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Discussion on Teaching of Chemical Equipment Design Based on Deep Learning

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Abstract: This paper discusses the application of deep learning technology in chemical equipment design, and according to the specific characteristics and needs of chemical equipment design learning, on the basis of improving teaching quality, students' innovative ability and scientific ability are improved. The results show that the present teaching situation of chemical equipment design has been deeply studied and discussed, and the current teaching situation of chemical equipment design has been obtained, and analyzed from the aspects of learning content, learning method, learning evaluation and teaching staff; The teaching design of chemical equipment design based on deep learning-the classification method of pressure vessel was carried out, which stimulated students' interest in learning, improved their knowledge application ability and problem-solving skills, and laid a solid foundation for students' future study and development.

1. Introduction

With the improvement of science and technology, artificial intelligence has penetrated into all fields of society, and education is no exception. As an important branch of artificial intelligence, deep learning shows great potential in education and teaching with its powerful ability of feature extraction and pattern recognition [1].

Chemical Equipment Design, as a theoretical and practical course, can cultivate students' scientific literacy and innovative ability. However, the traditional teaching mode often has some problems, such as limited teaching resources and single teaching methods, which are difficult to meet the individualized and diversified learning needs of students. Therefore, how to use deep learning technology to improve the teaching status and improve the teaching effect of Chemical Equipment Design has become a hot issue in the field of education.

Deep-Learning is divided into broad sense and narrow sense. In a broad sense, deep learning is an artificial intelligence technology, and in a narrow sense, deep learning refers to the process of human understanding and learning complex concepts, skills and knowledge through experience and practice [2]. Different from machine deep learning, human deep learning involves not only information intake and processing, but also emotion, intuition, critical thinking, creative thinking and other aspects, emphasizing learners' understanding of the essence of knowledge, effective transfer and critical reflection ability. Excellent learning content, independent and good learning

motivation, understanding of complex concepts, refinement of skills, critical thinking, creative thinking, emotional attitude and values, social and cultural factors are all the key contents to form deep learning. Deep learning requires students to build a complete knowledge framework by learning, thinking, memorizing, transferring and processing chemical knowledge, so as to strengthen students' ability to solve problems [3].

1.1 The difference between deep learning and shallow learning

From the cognitive perspective, learning objectives can be divided into six types: memorizing (recognizing and memorizing), understanding (mastering meaning), applying (applying knowledge to new scenes), analyzing (disassembling complex problems as a whole), synthesizing (integrating knowledge) and evaluating (judging value), as shown in Figure 1.

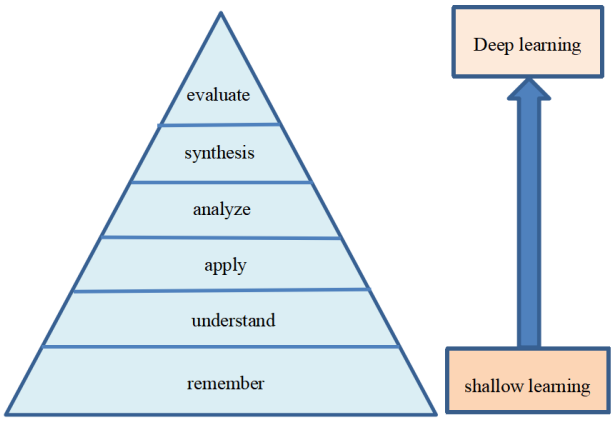

Figure 1: Classification of learning objectives

Surface-Learning means that students simply learn knowledge through teachers' teaching, simply understand and remember what teachers teach, only understand the surface meaning of knowledge but have no own understanding of what they have learned, only know knowledge but don't know why, and don't explore the meaning of deep knowledge by themselves. Compared with deep learning, they also lack the process of understanding, analysis and application, which belongs to shallow cognition of knowledge.

Deep learning is different from shallow learning in motivation drive, participation degree, memory mode, knowledge structure, application skills, reflection level, thinking complexity and learning strategies [4], as shown in Table 1.

Table 1: Differences between shallow learning and deep learning

Comparison dimension	Deep learning	Shallow learning
Learning motivation	Self-development needs	External pressure
Input degree	Active learning	Passive learning
Memory mode	Memorize on the basis of understanding	Mechanical learning
Knowledge structure	Master knowledge and be able to apply what you have learned.	Master only concepts and principles
Comparison dimension	Deep learning	Shallow learning
Migration ability	Be able to migrate application capabilities autonomously in reality	Can't apply what you have learned flexibly
Reflective state	Critical thinking, self-reflection	Lack of reflection
Thinking level	Higher order thinking	Low-order thinking
Learning style	Learn and reflect through the real situation	Learning method of memorizing-memorizing-practicing

1.2 Advantages of deep learning

The advantages of deep learning are reflected in the following aspects [5-6]:

(1) Improve learning effect: deeply cultivate learners' ability of active learning and research spirit, understand and apply knowledge, and improve learning efficiency;

(2) Cultivating innovative thinking: through systematic study, learners can cultivate innovation and creativity, think independently, and put forward novel opinions and solutions in the face of problems;

(3) Promoting all-round development: Deep learning focuses on the all-round development of learners, which is not only the mastery of knowledge, but also the development of thinking ability. The development of emotional attitude and the promotion of values are the key points of in-depth study. Through deep learning, learners can be improved at multiple levels to achieve the purpose of mastery;

(4) Adapt to individual needs: deep learning pays attention to individual differences of learners and can carry out personalized teaching according to learners' interests, abilities and learning styles;

(5) Promoting teachers' professional development: Deep learning puts forward stricter standards for teachers. Teachers must have solid discipline literacy, teaching knowledge and educational philosophy, and be able to design and implement deep learning teaching activities.

The application of deep learning in the field of education not only improves students' learning effect, cultivates innovative thinking, promotes all-round development, adapts to individual needs and promotes teachers' professional development, but also faces certain challenges, such as the improvement of teachers' professional ability and the improvement of teaching resources evaluation methods.

2. "Chemical Equipment Design" Teaching Status

At present, the teaching content of Chemical Equipment Design covers many fields such as college physics, advanced mathematics, theoretical mechanics, chemistry and chemical equipment experiment. In teaching practice, teachers generally follow the contents of teaching materials for classroom teaching, emphasizing the systematicness and logical coherence of chemical equipment knowledge [7]. However, in the actual teaching process, some teachers only focus on imparting theoretical knowledge, but lack the cultivation of students' experimental ability, chemical equipment calculation ability and practical problem solving ability.

The classroom study of Chemical Equipment Design not only requires students to remember the formula of chemical equipment, but also guides students to use deep learning methods to understand the design principle of chemical equipment and think critically, such as: mastering its principle in the process of chemical equipment experiment; Summarize the design principles of various chemical equipment and form their own views; Study and reflect on the existing research results [8].

The teaching methods of Chemical Equipment Design are diversified, including teaching method, experiment method, discussion method, discovery method and so on. In specific teaching practice, teachers will flexibly choose appropriate methods according to students' personality differences, learning needs and specific teaching objectives, in order to achieve the best teaching effect. In recent years, with the in-depth development of educational informationization, new teaching methods such as multimedia teaching and network teaching have emerged constantly, and have been widely introduced into the teaching process of Chemical Equipment Design. These new teaching methods not only greatly enrich teaching methods, but also provide new possibilities for improving teaching quality and students' interest in learning [9].

Because of the complex concept and diverse structure of Chemical Equipment Design, students

need to have high abstract thinking ability and logical reasoning ability, but the cultivation of these abilities is often neglected in teaching at present. Students may be skilled in reciting and memorizing the structure and types of chemical equipment, but their understanding of the design principles of chemical equipment is insufficient [10].

Teachers need to adjust teaching strategies and design more inquiry activities and practical operations to encourage students to participate in discussion and thinking, instead of just passively accepting knowledge, so as to change this situation. Schools should also provide advanced teaching facilities, abundant experimental materials and interdisciplinary learning projects for cultivating students' deep learning ability. At the same time, it is necessary to pay attention to teachers' professional development, and enhance their ability to understand and practice deep learning through continuous training and discussion.

3. Discussion on the teaching of Chemical Equipment Design based on deep learning

At present, the progress of deep learning in the field of chemical equipment is not ideal, so it is particularly important to promote the implementation of deep learning in the classroom teaching of chemical equipment. In order to ensure that students can study deeply, teachers must carefully plan and prepare specific teaching links. The realization of deep learning requires teachers to design learning objectives, contents, processes and evaluations in an all-round way. This paper will put forward teaching strategies to promote deep learning from the following aspects: defining learning objectives, formulating learning objectives, planning learning activities, and implementing continuous teaching and teaching evaluation.

Taking the classroom of Chemical Equipment Design as an example, the deep learning technology is applied to the teaching process. Through the actual teaching process, it is found that the teaching mode of Chemical Equipment Design based on deep learning has achieved good results in improving students' interest in learning and promoting the understanding and application of knowledge.

3.1 Clarify learning objectives

When designing the course of Chemical Equipment Design, teachers should first study the curriculum standards in depth and understand the requirements for teaching objectives and students' learning achievements; Secondly, students' knowledge base, study habits, interests and hobbies should be carefully assessed to ensure that the set learning goals are consistent with the actual situation of students. On this basis, teachers should focus on formulating specific and clear teaching objectives, which should clearly explain how students will master the core concepts and principles of chemical equipment through deep learning. It not only takes teaching objectives as teaching guidance, but also makes them measurable, so that teachers can use various evaluation methods to test students' learning situation. Setting specific and measurable learning objectives is beneficial for teachers to guide students to study deeply in class, so that students can have a deep understanding and mastery of the core knowledge of chemical equipment.

3.2 Designing Learning Content

Teachers need to screen out the concepts and principles that can cause students to think deeply, explore and understand from a large number of examinations of chemical equipment knowledge. Then, the teacher should sort out these contents into a knowledge system and a suitable logical structure, so that students can clearly observe the connection and level between different knowledge points. In addition, teachers should decompose this knowledge system into several interrelated

modules, each of which contains a series of interrelated knowledge points and skills. The mastery of these knowledge points and skills is helpful for students to systematically learn and understand the knowledge of chemical equipment. Through such orderly arrangement and decomposition, teachers have played an effective role in promoting students' in-depth study and making them master the core concepts and principles of chemical equipment more firmly.

3.3 Planning Learning Activities

Teachers should design a series of teaching activities beyond the traditional knowledge transfer mode to stimulate students' critical thinking and creative thinking. For example, organizing inquiry experiments can make students discover the principle behind the phenomenon of chemical equipment through personal experience and observation, and carry out collaborative discussion activities, so as to promote the communication and thought collision among students, cultivate students' team cooperation ability and critical thinking, guide students to apply their knowledge to solving practical problems, deepen their understanding of knowledge and stimulate creative thinking, and make students have a deeper understanding of chemical equipment knowledge, and develop students' advanced thinking ability through deep participation in teaching activities.

3.4 Reflecting on the Teaching Process

Teachers' reflection on teaching activities is an important link to improve teaching quality. A comprehensive analysis of teaching design and an assessment of its effectiveness specifically involve the selection of teaching content, the application of teaching methods, the degree of students' participation, the completion of teaching objectives and other aspects of reflection, and find out the bright spots and shortcomings in the teaching process, and improve and improve them.

In order to promote students to have a further understanding and grasp of chemical equipment knowledge, it is necessary for teachers to improve their teaching strategies accordingly. Teachers should adjust their teaching methods, introduce more practical cases to analyze, use multimedia tools to assist teaching, design more challenging topics or projects to increase the opportunities for students to interact and cooperate, and carry out different teaching for different students' learning styles and ability levels, so as to ensure that each student can get the most suitable learning experience in class.

3.5 Promote students' autonomous learning

In teaching activities, teachers should take the cultivation of students' autonomous learning ability as one of the important goals, that is, guide students to gradually learn how to acquire knowledge independently, understand concepts and solve problems. Therefore, without the direct guidance of teachers, we can independently carry out effective in-depth learning activities and have in-depth understanding and application of knowledge.

It is an important content to cultivate students' autonomous learning ability to make students have the ability to learn independently and make them learn effectively without teachers' guidance.

3.6 Instructional Design of Chemical Equipment Design Based on Deep Learning-Taking Classification Method of Pressure Vessel as an Example

3.6.1 Study Topics

Chemical equipment is composed of inner parts and outer shell, and the outer shell is a pressure vessel. Usually, the pressure vessel is composed of cylinder, head, support, opening nozzle, sealing

device and safety accessories. All chemical equipment is a typical pressure vessel from the outside, which belongs to different chemical equipment according to different internals, such as heat exchanger, separator, reactor, storage and transportation container, etc. [11].

Pressure vessel is a typical common chemical equipment, which generally contains pressure inside. According to the size of internal pressure and external pressure, it can be divided into internal pressure vessel and external pressure vessel. If the internal pressure is greater than the external pressure, it belongs to internal pressure vessel; If the internal pressure is less than the external pressure, it belongs to the external pressure vessel [12].

3.6.2 Learning Objectives

(1) Let students understand the concept of pressure vessel, including the basic concepts of cylinder, head and sealing device.

(2) Let students master the classification methods of pressure vessels, including classification according to design pressure, unit operation and wall thickness.

(3) Cultivate students' experimental operation ability and observation ability, and improve their scientific thinking ability.

3.6.3 Content of learning

In order to achieve the best learning effect, this unit has designed three learning hours, as shown in Table 2.

Table 2: Learning contents of pressure vessel classification method

Class hours	Learning objectives	Learning content	Learning activities	Learning resources
The first class hour The basic concept of pressure vessel, cylinder, head, sealing device, etc.	Students can understand the basic concepts of pressure vessels, students can distinguish cylinder, head, support, sealing device, opening nozzle, etc., and understand their classification and characteristics.	Basic Concepts of Pressure Vessel Distinction of cylinder, head, support, sealing device and opening nozzle	Teachers vividly explain the basic concepts of pressure vessels, the definitions and characteristics of cylinders, heads and supports through PPT, physical objects and other auxiliary tools.	PPT, textbooks and other teaching tools. Laboratory equipment and materials, after-school workbooks and related reading materials
Second class hour Classification method of pressure vessels	Understand what design pressure, unit operation, and wall thickness are, and classify them according to the above three factors.	Design pressure classification: low pressure vessel, medium pressure vessel, high pressure vessel and ultra-high pressure vessel Classification of unit operations: heat exchange vessels, separation vessels, reaction vessels and storage and transportation vessels Classification of wall thickness: thin-walled vessels and thick-walled vessels	Teachers explain low-pressure vessels, medium-pressure vessels, high-pressure vessels, ultra-high-pressure vessels, heat exchange vessels, separation vessels, reaction vessels and storage and transportation vessels through PPT and textbooks. Thin-walled containers and thick-walled containers, etc.	PPT, objects and other auxiliary teaching tools. Experimental equipment and materials, such as pressure vessels. Homework workbooks and related reading materials.
Third class hour Carry out disassembly and assembly experiment operation, observe the structure and classification of pressure vessels, etc.	Through disassembly and assembly experiments, students can know the structural characteristics of pressure vessels.	Pressure vessel disassembly and assembly experiment: Disassembly and installation of different types of pressure vessels.	Teachers explain the internals and shells of pressure vessels through PPT and textbooks. Conduct group discussions and organize students to carry out experiments.	PPT, objects and other auxiliary teaching tools. Experimental equipment and materials: pressure vessels.
The fourth lesson hour Learning summary	Students can review and consolidate the classification and characteristics of pressure vessels learned this semester.	Structural characteristics of pressure vessel: cylinder, head, support, opening nozzle, sealing device and safety accessories; Classification of pressure vessels: according to design pressure, unit operation and wall thickness.	Review and review: The teacher guides the students to review the knowledge of the classification and structural characteristics of pressure vessels learned this semester, focusing on the key concepts and principles.	Teaching materials and teaching PPT Test paper: A test paper designed by teachers to evaluate students' mastery.

3.6.4 Learning evaluation and reflection

First, teaching evaluation

This teaching activity summarizes and reviews the basic concepts of pressure vessels, as well as the composition and classification of common pressure vessels. Through the test after class, we can know that students have a good grasp of the basic concepts and characteristics of pressure vessels. Most students can accurately describe the definitions of pressure vessels, chemical equipment, cylinders, heads and supports, and understand the differences between them [13].

In the test, students have a good grasp of the common structure of pressure vessels, such as cylinder, head, support, opening nozzle, sealing device and safety accessories. Most students can accurately answer the composition and structural characteristics of these pressure vessels [14].

However, in the test of pressure vessel wall thickness classification, there are some deficiencies in students' learning situation. This shows that in the future teaching, it is necessary to explain the classification method of pressure vessels according to wall thickness more deeply in order to improve students' understanding and application ability.

Second, teaching reflection

The content arrangement is reasonable, and it is necessary to refine the introduction of pressure vessel types and analyze actual cases, so that students can have a deeper understanding and distinguishing ability of the internal structure of chemical equipment [15].

In teaching activities, in order to promote students' active participation and interactive discussion, they should be encouraged to put forward questions and opinions on their own initiative, so as to achieve better results in the cultivation of thinking ability and the improvement of problem-solving skills. This will make the learning more active, and learning and thinking promote each other.

It is very important to give timely guidance and explanation to the problems in the test, so that students can fully understand and master the key knowledge points.

It is suggested that more hands-on practical activities should be added in the future classroom teaching. Such as experimental operation and observation of phenomena, so that students can have a more accurate understanding and grasp of the structure of pressure vessels. At the same time, it also lays a foundation for future scientific research and combine theory with practice in teaching. This will strengthen the tracking and assessment of students' learning situation, solve the problems in the learning process in time, and improve students' learning effect.

4. Conclusion

This paper mainly discusses the application of deep learning technology in chemical equipment design, so as to improve students' innovative ability and scientific ability on the basis of improving teaching quality according to the specific characteristics and needs of chemical equipment design learning. The teaching effect of chemical equipment design classroom can be brought into full play.

Firstly, the application of deep learning technology in chemical equipment design classroom and its advantages in chemical equipment design teaching are deeply analyzed, including the overview of deep learning and the difference between deep learning and shallow learning. The purpose and significance of studying deep learning in chemical equipment design learning are clearly defined, and the coping strategies are put forward when facing challenges, thus improving the learning efficiency.

Secondly, the current teaching situation of chemical equipment design is deeply studied and discussed, and various methods are used to investigate and analyze, and the current teaching situation of chemical equipment design is obtained, and analyzed from the aspects of learning content, learning method, learning evaluation and teaching staff.

Finally, the teaching design of chemical equipment design based on deep learning-

"Classification Method of Pressure Vessel" was carried out, which stimulated students' interest in learning, improved their knowledge application ability and problem-solving skills, and laid a solid foundation for students' future study and development.

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