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Application and optimization of short videos in teaching specialized english for chemical engineering

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Abstract
In this paper English short videos were applied in teaching the course of Specialized English for Chemical Engineering. After confirmation of the study objects, the types of English short videos and playing time were analyzed. The teaching efficiency was evaluated by classroom video recording data, questionnaire survey and test results. Finally, the proportion of different type and playing time of English short videos in classroom teaching were optimized. The research results increased the classroom teaching efficiency, also increased the learning interest and recognition of students.

Keywords: Chemical engineering, specialized english, short videos, optimization, teaching efficiency

Introduction

With the development of global chemical industry and the acceleration of economic integration, the chemical engineering requires a large number of talents to take on the responsibility of connecting local and global industries with international exchanges and trade. Therefore, this important task to cultivate chemical engineering talents was fell on universities [1].

In order to further enhance the international knowledge and perspective of chemical engineering talents in universities, the course of Specialized English for Chemical Engineering is particularly important. This course highlights practicalities in global chemical industry and it assists students to proficiently apply specialized English knowledge in further education, employment, and international communication [2, 3]. Compared to other basic English courses, this course has the following characteristics: Firstly, more specialized vocabularies. It includes chemical substance names, chemical equipment names, description of chemical properties and chemical reactions, etc., which have a significant increase in difficulty compared to basic English courses. Secondly, more written language. In textbooks and related articles, the paragraphs were used in specialized language which contained logically grammar structures and a lot of technical terminologies. It required a certain vocabulary and grammar knowledge to understand the meaning of paragraphs. Thirdly, dull learning process. For students who are exposed to unfamiliar specialized vocabulary for the first time, it is necessary to spend lots of time on memorizing and understanding. Therefore, students should overcome difficulties and pressures such as proficiently memorizing and applying vocabulary in learning process. Previous teaching method mainly focused on listening, reading, and writing, as well as classroom PPT explanations. This method obtained certain results in teaching, but students' interest in learning cannot be improved, which can affect the quality of teaching [4, 5]. With the application of multimedia resources in classroom teaching, students' acceptance of this course had been improved [6]. In order to meet the teaching syllabus for *Specialized English for Chemical Engineering*, multimedia resources must be selected and playing time must be optimized [7].

In order to solve the above problem, our team analyzed the characteristics of students whose major are chemical engineering in our university for the past 5 years and focused on the key and difficult points of this course syllabus. We also combined international language education methods and added a certain proportion of strictly screened English short videos in classroom teaching. Finally, teaching effectiveness by our method was evaluate and the class hour ratio of English short videos to achieve better classroom teaching results was optimized.

Research method of short video application in classroom teaching

Selection of research objects

The research object of this research was a total of 109 undergraduate students who participated in the course of Specialized English for Chemical Engineering from 2019 to 2023.

After a questionnaire survey, it was concluded that these research subjects have the following characteristics: Firstly, students all participated in the study of this course in their first semester of 3rd year. Secondly, they had a good foundation in English. The proportion of students who had intermediate English level was exceeded 90%, and the proportion of students who had advanced English level was 24%. Thirdly, students' limited interest in this course. As students majoring in engineering, their interest in language courses is limited. Students placed more emphasis on the practicality of this elective course than their interest. Fourthly, previous teaching method of this course was outdated. Fifth, there students had a high level of acceptance of multimedia teaching. They had long-term exposure to the internet and a high level of acceptance of online multimedia.

Teaching method and learning time

Strictly adhere to the requirements of the teaching syllabus, two teaching methods without deviating from the key points in the textbook were evaluated. Teaching Method A: Only teach the content of the textbook, using PPT to explain through text and pictures. Teaching Method B: Play English short videos related to the key points in the textbook, and then used PPT to explain the specialized vocabulary and dialogue displayed in the short videos.

This course has a total of 32 class hours. Through a questionnaire survey and analysis of students' acceptance of multimedia teaching in different years, the teaching hours of English short videos have been adjusted. Table 1 lists the class hour data used for teaching methods A and B in different years.

Table 1: Teaching hours distribution of teaching methods in different years

Year	Number of people	Class hours for teaching methods A	Class hours for teaching methods B
2019	22	16	16
2020	21	12	20
2021	22	8	24
2022	21	4	28
2023	23	0	32

Selection and advantages of short videos

All selected English videos contained specialized vocabulary which was related to chemistry and chemical engineering. Then, according to the teaching syllabus and key points of textbook, different English video clips were collected and their names are shown in Table 2.

The short videos from "Breaking Bad" drama included the impact of chemical reagent addition order on results, organic synthesis, chemical reagent names, etc. The short videos from "The Big Bang Theory" drama include helium gas changing tone, operation of large detection instruments, etc. The selected BBC documentary included chemical history, characters, chemical elements, atomic structure, chemical composition of substances, etc. The selected RSC experimental teaching video included chemical operations, such as distillation, evaporation, filtration, extraction, crystallization, etc.

Table 2: Types, names and advantages of selected english short videos

Type	Name	Advantages
English drama	Breaking Bad	Exciting plots, part of element names
	The Big Bang Theory	Humorous plot, a few specialized words
BBC documentary	Chemistry: A Volatile History	Popular science videos with general chemical words
	The Story of Science	
Experimental teaching video	RSC	Specialty, more chemical engineering words, scientific and logical explanation

The plots of English drama were highly interested with simple vocabulary and dialogues. In the total text, the proportion of specialized vocabulary was less than 3%. The documentary dialogue text involved a lot of popular science vocabulary. Although the content of history and characters were related to chemistry, the proportion of specialized chemical engineering vocabulary was less than 15%. The RSC experimental teaching video is closer to the course syllabus and the explanation was more professional, hence, the proportion of chemical engineering vocabulary was higher than 35%.

Evaluation method of teaching effectiveness

The evaluation of teaching effectiveness was analyzed by data from the following three methods:

1. Classroom video recording. Record the entire process of teaching through video cameras, and after class, the number of students active in the classroom, the length of classroom focus, and the number of participants in classroom discussions by different teaching methods were calculated and compared.
2. Questionnaire survey. Collect feedback from students on the evaluation of the learning effectiveness of knowledge points, the level of interest in video types, and the duration of video playback.
3. Analysis of classroom test scores. After completing the two teaching methods separately, two classroom tests based on all knowledge points was given to student and the scores were analyzed.

Analysis and optimization of english short videos on classroom teaching effectiveness

The effect of short video types

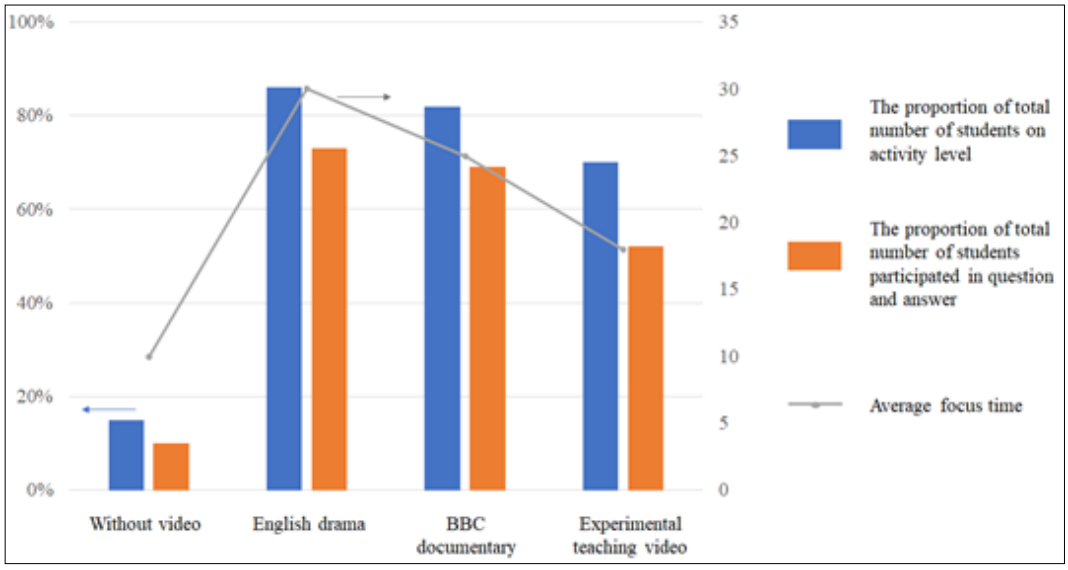

Fig 1: Effect of english short videos on learning efficiency

Figure 1 showed the impact of English short videos on students' classroom participation and focus time. When English short videos were not included, the proportion of students who were able to effectively participate in classroom teaching was low, they could not actively communicate and respond to teacher's questions slowly, also they generally focused on learning for less than 10 minutes. With the addition of English short videos, students' focus time to the classroom had greatly increased. When playing English short videos, over 92% of students focused on the video projection area. Students showed more interests in exciting short videos with over 30 minutes focus time. Even for experimental teaching videos with high difficulty, students can maintain focus at least 18 minutes. After the video was played, the number of students can ask questions increased by an average of 62%, and the number of students participating in answering teacher's questions increased by an average of 56%. By analyzing the data in Figure 1, it can be concluded that the addition of English short videos in classroom teaching can indeed improve the effectiveness of classroom teaching. However, the content and form of a single type of English short video are also relatively single, which can easily lead to students' visual fatigue. Therefore, the matching ratio between different types of English short videos also needs to be optimized.

According to the survey data, 84% of students are more interested in dramas and documentaries. Similarly, from the data in Figure 1, it can be concluded that students have a higher level of interest in exciting English short videos. But these three types of English short videos had their own advantages and disadvantages. English dramas had strong interest and exciting plot, but this type video contained limited knowledge and weak professionalism, which deviated greatly from the key points of the teaching syllabus. With a small amount of specialized vocabulary, especially with fast speaking speed, the plots shifted students' attention to the course content resulting in less significant improvement in classroom teaching effectiveness. Documentaries were highly popular in science and had a moderate speaking speed. During playing, students increased their acceptance of specialized vocabulary. However, due to their mixed knowledge and slang, the vocabulary was too simple for undergraduate students with a certain English foundation. The experimental teaching videos had the highest professionalism and slower speaking speed, so students can learn a large number of specialized vocabularies. However, the experimental teaching videos had disadvantages such as weak interest, high difficulty in some specialized vocabulary, and complex grammar, requiring teachers to frequently interrupt the videos and switch to classroom explanations. Students' attention switched too frequently between the video area and the teacher, which had a certain impact on their classroom concentration.

Based on above data, the optimal ratio of English dramas, documentaries, and experimental teaching videos is 1:1:2. This ratio not only enhanced the exciting of classroom teaching, but also fixed students' focus on specialized knowledge learning within one class hour, which was conducive to improving the effectiveness of classroom teaching.

The effect of short video playing time

In the questionnaire survey, over 85% of students expected more than 30 minutes of English short video playback time per class hour. However, the results obtained from the analysis of classroom test were shown in Figure 2. In classroom teaching, when 50 specialized vocabularies appeared in English short video, the number of specialized vocabularies mastered by students increased with increasing of playing time. However, when the playing time exceeded 25 minutes, students' focus on specialized vocabulary will be shifted by other content in the video, and they forgot some vocabularies, reducing learning efficiency. Therefore, based on the comprehensive analysis of Figure 2, survey questionnaire, and classroom testing data, it was determined that the optimal short video playing time for each class hour was 20 minutes. After playing, teachers could use interspersed explanations to deeply analyze the key points in the video content and expand their knowledge points, which can maximize students' classroom learning efficiency.

After combining the above optimization data, actual classroom teaching effectiveness, and teaching methods listed in Table 1, the analysis results showed that with increasing English short video class hours in classroom teaching, the overall activity, focus time, and learning effectiveness of students in the classroom had significantly improved. Therefore, English short video teaching should run through the entire teaching process of this course.

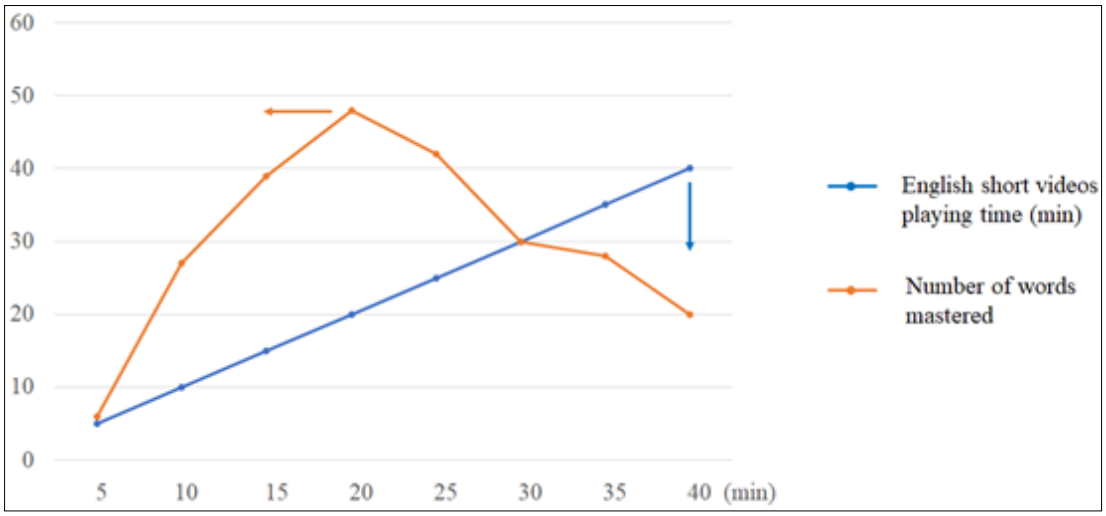

Fig 2: Relationship between english short videos playing time and number of mastered words

Student identification with short videos in teaching

After optimizing English short videos in classroom teaching, and comprehensively analyzing questionnaire surveys and student in class test scores, the following data is obtained:

1. The proportion of students who agree that "Specialized English for Chemical Engineering is an interesting and practical course" has increased from 18% to 73%; The proportion of students who agree that "learning specialized English not only requires conventional listening, speaking, reading, and writing methods, but also should combine with current internet information resources" has increased from 64% to 100%. The improvement of teaching methods has significantly increased students' interest in this course.
2. Students have a 100% agreement with the selected English short video content for this course. The recognition rate of the English short video content matching the key points of the teaching syllabus reaches 100%. The positive feedback rate for the playing time ratio reached 98%. These results indicated that students were highly receptive to the application of English short videos in classroom teaching.
3. After analyzing the results of the classroom test, the English short video teaching method had improved students' mastery of specialized vocabulary by 63%. The understanding ability of randomly selected scientific articles had increased by 49%. The results indicated that students had mastered the learning methods of specialized language courses through this course and can apply them to the reading of other professional passages.

The above data and analysis indicated that this method was not only conducive to improving the effectiveness of classroom teaching for Specialized English for Chemical Engineering, but also guided students to allocate the proportion of multimedia resources in their learning, providing assistance for future self-learning and other course learning.

Conclusion

In the classroom teaching of Specialized English for Chemical Engineering, the application of multimedia resources has become an inevitable trend. Appropriate English short videos should be selected and the type and playing time of different videos would be optimized to effectively improve the teaching effectiveness. This teaching method increased students' interest in learning, and it also made a contribution to the cultivation of more talents in the field of chemical engineering. The optimized teaching method using English short videos in classroom had been recognized by students and provides some guidance for their future learning.

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