Advances in Educational Technology and Psychology (2025)
Clausius Scientific Press, Canada
DOI: 10.23977/aetp.2025.090407
ISSN 2371-9400 Vol. 9 Num. 4

Application and Strategy of Computer Multimedia Technology in College Students' English Reading and Writing Teaching

Hongli Pang[1,a,*]

[1]*School of Foreign Studies, Liaoning University of International Business and Economics, Dalian, 116000, Liaoning, China*
[a]*panghongli888@gmail.com*
[*]*Corresponding author*

Keywords: English Reading and Writing Teaching, Target Tracking Algorithm, Computer Multimedia Technology, Optical Flow Tracking Algorithm

Abstract: With the rapid development of information technology, computer multimedia technology has become one of the important means to improve the quality of higher education teaching. This paper aims to explore the application of computer multimedia technology in college students' English reading and writing teaching and its optimization strategy. First, the target tracking algorithm under the computer multimedia algorithm is studied. CamShift, Kalman filtering and other technologies are used to achieve real-time tracking of multimedia classroom courseware, and the angle of the camera is automatically adjusted according to the position of the teacher to achieve better recording effect. Then, a questionnaire survey was conducted on teachers and students of a certain university, and a one-month teaching was carried out. Finally, the results were verified by examinations. The experimental results show that the average reading and writing scores of the two classes before teaching are basically the same, and the average reading and writing scores of the experimental class after teaching are also basically the same, but the scores have surpassed the control class, with an average score of 3.3 points higher. It can be seen that multimedia-assisted teaching helps to improve students' reading and writing scores.

1. Introduction

In the 21st century, with the rapid development of computer technology, educational informatization has become an important measure to promote educational reform and development. The development of computer technology has greatly changed the study and life of human beings. Especially with the development of modern educational technology, students can change from passive learning to active learning. Under the application of information technology, they can choose their own learning methods and learning content according to their own characteristics. Multimedia technology has been widely used in the teaching of various subjects. In college English reading and writing teaching, how to improve teaching efficiency and teaching effect through multimedia technology has become a challenge now.

This paper mainly talked about the target tracking algorithm under the computer multimedia algorithm, and introduced the CamShift algorithm, the optical flow tracking algorithm, the Kalman filter method and other methods. Then teachers and students of a university were investigated and analyzed, and they went to the classroom to observe the classroom reactions of teachers and students, and then used multimedia to teach for a month. The innovation of this paper lies in teaching by words and deeds. It is very innovative to go to the school to audit and teach in person. Therefore, the conclusions of this paper are also very accurate, and the research of this paper is also very valuable.

2. Related Work

College students' English reading and writing ability is a very important part of their subjects, and because computer-assisted language learning can improve foreign language proficiency. With the help of a blog, Spanou S developed the literacy and writing skills of a group of B1 English language learners at a private language academy in Athens, Greece, forming two groups of adolescent learners. The control group used traditional teaching materials for teaching, and the experimental group used differentiated language teaching methods for teaching [1]. Sohail J assessed the extent to which syntactic awareness contributes to literacy comprehension in English-French bilinguals, taking into account the potential for direct and indirect relationships through word literacy. Participants were 146 first-year students enrolled in an early French immersion program in Canada [2]. Fauzi C aimed to determine the impact of a whole-language approach on early English literacy in children aged 5-6 in a kindergarten in the Yogyakarta Special Region. Twenty-nine participants were included in the experimental class subjects as well as in the control class, with only a post-test control group designed. Observation is a way of recording data to study early literacy [3]. The Polsuk T study examined the appropriateness of university EFL students. The results of study help English teachers choose the most appropriate textbooks for learners of different levels to develop their reading and writing skills[4]. They all introduced the meaning of English reading and writing teaching and how to improve its level. They also mentioned computer multimedia technology, but they did not give a detailed introduction on how to use this technology to improve English reading and writing level.

With the continuous development of the Internet, great changes have taken place in the way contemporary college students acquire knowledge. In the article, Chen X used computer-aided multimedia technology to improve the physical education instruction paradigm. The new method focuses on multimedia tools and its application in physical education, and the test results of the simulation sub-part demonstrate the effectiveness of the method [5]. The progress of computer technology and the change of learning concept are the core factors that promote the continuous development of online teaching. Qiu Y studied the application of computer-aided multimedia teaching platform in the reform of university education. Multimedia teaching has outstanding advantages and great potential, and has become a key link to improve the quality of education and teaching [6]. Yue N mainly studied the design of computer multimedia-assisted English vocabulary teaching courseware [7]. All of them have done research in various fields of computer multimedia technology and achieved certain results. They also explained and explained the importance of classroom education, but they did not do the survey and did not tell how to use the technology.

3. Application Algorithm of Computer Multimedia Technology in College Students' English Reading and Writing Teaching

This paper aimed at the error tracking problem existing in various situations when using the CamShift tracking algorithm in classroom teaching, and gave the corresponding solutions. Aiming

at the temporary occlusion problem of moving objects, this paper uses the Kalman filter algorithm to locate the target in the next frame. Then the real position of the target is found according to the color information of the area, which effectively prevents the distance from being too long due to color loss. Aiming at the problem of wrong tracking caused by the teacher writing with his back to the camera for a long time, this paper proposes a method based on the limitation of facial morphology. It is shrunk to the minimum, and based on the size information, the search window size is appropriately adjusted to return it to the face target. The algorithm flow is shown in Figure 1:

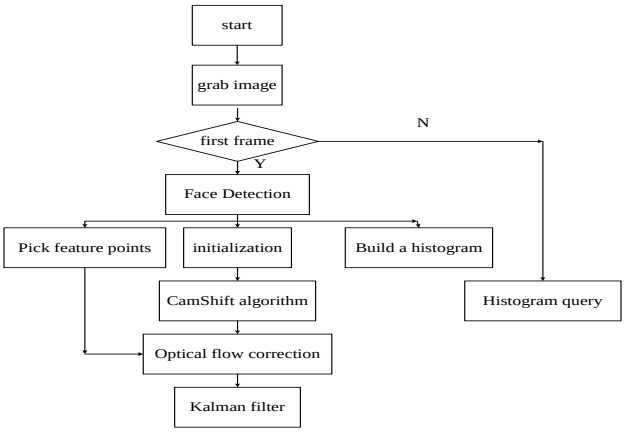


Figure 1 Overall flow chart of the tracking method

(1) CamShift algorithm

The algorithm flow of CamShift is shown in Figure 2. First, the initial search window is selected, so that the window exactly contains the entire tracking target. In this paper, the AdaBoost face detection algorithm is used to initialize the search window, and the detected face rectangular area is used as the initial search window of CamShift. Then the value on the H channel of each pixel in the window is sampled, the color histogram is calculated, and the histogram is saved as the skin color histogram of the target.

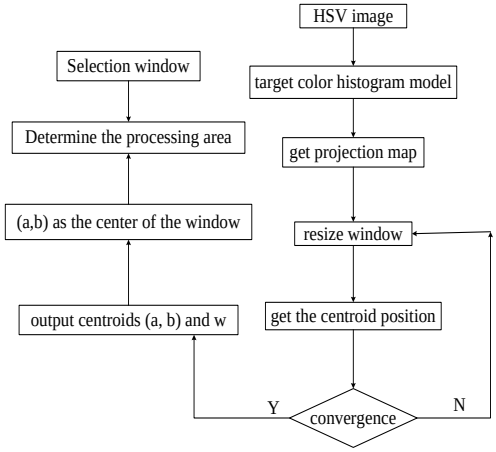


Figure 2 Flowchart of CamShift Algorithm

(a,b) is set to the pixel coordinates in the search window, and $J(a,b)$ is the pixel value at (a,b) in the projection image. The zero-order moment of the search window is defined as N_{00}, the first-order moment N_{10}, N_{01} and the second-order moment N_{20}, N_{11}, N_{02} are as follows:

$$N_{00} = \sum_a \sum_b J(a,b); N_{10} = \sum_a \sum_b aJ(a,b); N_{01} = \sum_a \sum_b bJ(a,b) \quad (1)$$

$$N_{20}=\sum_a\sum_b a^2J(a,b);N_{11}=\sum_a\sum_b abJ(a,b);N_{02}=\sum_a\sum_b b^2J(a,b) \tag{2}$$

Then the centroid position of the search window is:

$$a_c=\frac{N_{10}}{N_{00}};b_c=\frac{N_{01}}{N_{00}} \tag{3}$$

At the same time, the direction φ, length u and width v of the target area in the search window can also be calculated.

$$\varphi=\frac{1}{2}\arctan\left(\frac{2\left(\frac{N_{11}}{N_{00}}-a_cb_c\right)}{\left(\frac{N_{20}}{N_{00}}-a_c^2\right)-\left(\frac{N_{02}}{N_{00}}-{b_c}^2\right)}\right) \tag{4}$$

$$u=\sqrt{\frac{(x+c)+\sqrt{y^2+(x-c)^2}}{2}} \tag{5}$$

$$v=\sqrt{\frac{(x+c)-\sqrt{y^2+(x-c)^2}}{2}} \tag{6}$$

Then the search window is resized according to the zero-order moment N_{00}, and the center of the search window is moved to the centroid (a_c,b_c). If the distance moved is greater than a preset fixed threshold, a new round of window position and size is calculated. Iterative adjustment is performed until the moving distance between the center of the search window and the center of mass is less than a preset fixed threshold. Or when the number of loop operations reaches a certain maximum value, it is considered that the convergence condition is satisfied, and the next frame of image is entered for a new round of target search. In the new video image, the position and size of the new search window are set by using the window centroid position and zero-order moment finally obtained from the previous frame image [8].

Due to the change of the distance of the tracking object from the camera or the rotation of the tracking object, the size of the tracking target area is constantly changing. The CamShift tracking algorithm recalculates the size of the search window during each iteration. The width of the search window is set to V_{search} and the height to G_{search}, then:

$$V_{search}=2*\sqrt{\frac{N_{00}}{255}} \tag{7}$$

$$G_{search}=1.2*V_{search}=2.4*\sqrt{\frac{N_{00}}{255}} \tag{8}$$

The Formula 8 is obtained because the maximum value of the probability distribution is 255, so the area of the tracking area should be set as the area is two-dimensional, while the width and height are one-dimensional, so the square root of the area should be calculated. At the same time, it is hoped that the search window will continuously move to the peak area of the probability

distribution. Therefore, the search window is larger than the target area, and $\sqrt{\frac{N_{00}}{255}}$ is multiplied by a scaling factor of 2. Since the face is oval, and the aspect ratio is roughly 1.2:1, so $G_{search} = 1.2 * V_{search}$. Therefore, the CamShift algorithm adaptively adjusts the size of the search window within and between frames of the image according to the results obtained in the previous step, so that the constantly moving target can be tracked.

(2) Kalman filter method

Kalman filter is an optimal recursive filter that introduces the concept of state space into estimation theory. It regards the signal process as a linear output under white noise, and uses the state formula to express the relationship between the input and output. The rationale is expressed in Figure 3 [9].

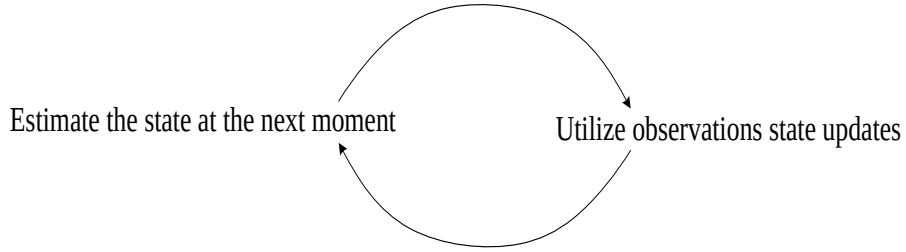


Figure 3 Kalman filter filter loop principle

It uses the formula of state and the recursive method to estimate, and gives the solution in the form of estimated value. The recursive process of the Kalman filter to solve the estimated value is described below.

Firstly, a system of discrete control process is established, which can be described by a linear stochastic differential formula:

$$A_r = X \times A_{r-1} + S_r \tag{9}$$

At the 0th moment, according to the requirements of the system application, initialize the system state A_0, the state transition matrix X, the measurement matrix F, the dynamic noise variance matrix P, the measurement noise variance matrix K, and the initial error variance matrix Q_0.

At time k-1, the state prediction formula of the system is:

$$A'_r = X \times A_{r-1} \tag{10}$$

$$Q'_r = X \times Q_{r-1} \times X^D + P \tag{11}$$

At time k, the system state update formula is:

$$A_r = A'_r + R_r \times (L_r - F \times A'_r) \tag{12}$$

R_r is the Kalman gain matrix.

The research object tracking technology in this paper is a set of multimedia courseware recording system. The purpose of this method is to use a tracking algorithm. Without manual labor, the image captured by the camera is tracked in real time to obtain the teacher's position, and based on the teacher's position. The direction of the camera is automatically adjusted to ensure that the teacher is within the line of sight of the camera, so as to achieve a better recording effect [10-11].

4. Application and Strategy of Computer Multimedia Technology in College Students' English Reading and Writing Teaching

4.1 Experiment

In this paper, 4 teachers are randomly selected for each major in the first, second and third grades of the school, with a total of 12 teachers; 50 students are randomly selected in the second and third grades, plus 83 students who participate in the teaching experiment. Freshman students, a total of 183 students are surveyed. There are a total of 195 questionnaires for teachers and students, including 12 questionnaires for teachers, all of which are recovered and valid, with an effective rate of 100%; a total of 183 questionnaires for students, 179 questionnaires are actually recovered, and 176 are valid questionnaires, with an effective rate of 96.2%.

First of all, the traditional reading and writing teaching method adopted by the two classes - PWP reading and writing teaching mode [12], does not use multimedia in the teaching process, and completes the study of the reading and writing parts of Unit1 and Unit2 in the compulsory course one of the Foreign Research Institute version of the university, including Reading text and CultureCorner sections. After the study is completed, a pre-literacy test is administered. Test scores are recorded and students are analyzed for literacy problems demonstrated on the test papers. By comparing the situation of the two classes collectively, such as the urban-rural population ratio, the gender ratio of male and female students, and the difference in age of the students, it is found that the two classes are basically similar, and the gap is not large.

The two freshman classes participating in the control experiment: class A and class B, are divided into control class and experimental class. The task of experimental teaching is to complete the reading and writing of Unit3, Unit4, Unit5, and Unit6 in the compulsory one of the FLTRP version. The teaching content of the experiment also includes Reading text and CultureCorner. In teaching literacy to both classes, the improvement of literacy problems exposed by students in the pre-test papers is emphasized. During the reading and writing class, the traditional non-multimedia-assisted reading and writing teaching mode is adopted for the control class of Class A, and no other teaching changes are made. For the experimental class of class B, multimedia is added to assist the teaching on the basis of the traditional reading and writing teaching mode, and no other aspects of teaching have been changed. After the teaching is completed, a post-test reading and writing test is conducted for this study. Post-test scores were recorded [13]. After the post-test scores and test papers are analyzed, they are compared with the pre-test scores.

4.2 Survey Results and Data

(1) Teachers' questionnaire results and analysis

Teacher Basic Information

Before implementing the experiment in two classes, teachers are firstly distributed with questionnaires. In this part, the presentation and statistical analysis of the results will be carried out according to the components of the questionnaire. The specific analysis is as follows:

From the survey data in Figure 4, it can be seen that in this school, most of the teachers are between 31-41 years old, and the teaching age is between 6-10 years of female teachers. More than half of the teachers have a bachelor's degree or above, and 70% of the teachers have more than 3 years of multimedia teaching experience. According to the development stage of teachers, teachers with a teaching experience of 6-10 years have passed the stage of adapting to the teaching profession and transitioned to the stage of forming and developing their profession in the teaching profession. Therefore, if it can be based on empirical research, the opinions and suggestions given to teachers in multimedia-assisted teaching at this time will definitely have a long-term impact on

teaching.

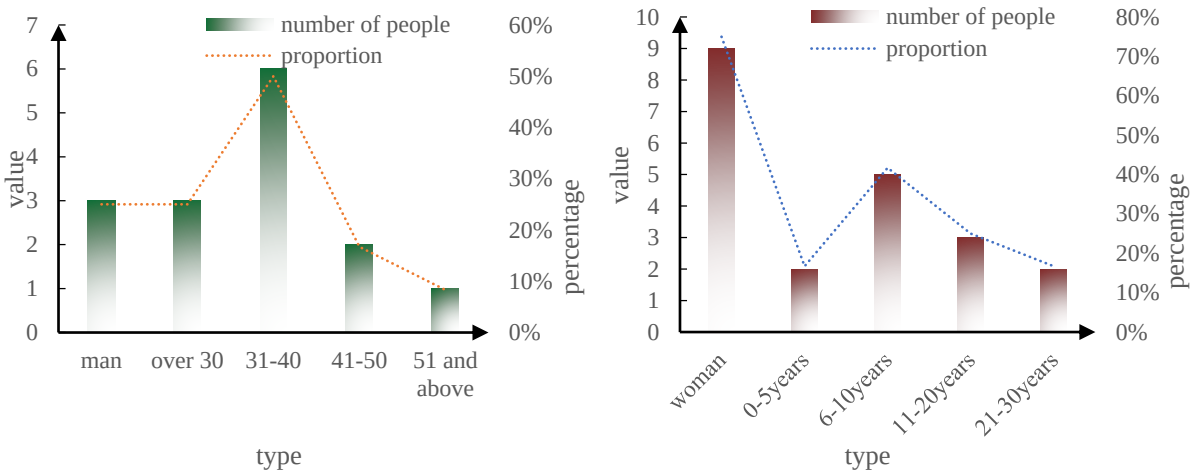


Figure 4 Statistics of teachers' basic information

Statistical analysis of Surveys Related to Literacy Teaching and Multimedia

Table 1 Statistics of the actual application of multimedia in teachers' reading and writing teaching

question	Options	number of people	Proportion
Frequency of using multimedia	often	2	16.7%
	sometimes	6	50%
	rare	4	33.33%
	never	0	0%

From the statistics of the survey results in Table 1, it can be known that teachers still often use multimedia as a teaching aid in English reading and writing teaching. Only about one-third of teachers use it less, and more than 60% of teachers use multimedia in their literacy teaching. It shows that in this school, multimedia is frequently used in reading and writing teaching, and the results of the experiment have practical value.

(2) Student questionnaire results and analysis

The statistical results of the basic information of students are as follows:

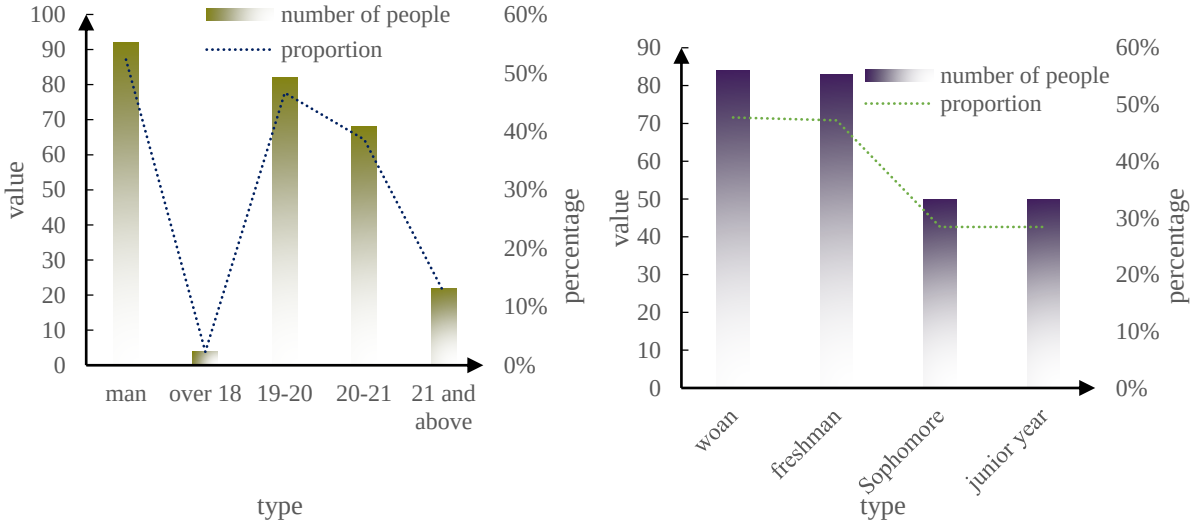


Figure 5 Statistical chart of the basic information of students

It can be seen from the above survey data that the proportion of male and female students in this

questionnaire is relatively balanced, and the students in the general class between the ages of 18-21. The surveyed objects can represent ordinary college students, and their views can more objectively reflect the current students' views and opinions. The current literacy class does not appeal to students. From the statistical results in Figure 5, it can be seen that only more than 30% of the students "liked" the current English reading and writing class. Among the remaining 60% of the students, the proportion of students who simply "disliked" reached 39.3%, nearly 40%. And about 26 percent of students had a "don't care" attitude toward literacy classes. Students cannot maintain a good attitude towards reading and writing, which will affect their performance in reading and writing. The positive role of readers mentioned by scholars earlier is difficult to reflect in reading and writing. It will be difficult to improve.

Statistical Analysis of Students' Use of Multimedia in Reading and Writing Classes

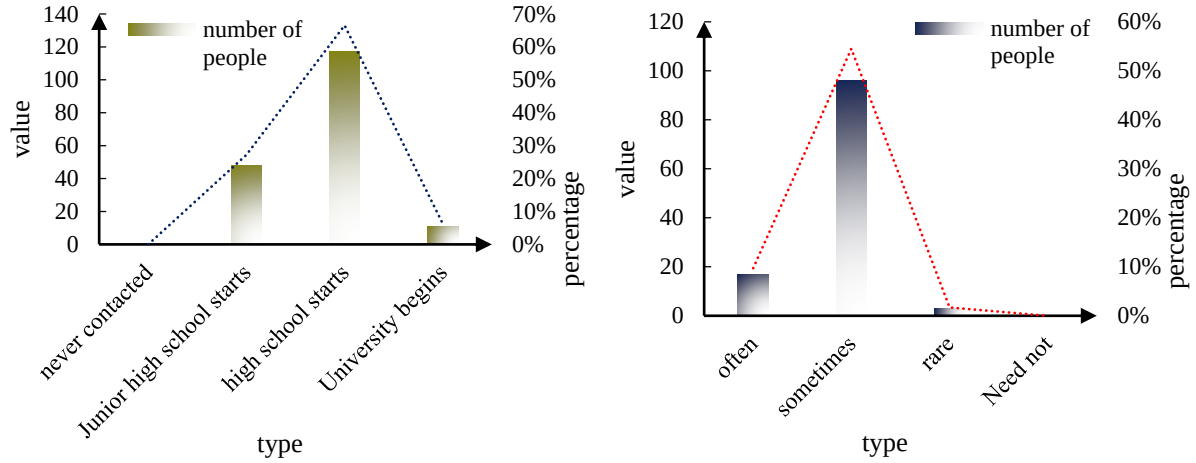


Figure 6 Statistics of students' use of multimedia in the classroom

Most of the students have experience with multimedia in the classroom. According to the survey results in Figure 6, more than 60% of students have been exposed to multimedia in English classes since high school, and less than 30% of junior high school students have been exposed to multimedia in elementary school. That is to say, about 90% of students have been exposed to multimedia before college.

Statistics of Students' Performance in Their Multimedia-assisted Classrooms

Table 2 Students' statistics on their performance in the multimedia classroom

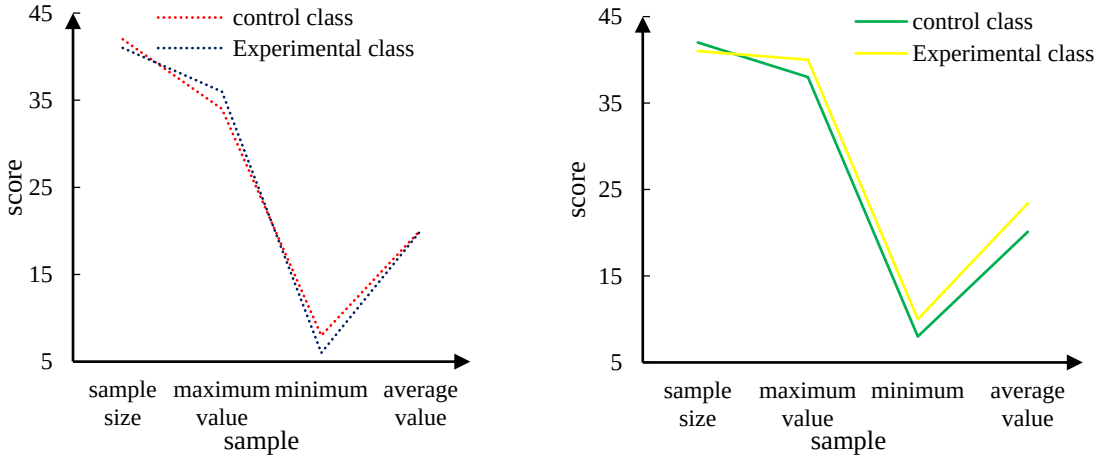
Question	Options	Number of people	Proportion
Will the intervention of multimedia make students feel that the article is easier to understand?	Meeting	103	58.5%
	Almost	62	35.2%
	Won't	11	23.3%

According to the students' answers, the following conclusions can be drawn according to Table 2:the intervention of multimedia can help students to better clarify the meaning of the article. About 58% of the students believed that the multi-media environment would be helpful for discourse comprehension. And 35% of students think there is no difference, it may be that they think they can understand the text enough, or they think multimedia is not helpful. As for the 6% of students who think that multimedia hinders their understanding of the text, it may be because the teaching content displayed by the teacher through the multimedia makes students confused, or does not use it correctly and does not help.

(3) Educational experiment results and analysis

The first is the statistics and analysis of the pre-test scores of reading and writing. There are four sections of reading and writing materials in the test paper before the test, with a total of 20

multiple-choice questions. Each section of reading and writing materials has 5 sub-questions, each with 2 points, for a total of 40 points. Students are required to complete the test in one lesson. After the test is completed, it is confirmed that all test papers have been collected and scored against the standard answers, and the scores are recorded. The statistical results of the pre-test scores for each class are as follows:



(a) Test scores before the experiment (b) Test scores after the experiment

Figure 7 Statistics line chart of each segment of the test for the control class and the experimental class

As can be seen from Figure 7, this paper can see that the average grade of the control class has not changed. This shows that under the traditional teaching of reading and writing, the overall performance of students does not change much, and the impact on students with better and worse literacy levels is not large. Looking at the reading and writing scores of the experimental class, the average class score increased from 20 to 23.4, an increase of 3.4 points and an increase of 15.4%. Observing the students of each grade, the experimental class has obvious changes in some grades compared with the control class. In particular, the number of students with scores between 20 and 30 has increased from 12 before the experiment to 16, which means that students with scores between 10 and 20 have improved their scores significantly through multimedia-assisted teaching. Based on the above data, it can be shown that after the one-semester experiment, in English reading and writing, the performance of the experimental class has been significantly improved compared to the control class. Multimedia-assisted English literacy teaching does help improve their reading and writing scores.

5. Conclusions

This paper discusses the current application status and effective strategies of computer multimedia technology in English reading and writing teaching for college students. The study shows that multimedia-assisted English reading and writing teaching can more obviously solve students' difficulties in reading and writing, and help improve some of their reading and writing abilities. Through tracking algorithms, English reading and writing patterns can be effectively identified, the quality of teachers' teaching can be improved, and a more real and vivid language learning environment can be created. This study has certain reference value for building an efficient, intelligent, and personalized foreign language teaching system, but there are still limitations. The application of multimedia technology depends on teachers' teaching design, technical literacy, and accurate grasp of students' learning behavior. Therefore, in the future, we should strengthen the training of teachers' educational technology capabilities, and combine big data and artificial

intelligence to optimize the integration and use of teaching resources to promote the intelligent development of foreign language teaching.

References

[1] Spanou S, Zafiri M N. Teaching Reading and Writing Skills to Young Learners in English as a Foreign Language Using Blogs: A Case Study[J]. Journal of Language and Cultural Education, 2019, 7(2):1-20.

[2] Sohail J, Duncan T S, Koh P W. How syntactic awareness might influence reading comprehension in English–French bilingual children[J]. Reading and Writing, 2022, 35(5):1289-1313.

[3] Fauzi C, Basikin. The Impact of the Whole Language Approach Towards Children Early Reading and Writing in English[J]. JPUD - Jurnal Pendidikan Usia Dini, 2020, 14(1):87-101.

[4] Polsuk T. A Review Of English Textbook Entitled "Skillful: Reading And Writing, Student's Book 1" By David Bohlke And Dorothy Zemach[J]. International Journal of Research -GRANTHAALAYAH, 2017, 5(5):116-124.

[5] Chen X. An improved method for physical education guiding paradigm by using computer assisted multimedia technology[J]. Revista de la Facultad de Ingenieria, 2017, 32(9):166-173.

[6] Qiu Y, Wang H. Smart classroom and computer multimedia application in physical education and Wushu movement analysis[J]. Revista de la Facultad de Ingenieria, 2017, 32(3):392-399.

[7] Yue N. Computer multimedia assisted English vocabulary teaching courseware[J]. International Journal of Emerging Technologies in Learning (iJET), 2017, 12(12):67-78.

[8] Ayittey A, Arthur-Nyarko E, Onuman F. Impact of Multimedia Instruction in Biology on Senior High School Students' Achievement[J]. Computer Science and Information Technology, 2019, 7(5):162-173.

[9] BRESHANICA, BELLARD. Achieving Complex Learning Outcomes Through Adoption of a Pedagogical Perspective: A Model for Computer Technology Delivered Instruction[J]. Journal of educational multimedia and hypermedia, 2018, 27(1):5-23.

[10] Xu L. Study on the application effect of multimedia CAI technology in university physical class and teaching evaluation[J]. Boletin Tecnico/Technical Bulletin, 2017, 55(18):331-337.

[11] Zhao Y. Study on the exhibition art design and technology application based on computer aided design[J]. Revista de la Facultad de Ingenieria, 2017, 32(3):464-471.

[12] Liang W. Scene art design based on human-computer interaction and multimedia information system: an interactive perspective[J]. Multimedia Tools and Applications, 2019, 78(4):4767-4785.

[13] Indira P, Dhanalakshmi D K, Research Scholar. Effectiveness of Multimedia Package for Enhancing Achievement in Computer Science among XI Standard Students[J]. SSRN Electronic Journal, 2018, 5(12):58-62.