THE APPLICATION AND PRACTICE OF MULTIMEDIA TECHNOLOGY IN THE TEACHING OF HIGHER VOCATIONAL LOGISTICS UNDER THE BACKGROUND OF DOUBLE CARBON

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ABSTRACT

In the context of carbon peaks and carbon neutrality, the traditional senior logistics majors generally have high investment, high consumption, and difficulty in implementation in teaching. In this paper, multimedia technology is introduced into the teaching practice of higher vocational logistics majors. Guided by the learning theory of constructing contextual cognition and the educational idea of "learn skills from practice", multimedia demonstration, multimedia experience, multimedia interaction, multimedia assessment, and other forms of teaching are carried out in multimedia practical training through several teaching steps, such as multimedia simulation teaching design, teaching implementation, and effect evaluation. In the teaching assessment, the use of multimedia teaching can make 23.2% of the students proficient in warehouse management and the process of each operation, so 88.4% of the students have a good grasp of the knowledge points of logistics professional teaching. It shows that multimedia technology can, to a certain extent, effectively crack the phenomenon of high input, high consumption, and difficult implementation in the teaching of higher vocational logistics majors and enhance the teaching effect of logistics practical training.

KEYWORDS

Carbon dafeng; carbon neutral; multimedia technology; logistics profession; higher education teaching

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1. INTRODUCTION

With President Xi Jinping's commitment to the international community to reach carbon peaks and carbon neutrality at the 75th General Debate of the United Nations General Assembly, the teaching of practical courses for higher-level logistics majors has also ushered in a major challenge[1]. At present, the setting of practical aspects in the training program of higher vocational logistics majors requires high cost of site construction and later maintenance[2], as well as the content of students' skills training is difficult to keep up with the development and changes of logistics industry because the teaching equipment is not updated for years, which leads to a serious disconnect between the skills possessed by students through practical training and the development of the industry[3]. At the same time, the teaching of logistics majors in Chinese higher vocational schools still has not got rid of the traditional teacher-oriented one-way teaching activities[4], and the student-oriented form is not fully reflected, so it is difficult for the skills practical training classes to achieve the expected effect, which makes the student's satisfaction with the teaching contents low[5]. In addition, the classroom evaluation indexes of higher-level logistics majors cannot effectively guide students to know and understand the operational process of logistics in which they can make efforts to make positive contributions to the realization of the "double carbon" (which is defined as carbon emissions and carbon neutrality) goal[6], so it is necessary to make appropriate adjustments in the teaching content setting, teaching methods and assessment mechanisms of higher-level logistics majors to meet the latest development of logistics. Therefore, it is necessary to make appropriate adjustments in the teaching contents, teaching methods, and assessment mechanisms of senior logistics majors to meet the latest requirements[7].

The "double carbon" goal is an external requirement for the high-quality development of logistics professional training in higher education institutions. The "double carbon" goal is a fundamental requirement for China's sustainable economic development and green low-carbon development[8], which means that technical and production innovations are needed at many levels to reduce the investment of energy-consuming equipment in the training process of logistics majors in higher education institutions[9]. The "double carbon" goal is complementary to the future development of logistics majors in higher education institutions, which should continuously improve the teaching quality of logistics majors in the process of serving the national development strategy[10]. "This is an important opportunity for higher education institutions to highlight the value of serving national economic and social development needs, and it is also an important driving force for building a high-quality logistics professional education system[11]. The "double carbon" goal makes logistics professional talents, integrate logistics professional talents training with the regional green development planning layout[12], and integrate the systemic concept into the construction of capacity to enhance the ability of training logistics professionals high-quality skilled talents capacity of logistics majors[13]. Multimedia teaching in Western countries, so the level of multimedia application was relatively high[14]. Since the mid-1920s, research has been conducted in the United States on computer-based

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instruction in elementary[15]. The American Center for Educational Development took an experimental approach to research[16]. Some scholars have conducted experiments to study the "carrier" and "structure" characteristics of media[17]. Wu Y et al [18] used an origami test as a basis to investigate whether there is individual variability. The results showed that there were not only individual differences in the effectiveness of multimedia but also the combination of different multimedia could achieve better results[19]. The first stage started in the mid-late 1980s when multimedia teaching in China was mainly quoted from foreign multimedia technology, so the development of multimedia technology was still relatively weak[20]. The second stage was from the early 1990s, during which the application of computers in China became more and more common as the knowledge of various aspects of computers increased, and the research on multimedia teaching in foreign countries continued during this period, and multimedia education in China began to enter a concrete implementation stage[21]. The third stage is from the mid-1990s to the present, with the continuous growth of the social economy, and innovation of the improvement of China's education level, the application of multimedia teaching began to be popular in this period[22]. However, relatively speaking multimedia teaching in China is mainly applied in the classroom[23]. In terms of research directions, multimedia teaching in China is mainly studied[24-25]. For example, the development of a multimedia system of automated three-dimensional warehouses by Yang J et al[26] improved the teaching efficiency of logistics majors and enabled students to quickly grasp the operational characteristics of three-dimensional warehouses. Wu Y J et al[27] designed a three-dimensional multimedia system of an automated three-dimensional warehouse based on RSTest Stand and a multimedia system design about facilities and equipment related to the logistics simulation system of terminals and ship segments. This provides a reference example for higher-level logistics practical training teaching. Most of the multimedia simulation training platforms relying on multimedia technology are applied in higher vocational education. Turkan Y et al[28] built a Flexsim multimedia simulation training room in 2014, which can realize the simulation of almost all logistics phenomena. Różewski P et al[29] started to invest in the construction of a logistics multimedia simulation teaching laboratory in 2015, which has taken shape now. When D et al[30] built and improved the logistics multimedia simulation training center in 2016 (logistics equipment virtual simulation system, 3D interactive transportation virtual simulation system, 3D interactive distribution virtual simulation system), etc. Kong X T R et al[31] carried out virtual simulation teaching in logistics practical training, emphasizing the adoption of virtual simulation teaching in logistics majors, and the way of assessment changed from "knowledge structure assessment" to "ability standard assessment". Orona G A et al[32] proposed the specific implementation of multimedia technology in the teaching of logistics management, pointing out that the course needs to open relevant logistics simulation training courses, so that students can make full use of multimedia simulation software to operate and improve practical ability.

In summary, although Chinese scholars started to study multimedia technology relatively late, the development of multimedia technology in China is still very rapid.

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The application of multimedia teaching systems supported by multimedia technology in logistics professional practical training teaching in secondary vocational schools is becoming more and more common, and the teaching function of simulation systems is becoming more and more perfect. However, the current situation of using multimedia technology to assist logistics professional practical training teaching in higher vocational schools is not optimistic. This study takes the current situation of the logistics industry and the current situation of China's traditional higher vocational logistics professional practical training teaching as the starting point, applies multimedia technology to the front line of higher vocational logistics professional practical training teaching, focuses on improving the logistics professional practical training teaching environment, reducing the cost of practical training teaching and easing the practical training teaching It also aims to improve the logistics training environment, alleviate the problems of high investment and difficult implementation of practical training, improve the logistics skills of vocational school students, promote the development of vocational education informatization, and help achieve the goal of carbon neutrality and carbon peak at an early date.

2. THE TEACHING OF HIGHER VOCATIONAL LOGISTICS MAJORS IN THE CONTEXT OF DOUBLE CARBON

In 2020, China put forward the strategic goal of "double carbon", which is defined as carbon emissions aiming to reach the maximum by 2030 and carbon neutrality by 2060. To cultivate technical talents who can adapt to society, higher education institutions discuss the education of logistics students, follow the pace of the times and study the teaching mode of logistics majors from the perspective of low carbon, to ensure the social adaptability and competitiveness of students in higher education institutions.

2.1. TEACHING CHARACTERISTICS OF THE LOGISTICS PROFESSION

It has been more than twenty years since the establishment of the Chinese logistics profession, during which the Chinese logistics industry has gradually developed from traditional simple transportation and storage to professional, multi-technology combined modern logistics, and the industry has undergone great changes. Therefore, the points that need to be noted in the teaching process are: First, logistics is closely combined with modern multimedia, in which a large number of modern multimedia are used, such as computer simulation technology, network technology, etc. To better carry out teaching activities, senior logistics students first need to master the interplay of various multimedia technologies, and combined with the actual situation, will use common logistics information processing tools, understand the latest logistics system, and even carry out the operation of the logistics system. Secondly, they should recognize the importance of multimedia technology to the modern

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logistics industry in the process of learning, and establishing the correct cognitive concept. Finally, the teaching of logistics professional courses involves a large number of logistics facilities and site planning and layout knowledge, for logistics companies, the number of logistics warehouses and the planning of warehouse addresses not only directly affect the cost of logistics and logistics efficiency, but also affect natural resources environmental consumption and carbon emissions, therefore, in the teaching practice of senior logistics professional, both the number of warehouses and address planning should be based on the double carbon background of multimedia technology, using some mathematical modeling tools or mathematical algorithms, which require teachers to be able to clearly explain these modeling tools and mathematical algorithms in the teaching process. It is also necessary to combine the logistics profession with the actual industry situation, requiring teachers to teach in conjunction with industry development. The logistics profession requires teachers and students to pay attention to the real-time industry dynamics and grasp the changing trends of the industry, to help improve the future employment of students and meet the needs of society.

2.2. ADVANTAGES OF MULTIMEDIA TEACHING

The logistics profession is a specialized profession that combines practice and theory; therefore, the teaching of logistics in higher education institutions requires a high level of theoretical and practical aspects in the classroom. This profession involves the transportation, storage, processing, and distribution of goods, and these processes often require the use of modern multimedia technology for students to have a more intuitive understanding of their knowledge. The multimedia technology teaching mode provides two kinds of teaching modes including online and offline, which can make full use of the convenience of online teaching and the participation of offline teaching, and can fully adapt to the students' course arrangement and provide them with more choices. In the teaching process of using multimedia technology, it can play its great advantages, which are mainly reflected as follows: Firstly, multimedia means making students listen and watch together, changing the traditional teaching mode of the teacher talking and students listening, and also saving teaching time and completing teaching contents accurately and efficiently. In the traditional class mode, teachers mainly teach through drawing and handwriting, which leads to poor listening effects for students. With the use of multimedia technology, a lot of time can be saved, the original multiple lessons to complete the content may now take only one lesson, which significantly saves teaching hours, making the classroom transfer more information, and the dissemination of knowledge more convenient, and give teachers enough space to play. Secondly, it enables students to better understand the difficult points of learning and important content, through multimedia learning, various communication methods greatly improve the previous situation of uniform traditional learning mode, in the application of multimedia technology, educational content is summarized as follows: in the classroom to teach photos, illustrations, videos, animations, etc., so that complex and difficult knowledge becomes simple and easy to understand, the boring theory into photos and animation, intuitive and easy to

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understand. But in the process of multimedia education, the dominant position of the teacher is easily weakened, in the traditional mode of education, the teacher's educational ideas are often easily conveyed directly to students through heuristic methods, and when multimedia teaching, often can not achieve the purpose of such heuristic education, therefore, the use of multimedia technology teaching tools should play a certain role in guiding learning, while conventional teaching methods can not be reduced or replaced by new technological tools. The conventional teaching process cannot rely too much on multimedia technology, teachers need to mix the old with the new and pay equal attention to what is written on the board, only then can students become more interested in multifaceted learning and improve the effectiveness of teaching and learning, achieve interactive learning and increase students' motivation and initiative.

2.3. TEACHING EFFECTIVENESS EVALUATION METHODS

Therefore, this paper tries to optimize the existing teaching quality evaluation process, establish a scientific, objective, and perfect evaluation index system, evaluate teachers' teaching quality through reasonable methods, and apply the evaluation results to improve teachers' teaching effect. The evaluation of teaching quality is an evaluation of the school and teachers. Teaching quality evaluation is the evaluation of the effectiveness of the work of schools and teachers, and also a clear understanding of student's mastery of knowledge, of which hierarchical analysis is a common method of evaluating teaching effectiveness. When conducting power allocation, a hierarchical weighted decision analysis method was proposed when applying network system theory and multi-objective comprehensive evaluation methods. The method decomposes complex evaluation metrics into several constituent elements. The complex problem is how to judge the teaching effect of multimedia teaching, and the components are the consistency index of teaching effect and the corresponding weight coefficient of each index. And groups these elements according to the dominant relationship to form a hierarchical structure, and then compares the elements in each level to determine the relative importance of each element, and finally analyzes the judgment of all personnel to determine the total weight of each solution relative to the target level, on which the qualitative and quantitative analysis of the decision-making method is based. The analysis and evaluation steps generally include: decomposing the system into its constituent elements and grouping them to form a recursive hierarchy, constructing a judgment matrix, comparing the elements of each layer, and testing the consistency of the judgment matrix. First, a judgment matrix is constructed, and a two-by-two comparison of the elements at each level is performed, as in equation (1).

$$A \triangleq \left(a_{ij}\right) \tag{1}$$

In the above equation, represents the scale of importance of element i compared with element j. A stands for judgment matrix, i and j represent numbers of matrix

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elements. After constructing the judgment matrix, the consistency test of the matrix needs to be launched, and the main indicators are as in equations (2) and (3).

$$\text{C.I.} = \frac{\lambda_{\max} - n}{n-1} \tag{2}$$

$$\lambda_{\max} \approx \frac{1}{n}\sum_{i=1}^{n}\frac{(AW)_i}{W} = \frac{1}{n}\sum_{i=1}^{n}\frac{\sum_{j=1}^{n} a_{ij}W_j}{W_i} \tag{3}$$

Where $C.I.$ is the consistency indicator, n is the matrix dimension, and $(AW)_i$ denotes the i component of vector AW. Find the corresponding random consistency index $R.I.$ according to the dimension of the matrix, and calculate the consistency ratio $C.R.$

$$\text{C.R.} = \frac{\text{C.I.}}{R.I.} < 0.1 \tag{4}$$

Based on the judgment matrix, the weight *W* of each layer of elements relative to the previous layer is calculated.

$$W = \left(W_1, W_2, \cdots, W_n\right)^T \tag{5}$$

Square root method to calculate the weight values of different dimensions:

$$W_t = \frac{\left(\prod_{j=1}^{n} a_{ij}\right)^{\frac{1}{n}}}{\sum_{i=1}^{n}\left(\prod_{j=1}^{n} a_{ij}\right)^{\frac{1}{n}}}, i = 1,2,\cdots,n \tag{6}$$

This section details the characteristics of logistics majors in China and the problems they face, and also analyzes the advantages of using multimedia teaching in the context of double carbon, and finally evaluates the effect of using multimedia teaching. To make the whole study more rigorous, we make a theoretical analysis of the teaching effect of the system. The content of this section lays the foundation for the subsequent implementation of education for logistics students in higher education institutions using multimedia technology.

3. RESULTS AND DISCUSSION

This study uses multimedia virtual technology to analyze the teaching process of logistics students in higher education institutions under the background of double carbon, taking the management of a logistics warehouse as the research object, the study selects a sophomore student of a higher education institution, whose age is between 19 and 21 years old, and after the course, to verify the teaching effect of multimedia virtual technology, a web-based questionnaire is used for higher education

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students To verify the teaching effect of multimedia virtual technology, a web-based questionnaire was used to evaluate and analyze the teaching effect. The number of students studied in the paper is 90, but the valid data collected is 69.

3.1. LEARNING ABOUT WAREHOUSE MANAGEMENT

The process includes several specific processes, such as warehousing planning, warehousing acceptance, warehouse storage area planning, etc. The teaching objectives are summarized as follows. The process requires students to master the basic process of warehousing operations, master the basic operational steps and methods of goods acceptance, and understand the various documents involved in the process of goods warehousing, and at the same time, according to the supplier's notice of warehousing, the preparation of warehousing operations plan, according to the nature of goods receiving inspection, according to the goods to plan the storage location and warehouse area, but also must have the ability to deal with the receiving process The ability to handle abnormal situations in the receiving process. This study uses virtual technology that can realize multiple scenes, full process, and full view in the real environment to carry out the inbound operation process teaching, which is conducive to deepening the learners' perception and understanding. The space provided by the multimedia environment enhances the students' spatial sense, satisfies their needs for multiple and repeated trials, improves their ability to plan the storage area, and achieves the set teaching objectives. The warehousing operation mainly includes the following activities: making warehousing plans, preparing for warehousing, receiving and transporting goods, reviewing documents, preliminary acceptance, handing over goods, accepting goods, handling goods for warehousing, and assigning cargo space. Among these activities, preparation for warehousing, review of documents, and handling of goods in the warehouse are declarative knowledge, which can be taught through pictures, videos, and other auxiliary means, or the resources provided by the multimedia environment. Inbound planning, goods receiving, preliminary acceptance, goods acceptance, and cargo space allocation belong to procedural knowledge, and it is more conducive to students' thinking, understanding, and mastery to complete teaching through the multimedia environment. According to the data collected at the end of the course, students' basic learning of warehouse management is shown in Table 1 and Figure 1. In this study, the examination of student's mastery of warehouse management is mainly carried out by understanding students' cognition of knowledge points and their familiarity with warehouse management processes.

Table 1. Survey of Students' Mastery of warehouse management

Options	Subtotal	Proportion
Master all	16	23.2%
Basic mastery	45	65.2%
General mastery	7	10.1%
Not available	1	1.45%

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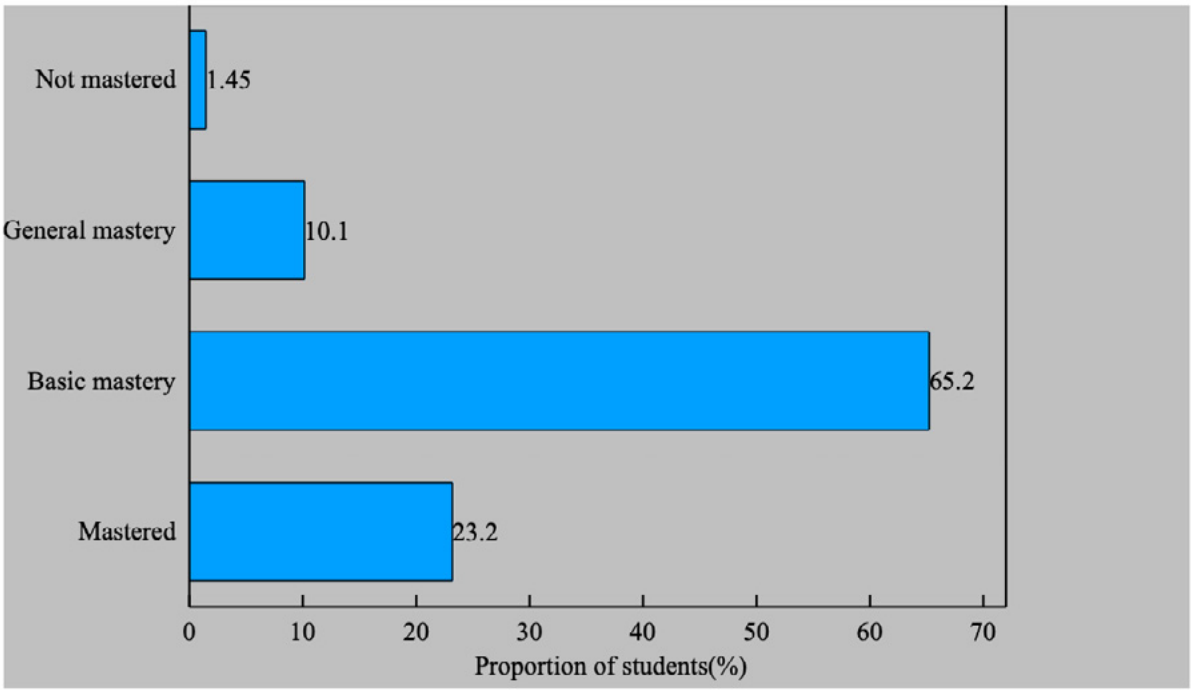

Figure 1. Students' mastery of the warehouse

As can be seen from Table 1 and Figure 1, 23.2% of the students can master the warehouse management process and various operations, 65.2% of the students can master, 10.14% of the general mastery, while only 1.45% did not master, 88.4% can have a good grasp of the teaching knowledge points, the overall effect is good. This shows that the use of multimedia virtual technology for warehouse management is an effective teaching method.

3.2. IMPROVEMENT OF STUDENTS' ABILITY

Cultivating students' independent learning ability and guiding students' good learning habits are more important. For students in higher education institutions, most schools currently adopt the traditional bundled education model for teaching logistics majors, as a student needs to learn dozens of courses, it seems that they have learned everything, but in fact, they feel that they have not learned anything, mainly because they have no deep understanding of the knowledge points. Many logistics students in higher education institutions find that the knowledge they have learned for the actual work can be used is not much, coupled with the lack of in-depth mastery of knowledge during school, thus causing the rapid forgetting of knowledge points. In the face of the competitive society, as logistics students, it is necessary to improve their learning ability and learn the knowledge they need by combining their actual situation and the demand of the social market, so the cultivation of students' learning ability is a necessary choice in the teaching process of higher education institutions. And this study also analyzed the students' independent learning ability, the results are shown in Table 2 and Figure 2.

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Table 2. Improvement of Students' independent learning ability

Options	Subtotal	Proportion
Very obvious	12	17.39%
Obviously	40	57.97%
General	16	23.19%
Not obvious	1	1.45%

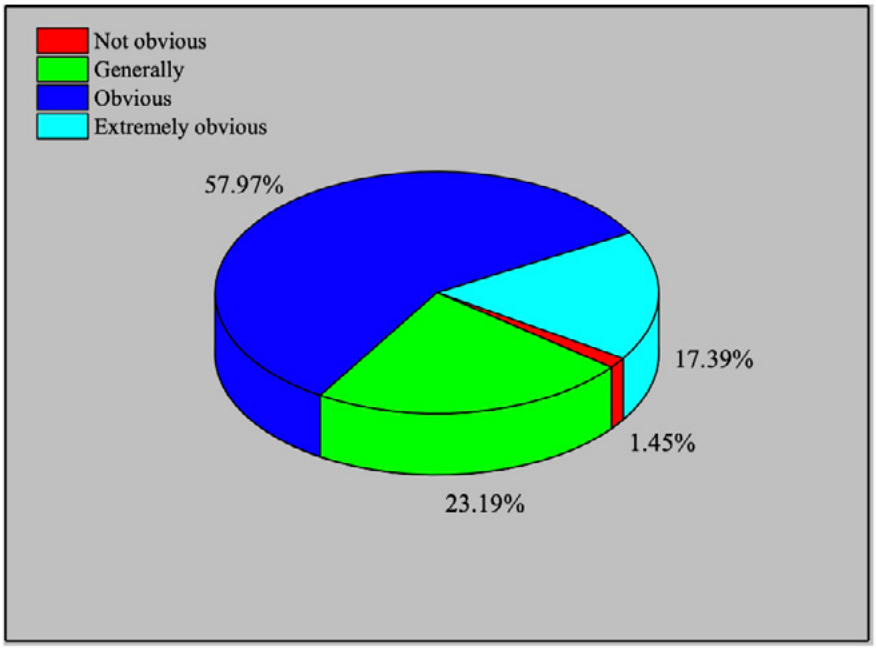

Figure 2. Degree of improvement of students' independent learning ability

The survey analysis of the improvement of student's independent learning ability was done, and the results are shown in Table 2 and Figure 2, from which it can be seen that 17.39% of students think their learning ability is improved very obviously, 57.97% think it is improved, 21.39% think it is improved in general, and 1.45% think it is not improved, in general, the students who think their independent learning ability is improved greatly Students account for 75.36% of the overall number, which is relatively high. The results show that the use of multimedia technology can provide good educational measures and methods for logistics professional education in higher vocational institutions. Compared with the teaching effect without the use of multimedia teaching, the study found that students who use multimedia technology to teach have better cognition and understanding of knowledge.

3.3. IMPROVEMENT OF LEARNING INTEREST

This study is fundamentally different from the traditional teaching model. According to the teaching content, through multimedia simulation technology, students are allowed to simulate field practice, which enables students to be in the situation

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designed by the teacher, increases communication and exchange between teachers and students, strengthens students' understanding of logistics business, enhances students' practical problem-solving ability, and enables students to apply what they have learned flexibly. Meanwhile, in the context of certain practical cases, practical tasks are assigned as the main line, using the Task-driven method, students, carry out activities around different process tasks in the warehouse management process, through the active application of learning resources to complete a task or decision, and at the same time, in the process of task implementation, students can also creatively design multiple solutions and ways to complete the task, and make choices. Students often have a strong sense of satisfaction and pride after completing the task, and the teacher's motivation will make students have a strong interest in the profession or course, which lays a solid foundation for better learning. At the same time, this survey found that 65% of the students showed obvious interest in logistics majors and were willing to continue their in-depth study, as shown in Figure 3.

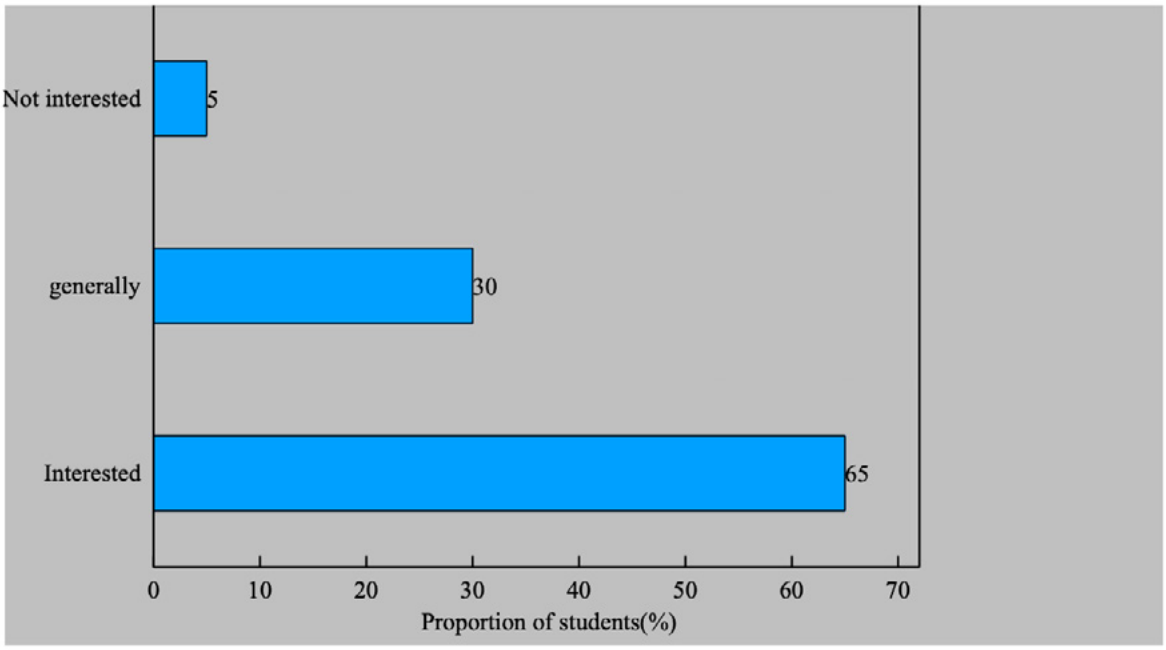

Figure 3. Students' interest in learning

4. CONCLUSION

Under the background of double carbon, with the advent of the big data era and the dramatic increase of the logistics business, the demand for high-end talents specialized in logistics management in China is increasing day by day. In the supply of logistics talents, higher education institutions are important educational institutions, especially for the cultivation of practical and compound talents. The unprecedented speed of development of China's logistics industry and the spurt trend of enterprises' demand for talents are the subjective and objective factors that make higher vocational colleges and universities face unprecedented pressure and challenges in the training of logistics talents. Therefore, how to improve the practical ability of higher

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vocational logistics students has become an important issue of concern for higher vocational colleges and universities. The multimedia teaching can improve the comprehensive quality of students, and enable them to learn more advanced and low-carbon and environmentally friendly logistics operations, transport high-quality logistics professionals to the society, and indirectly contribute to the society's carbon emissions. To this end, this paper takes logistics teaching in higher vocational institutions as the research object, verifies the application of multimedia technology in logistics teaching, and also verifies the usability of the logistics teaching design model in a multimedia environment, and completes the teaching design of warehouse management operation based on this model. The post-class teaching effect survey showed that compared with the traditional teaching model, students had a better grasp of the key contents of warehouse management such as inbound process and warehouse area planning, and their independent learning ability was improved. The specific work of this study is as follows.

1. By analyzing the characteristics of logistics majors and the problems students may encounter in the learning process, this study uses multimedia virtual technology as the teaching method. The logistics teaching design model in a multimedia environment is based on the classical teaching design model, summarizes the common elements in the classical teaching design model, and combines it with multimedia technology. The survey results show that 23.2% of the students can master the warehouse management process and various operations, 65.2% of the students can master them, and the overall number of students who can master the teaching knowledge points better is 88.4%.

2. Multimedia technology can conform to situational cognitive learning theory, constructivist learning theory, and tower of experience theory, and can enhance the application of teaching theory. Secondly, 75.36% of the learners feel that their independent learning ability has been greatly improved by the practical test of teaching in the storage course.

3. In this teaching of multimedia virtual technology, students' knowledge mastery of the whole process of related operations, their ability to learn independently, and their practical skills have been significantly improved, while also expanding the scope of teaching, breaking through time and space limitations, allowing learners to access more advanced logistics technology and equipment, and finally fully stimulating students' interest in learning, the study results show that more than 65% of students look forward to continuing to use multimedia technology for teaching and learning, and also want to use the method in other courses as well.

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