

Blended Teaching of Basic Course Engineering Graphics for Logistics Engineering Specialty

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ABSTRACT

As an important basic course of logistics engineering specialty, engineering graphics is not only the cornerstone and support of professional backbone courses, but also plays a significant role in the cultivation of logistics engineering talents. In the face of the situation that the teaching hours are compressed while the teaching quality cannot be affected, hybrid teaching has become a beneficial mode, which breaks the time limit of the traditional classroom, and effectively relieves the professional development needs of less teaching hours and higher teaching requirements. The establishment and construction of online resources, the division of online and offline teaching content and education functions, the design and organization of classroom teaching, and the assessment and evaluation methods of courses all affect the effect and quality of blended teaching. This paper analyzes the function and connotation of blended teaching, summarizes the experience of teaching team in the blended teaching and learning of the course, and demonstrates the rationality and development prospect of mixed teaching through the comparison of teaching effect between mixed teaching and traditional teaching mode.

Keywords: *Logistics engineering, Engineering graphics, Blended teaching, Online resources.*

1. INTRODUCTION

Taking the logistics system as the research object, logistics engineering studies the planning, design and construction of logistics system and related technical problems [1]. It mostly belongs to the engineering field [2]. Logistics engineering specialty is set up for training senior technical talents in the field of logistics engineering. "Engineering Graphics" has the reputation of "the language of engineering", which is an indispensable basic course of logistics engineering. The design and layout of logistics center and the design and manufacture of logistics equipment need to be expressed and presented by the theory and method of "Engineering Graphics" [3, 4].

The logistics engineering specialty of logistics engineering college of Wuhan University of Technology is the first batch of specialty approved by the state in 2003. After more than seventeen years of development and expansion, it has been built into a national characteristic specialty and the first batch of "outstanding engineers" training pilot specialty of the Ministry of education. In 2019, it was approved to be a national first-class undergraduate specialty construction

qualification. The new specialty construction requires strengthening the cultivation of practical application ability, and many courses have reduced the theoretical teaching hours, so does the course of "Engineering Graphics" [5]. It has also been changed from Class A to class B, and the teaching hours have been reduced from 88 class hours to 56 class hours accordingly. The blended, or hybrid teaching mode based on online teaching and offline teaching effectively alleviates the development needs of less teaching hours and higher requirements of curriculum teaching [5, 6]. The key to make good use of blended teaching is to correctly understand the mode of this teaching way, establish and improve online resources, reasonably divide online and offline teaching content, and scientifically design classroom teaching and learning [7].

2. UNDERSTANDING THE CONNOTATION OF BLENDED TEACHING CORRECTLY

Blended teaching is not a simple combination of "online" teaching and "offline" learning, nor is it a repeated teaching, but a combination of the two [8, 9]. Online teaching cannot replace classroom teaching, and

it is not a supplement to classroom teaching, but an organic part of the teaching process. The blended, or mixed, as it usually known, teaching mode not only breaks the space-time limitation of traditional classroom teaching, but also broadens the breadth and depth of teaching and learning, which is a profound change of traditional classroom teaching mode [10]. In that sense, the classroom teaching under the mixed teaching mode should not be a copy of the traditional classroom, but should complement each other with online teaching

activities. The mixed teaching must be carefully designed, reasonably divided and effectively organized, so that the online and offline teaching logic is clear, the connection is natural, and each undertakes different missions and completes different functions [11, 12].

Table 1 lists the function division of online teaching and offline teaching, as well as the comparison between hybrid or blended teaching classroom and traditional classroom teaching [13]

Table 1. Comparison of different kinds of teaching mode

	Online teaching	Offline teaching(Blended class)	Traditional Classroom teaching
Teaching content	Memory knowledge, repetitive knowledge, simple theory, standard and norm	Key and difficult knowledge, case application and analysis, knowledge sublimation and expansion	All knowledge
Teaching form	Self study and self-test, online counseling and communication	Teaching, discussion, classroom flipping, question answering, testing, competition, surveying and mapping	Teaching and Practice
Teaching task	Knowledge preparation, doubtful point record	Knowledge carding, leak detection and filling, explanation of key and difficult points, knowledge expansion, question answering and practice	Teaching and communication of knowledge
Teaching target	Active learning, personalized learning, eliminating individual differences	Solve problems, improve ability and cultivate quality	Understanding and memory of knowledge
Teaching role	Students are the leading role, teachers are behind the scenes	Teachers are directors and students are actors	teacher plays Monologue

Table 2. Framework and content of Engineering Graphics Course Resources Construction

Resource classification	Resource description and construction object		
basic information resources	Both online and offline courses have basic information, but the contents can be different.		Teacher team Course introduction Teaching program Teaching Calendar Assessment criteria
Offline resources	Teaching materials	Although the forms of offline teaching materials are still traditional forms such as teaching materials, exercise sets and wall charts, the core must be fundamentally reformed and reconstructed.	Teaching material Problem sets Physical model Wall chart Atlas
	Teaching activities	The design of classroom teaching activities should meet the needs of mixed teaching and flipped classroom.	Teaching strategy Teaching organization Teaching environment
Online resources	Teaching materials	Online teaching materials are the core and main body of online resources. The construction of online resources should correspond to the resources used in the classroom, so as to avoid the logical confusion of online and offline learning.	Electronic teaching materials Teaching video Teaching courseware 3D model library Atlas and explanation Question bank
	Teaching activities	Due to the lack of teachers' organization and thread, the design of online teaching activities is not easy to be complicated and should be simple and intuitive.	Course assignments Unit testing Q & A Discussion questionnaire investigation
	Managing information resources	Management information resources are the support framework and operation and maintenance guarantee of online resources.	Teacher information and authority Student information and authority Course opening management Statistical analysis of students' situation Maintenance of the platform
Expand resources online and offline	Expanding resources is the second classroom of "knowledge, ability and quality" training. It is also an important means and way to discover professional talents and cultivate innovative talents.		Curriculum peripheral knowledge Extracurricular interest group Subject competition Textual research on Cartography QQ group and wechat group

3. THE PREMISE OF BLENDED TEACHING -- THE CONSTRUCTION OF ONLINE RESOURCES

3.1. Framework and Content of Resource Construction

In a broad sense, teaching resources refers to all the elements that can be used in the teaching process, including infrastructure, education policies, teachers, teaching aids, teaching materials, courseware, cases, pictures, etc., financial, material and information [14]. In a narrow sense, teaching resources mainly include teaching materials, teaching tools, teaching environment and teaching design. Thus, teaching resources is a large system, covering a wide range.

In a sense, the construction of teaching resources is subject construction, specialty construction and curriculum construction. Different teaching staff carries out different research from different standpoints and angles. However, due to distinct disciplines, majors and courses, the types and quantities of resources involved are also unequal [15]. In the process of resource construction, it must be targeted. As a front-line teacher, the construction of teaching resources around the curriculum is mainly reflected in teaching materials, teaching tools, teaching environment, teaching strategies and so on.

As for the blended teaching mode, resources can be divided into online and offline resources. Of course, the two are not completely separated. They have their own unique and irreplaceable parts. Table 2 shows the resource construction framework and content of engineering graphics.

3.2. Construction, Organization and Management of Online Resources

Online resources are indispensable digital resources for blended teaching, which need to be constructed and managed with the help of network platform. This kind of platform is generally organized and managed by separate modules according to the type of resources. As shown in Table 3, it is divided into five modules: "basic information", "unit learning", "curriculum resources", "curriculum activities", and "extended resources". Most of the sub-items under the module are relatively fixed. What teachers need to do is to prepare and make all kinds of resources and upload them to the corresponding modules in accordance with the types of resources and curriculum needs.

Teaching is carried out according to the order of chapters and knowledge points. The resources corresponding to each knowledge point are distributed in different kinds of modules. For example, the video

and courseware of knowledge points are in the "course resources" module, while the related tests and assignments of knowledge points are in the "course activity" module [16]. Users need to search for the required teaching resources when learning a certain knowledge point, which seriously affects the learning efficiency. Therefore, the online resources are reorganized with knowledge points as the center. The teaching documents, videos, courseware, tests and other resources related to knowledge points are listed in the directory, so learners can use them easily. It should be noted that the resources of videos, courseware and tests

Table 3. Classification and reorganization of platform resources

Primary indicators	Second indicators	Third indicators	Fourth indicators
Essential information	Course introduction		
	Teaching program		
	Teaching Calendar		
	Teacher information		
Unit learning	Chapter one	Knowledge point 1	
		
	Knowledge point n	Knowledge video	Knowledge point courseware
		Knowledge point test	Problem solving
		
		
	Chapter two		
.....			
Curriculum resources	Teaching video		
	Teaching courseware		
	Electronic teaching materials		
	Problem solving		
	Teaching model		
	Teaching wall chart		
		
Curriculum activities	Course assignments		
	Q& A Discussion		
	Online testing		
	Course questionnaire		
	Question bank		
	test paper library		
		
Expand resources	Extracurricular knowledge		
	interest group		
	Textual research on the way		
	Subject competition		
		

under the knowledge points and the resources under "curriculum resources" and "curriculum activities" are not repeated construction, but the presentation of background resources under knowledge points. It is also important to note that the arrangement order of knowledge points should be consistent with the organization order of classroom teaching units to ensure the logical consistency of online and offline teaching content.

4. THE IMPLEMENTATION OF MIXED TEACHING

4.1. Redefinition of "before Class, during Class and after Class" in Teaching Process

The three stages of "before class, in class and after class" under the mixed teaching mode are no longer the traditional pre-class students' Preview (actually, many of them have no preview), the teacher explains in class, and the students review and do homework after class. Teachers and students participate in the three stages of teaching together, forming a closed-loop system, in which, teachers and students are always "online" and have real-time conversation, as shown in Figure 1.

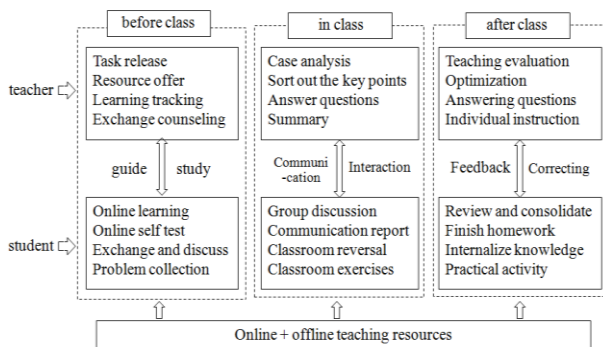


Figure 1. Three stages of teaching under the blended teaching mode

Before class, teachers release the teaching objectives and tasks, and students independently complete the acquisition of relevant knowledge through online resources (micro video, courseware, online test, etc.). Basic knowledge will not be taught in class. At any time, a communicate with students and teachers is capable to be accomplished through a variety of online tools (online platform Q & a discussion area, wechat group, QQ group, etc.) for instant solution. Some key and difficult knowledge can be exchanged and discussed in online groups who may learn together and cooperatively, and summarize common problems to be solved. Teachers track students' preview and design classroom teaching according to students' feedback.

In the class, according to the students' pre-class learning situation and the characteristics of the course content, the teachers may focus on the strengthening the

students' understanding, sublimation and expansion of knowledge by answering questions, sorting out the key and difficult points, group discussion, class reversal, knowledge competition, hands-on practice and other forms, as well as the cultivation of students' engineering awareness and innovation ability. The teacher's role in class is the director, and the students play the actor. Teachers should fully mobilize the internal motivation and energy of students, and let them do the leading role in the classroom.

After class, teachers summarize the classroom teaching effect, carry out teaching reflection, further adjust teaching content and improve teaching strategies and methods; students review, consolidate and internalize classroom knowledge, further expand and extend knowledge application, draw inferences from one instance.

4.2. Classroom Teaching Practice under Blended Teaching Mode

Classroom teaching under the mixed teaching mode is no longer a simple mode of "teachers tell students to listen", but requires teachers to carefully design teaching activities, so that students can consolidate and flexibly apply the basic knowledge learned online before class, emphasizing the application of learning and the cultivation of ability and literacy. Classroom teaching design should be based on different teaching contents, and different teaching strategies and methods should be applied.

4.2.1. Practice 1: self study and question answering mode

The mode of self-study and questioning aims to cultivate students' ability of self-learning, finding and solving problems, and thinking and asking questions, and students are required to complete the learning of knowledge points online and complete relevant assignments. In class, teachers' task is no longer giving lecture, but only responsible for answering questions, and arranging classroom tests. The choice of self-study content is very important. The content that is too simple and easy to learn lacks the challenge, which cannot stimulate the students' internal kinetic energy; the content that is unduly complex and difficult to understand will spend too much time on the students, which will hit the enthusiasm of self-study and fail to achieve the desired goal effect.

4.2.2. Practice 2: flipped classroom mode

Cultivating students' subjective consciousness, organizational ability and expression ability is also the task of blended teaching. In addition to training students' learning ability, classroom flipping mode also

cultivates students' subjective consciousness and expression ability, which has higher requirements for students. Students are required not only to be able to understand and digest this part of knowledge in advance, but also to have good language organization ability and stage speech ability, and be able to make the audience understand and understand from the perspective of teachers. Therefore, this part of the teaching content must choose some relatively simple, easy to understand and interesting knowledge points.

All students are required to prepare for the task before class. Students are randomly selected to be "temporary teachers" in class, which can promote all students to be trained for "preparing lessons". The PPT of lectures is provided by teachers, and students can modify it according to their own ideas and understanding. The results show that although students' teaching cannot be compared with teachers' teaching, the effect of this mode on students' exercise is very great. First of all, students should understand the key points of knowledge, then straighten out the internal logic of knowledge points, and finally organize language to express them skillfully. After all, students in front of the class are still very image oriented, so they are very well prepared.

4.2.3. Practice 3: Discussion Mode

This mode is mainly focused on cultivating students' divergent thinking ability, space construction ability, innovation ability and engineering literacy (cooperation consciousness, etc.), so as the students are able to understand and digest knowledge points through discussion. In this process, listening to other people's ideas and discovering their own mistakes can not only deepen the impression of knowledge, but also broaden students' thinking, enhance the friendship between students, and improve the ability of expression and cooperation.

All the knowledge is not suitable for thorough discussion. After that, one representative from each group will report the results of the group discussion. If the conclusions between groups are different, debates between groups can also be held. The correct conclusion can be reached through discussion and debate. In this process, the teacher can give some hints.

4.2.4. Practice 4: skill competition mode

This mode is to train students' knowledge application ability and engineering expression ability. The learning of knowledge is for the purpose of application. The application of knowledge requires some special abilities, and the application ability of knowledge also needs to be cultivated. Since the competition must be kept in a limited time, teachers must design the number of questions in the competition,

which should not be too large or too small. For example, choose the appropriate expression scheme according to the physical model. Although the answer may not be unique but with many solutions, it can still be distinguished the good from the other (no so good). Therefore, let the two students at the same table evaluate each other and learn from each other. Then the teacher selects some excellent examples from the whole class for comment and display.

After a semester of classroom practice and exploration, some results have been achieved and highlighted. The four models exercise students' abilities and qualities from different aspects and entry points. Among them, the mode of self-study and questioning tests students' self-learning ability and consciousness, forcing them to think and ask frequently. Classroom flipping mode has the highest requirements for students, not only to be able to understand, but also to be able to present. The discussion mode is most popular among students. It is a powerful and unconstrained style. The collision and mutual inspiration of different ideas can not only deepen the understanding and impression of knowledge, but also cultivate the ability of divergent thinking and spatial thinking. However, it takes a long time to discuss thoroughly and fully, which is subject to the length of class and the number of class hours, so it cannot be carried out frequently. The model of skills competition -to promote practice and learning by competition, can stimulate students' fighting spirit and enthusiasm for learning. Teachers' careful design of competition content can achieve more with one stroke and twice the result with half the effort.

Compared with the traditional teaching mode, the classroom atmosphere under the blended mode is more dynamic, the interaction between teachers and students is more active, students' participation is high, and their initiative is strong, and their learning ability, practical ability, physical expression ability and engineering literacy are significantly improved [16]. The diversified classroom has been affirmed by most students. In a survey of 658 students, 91.3% of the respondents thought that "the blended teaching mode enables learners to have a deeper understanding and mastery of knowledge", and 89% of the students "hope to continue to use the mixed teaching mode in the future".

In addition to the questionnaire, it also makes a comparison between the vertical and horizontal. The vertical comparison is to compare the results of the class using the blended teaching mode in this semester with the results of the traditional teaching mode in the same major in the last academic year; the horizontal comparison is to compare the results of the class with the traditional teaching mode at the end of this semester. The results show that the average score of the mixed teaching class is about 10 points higher, the excellent

rate is significantly improved, and the failure rate is obviously reduced than that of the traditional class.

5. CONCLUSION

The blended teaching mode is the product of the combination of computer technology, information technology, multimedia technology and educational technology. It has brought profound changes to the traditional teaching mode, and also brought greater space for the traditional classroom to play. It can have more time for the cultivation of ability and quality. However, the hybrid teaching must be supported by abundant online and offline resources, with scientific and reasonable teaching design and teaching evaluation to play its advantages.

Based on the construction of online and offline resources, this paper carried out a semester of mixed teaching practice for logistics engineering major. The practice shows that the mixed or blended teaching not only improves the students' understanding and application of curriculum knowledge, but also stimulates the students' internal potential and energy. The multi-faceted ability and literacy are trained and cultivated. There are reasons to believe that blended teaching will have a better development in the future.

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