22.75%

From Table 1, it can be clearly seen that there are very few people who do not understand the mobile learning model, but relatively more people have heard of it, and teachers and students account for 7.75% of the total number of people; people who know and know very well account for the majority, and the number of teachers and students accounts for 88% of the total number, which also shows from the side that the development of the mobile learning model has been relatively successful over the years.

The so-called mobile learning mode, that is, this mode breaks the constraints of time and space, and also breaks the shackles of traditional classrooms, which also means that students' learning situation is not managed by teachers, and basically depends on self-consciousness. When students use the mobile learning mode to write in English, the length of writing time reflects the autonomy of the students. This paper investigates the writing time of students under the traditional learning mode and the new mobile learning mode. The specific time limit is one week (7 days). The survey results are shown in Figure 6.

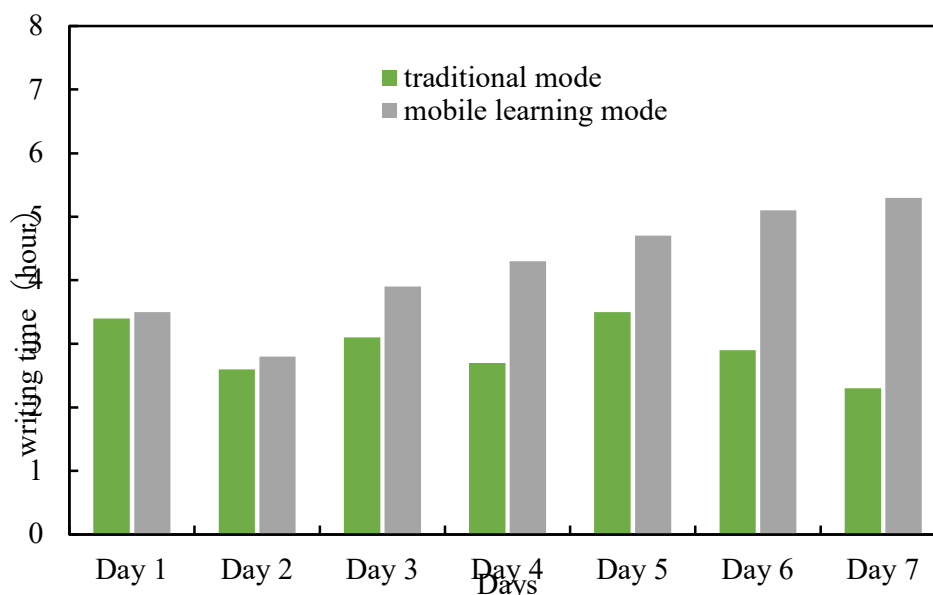
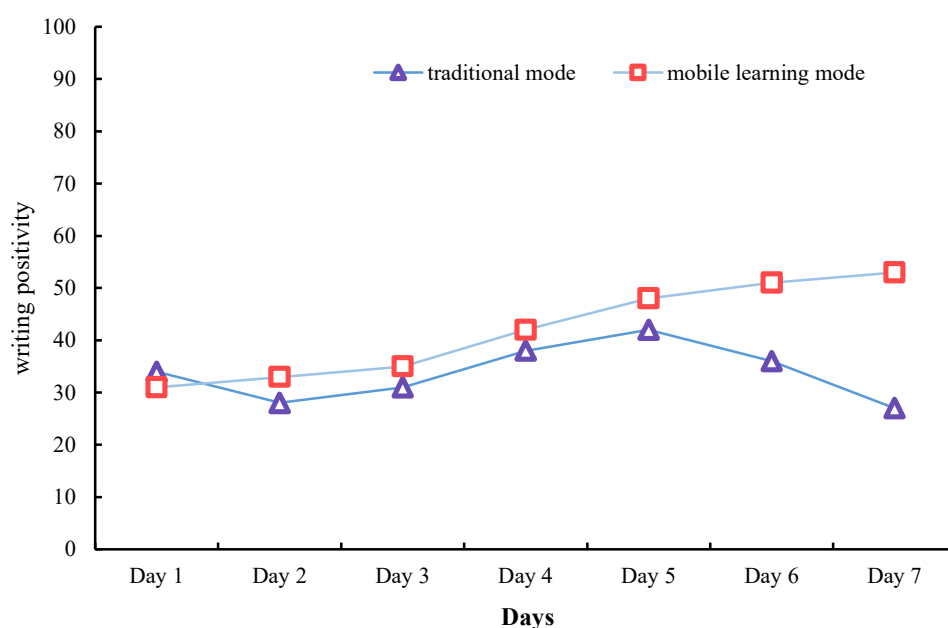


Fig. 6. Writing time in two learning modes

From the bar chart in Figure 6, it can be seen that the writing time of the mobile learning mode in the first two days is only a little higher than that of the traditional learning mode, and there is a phenomenon of decline. This is because the mobile learning model has just been integrated into the writing process, and students are not very comfortable with it. From the third day, the students' writing time has improved significantly. The third day is more than an hour longer than the second day, and the writing time of the next few days has also maintained an upward trend. In contrast to the traditional learning model, the writing time within 7 days has been fluctuating, and the overall time is much lower than the mobile learning model. Overall, the mobile learning model has a good effect in improving students' writing time.

In the method part, this paper mentions the writing class. Under the mobile learning mode, the enthusiasm of students in the writing class reflects the success of the learning mode. This paper investigates the writing enthusiasm under the traditional learning mode and the mobile learning mode. The full score of the enthusiasm is 100, and the specific time is 7 days. The survey results are shown in Figure 7.

**Fig. 7.** Writing motivation in two learning modes

It can be seen from the line chart in Figure 7 that the difference in writing enthusiasm between the two learning modes within 7 days is still relatively large. The writing enthusiasm in the first three days is relatively low, basically below 40 points. From the fourth day, writing motivation in both study modes started to rise, but from the fifth day, the motivation was different. The writing enthusiasm under the mobile learning mode has always been on the rise, while the writing enthusiasm under the traditional learning mode has been declining. Comparing the line charts, it can be seen that the writing enthusiasm in the mobile learning mode is much higher than that in the traditional learning mode, and it has been rising over time.

Writing scores directly reflect the quality of writing. In order to better demonstrate the practical effect of the new mobile learning model in English writing, a survey was conducted on the English writing scores of students under the two learning modes within 5 weeks. The sample of students is an English major in a certain institution, with a total number of 300 people, of which the grades are divided into excellent and qualified. The survey results are shown in Figure 8 and Figure 9.

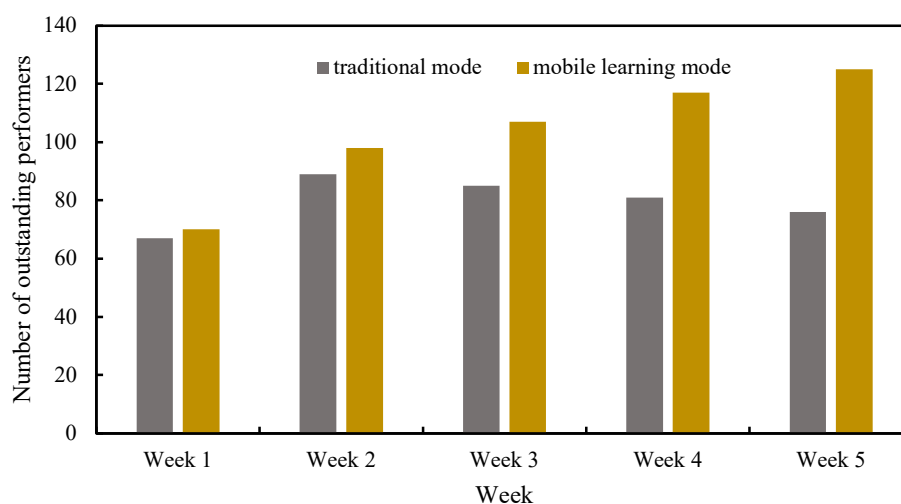


Fig. 8. The number of people with excellent writing scores in the two learning modes

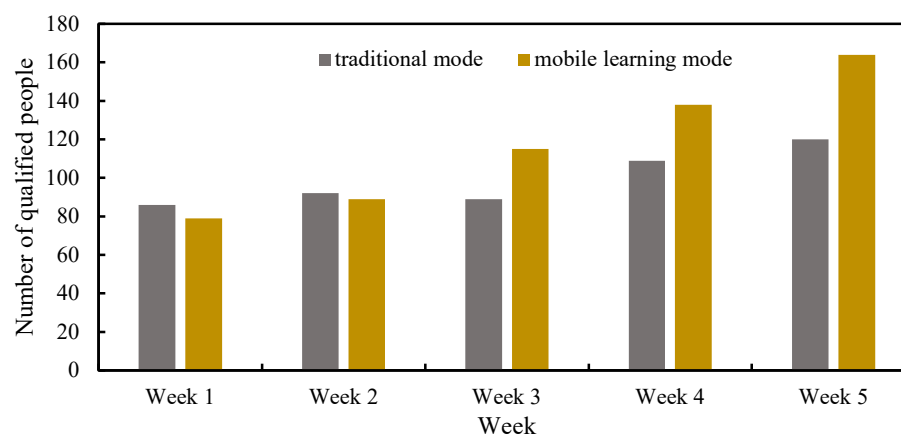


Fig. 9. The number of people who passed the writing score in the two learning modes

Figure 8 shows the results with excellent writing scores, and Figure 9 shows the results with good scores. It can be seen that in the first two weeks, the number of people with excellent writing scores and those who passed the writing scores in the two learning modes is not much different. Neither the number of outstanding performers nor the number of qualified performers exceeded 100 in the first two weeks. Over time, the number of high-achieving and passing grades in the mobile learning model has grown from the third week, while the number of high-achieving and passing grades in the traditional learning model has declined. Comparing the increase in the number of students under the two types of grades, it can be concluded that the addition of the mobile learning mode has made the students' writing scores improve continuously, while under the traditional learning mode, the students' writing scores have been erratic.

The purpose of applying the mobile learning mode to English writing is not only to improve the quality of writing, but also to improve the writing efficiency of students. In order to verify whether the mobile learning mode of college English writing combined with wireless network can improve students' writing efficiency, the writing efficiency of this mode within one year was analyzed and compared with the writing efficiency of the traditional learning mode. The comparison results are shown in Figure 10.

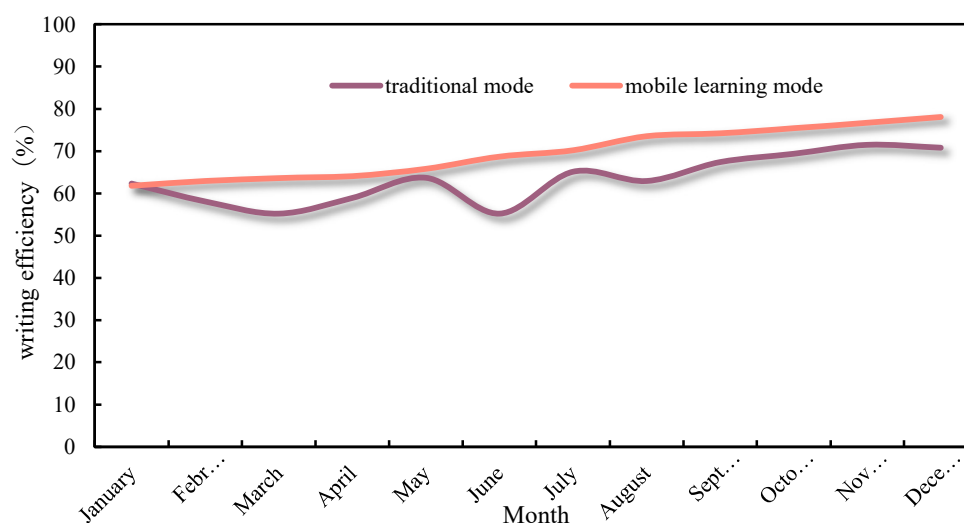


Fig. 10. Writing efficiency in two learning modes within 1 year

From the graph in Figure 10, it can be seen that there is still a big gap in the writing efficiency of the two learning modes within one year. Obviously, in the adaptation phase in January, the writing efficiency of the mobile learning mode is lower than that of the traditional learning mode. However, since February, the writing efficiency in the mobile learning mode has gradually increased, and it has maintained a trend of no decline until December. In contrast, the writing efficiency under the traditional learning mode, although there is an upward trend in the middle months, the overall fluctuation is too large. In contrast, it is easy to conclude that the writing efficiency of the mobile learning mode is 6.73% higher than that of the traditional learning mode within one year.

6. Conclusion

The emergence of the Internet not only has an impact on the traditional learning model, but also gave birth to a mobile learning model that adapts to the development of the times. Applying the mobile learning mode to college English writing not only changes the teaching method of writing, but also provides more methods for college students to learn English writing. Students should take advantage of the convenience brought by the Internet, and use various mobile devices and online platforms to organize and organize writing learning resources inside and outside the classroom, so as to realize mobile learning. In the learning process, students should be more active and serious, and they use this new learning mode to improve their English writing quality and writing efficiency.

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