THE DEVELOPMENT OF LEARNING PLATFORM WITH MIX REALITY TECHNOLOGY IN NEW ENERGY VEHICLE TEACHING FOR UNDERGRADUATE STUDENTS

JIE FENG

A THESIS SUBMITTED IN PARTIAL FULLFILLMENT OF THE REQUIREMENT FOR THE DEGREE OF MASTER OF EDUCATION PROGRAM IN LEARNING TECHNOLOGY AND INNOVATION FACULTY OF TECHNICAL EDUCATION RAJAMANGALA UNIVERSITY OF TECHNOLOGY THANYABURI ACADEMIC YEAR 2023

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วิทยานิพนธ์ฉบับนี้เป็นงานวิจัยที่เกิดจากการค้นคว้าและวิจัย ขณะที่ข้าพเจ้าศึกษาอยู่ในคณะครุศาสตร์อุตสาหกรรม มหาวิทยาลัยเทคโนโลยีราชมงคลธัญบุรี ดังนั้น งานวิจัยในวิทยานิพนธ์ฉบับนี้ถือเป็นลิขสิทธิ์ของมหาวิทยาลัยเทคโนโลยีราชมงคลธัญบุรี และข้อความต่าง ๆ ในวิทยานิพนธ์ฉบับนี้ ข้าพเจ้าขอรับรองว่าไม่มีการคัดลอกหรือนำงานวิจัยของผู้อื่นมานำเสนอในชื่อของข้าพเจ้า

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Name-Surname	Ms. Jie Feng
Program	Learning Technology and Innovation
Thesis Advisor	Assistant Professor Naruemon Thepnuan, Ph.D.
Academic Year	2023

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ABSTRACT

The research objectives were to: 1) develop the learning platform of Mixed Reality Technology in New Energy Vehicle Teaching for undergraduate students, 2) compare pre-test and post-test scores of students after learning through the learning platform of Mixed Reality Technology in New Energy Vehicle Teaching for undergraduate students and 3) examine students' satisfaction towards the learning platform of Mixed Reality Technology in New Energy Vehicle Teaching.

The population was students registered in 1901 and 1902 classes of New Energy Vehicles of Mechanical Engineering College of Sichuan University of Light Chemical Industry, China who were selected as the sample group of the Mixed Reality classes, with a total of 30 students. The research instruments consisted of the video clips on social media shared via the application, the evaluation form regarding the quality of media and contents, the pre-and post-training competency assessment form, and the evaluation form regarding student's satisfaction towards the digital technology. Statistics used for data analysis were mean, standard deviation and t-test for dependent samples.

The research results showed that: 1) the learning platform of Mixed Reality Technology in New Energy Vehicle Teaching had the quality of media at an excellent level with the average score of 4.70 and the quality of contents was at an excellent level with the average score of 4.87. 2) The students had the average pre-test score of 12.25 and post-test score of 15.95, respectively. It was found that the post-test scores were higher than the pre-test scores with the statistical significance level of .05 and 3) the students overall satisfied with the learning platform of Mixed Reality Technology in New Energy Vehicle Teaching at a high level with the average score of 4.50.

Keywords: learning platform, mixed reality technology, new energy vehicle teaching, undergraduate students

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On the occasion of the completion of the thesis, it also means that one and a half years of postgraduate life is about to come to an end. I can't help feeling and not giving up, but I am still grateful. Time flies, in this soon to leave the campus is full of endless grass and trees here. Looking back on the past, a lot of harvest, emotional. Here constantly enrich their green years, learn scientific and cultural knowledge, cultivate moral education quality.

On the occasion of the completion of this paper, I would like to express my heartfelt gratitude to all those who have helped and supported me during this period!

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Finally, I would like to sincerely say to all the teachers, leaders, classmates and family members who have helped and cared for me throughout my postgraduate study: Thank you for your trouble!

Jie Feng

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CHAPTER 1
INTRODUCTION

1.1 Background and Statement of the Problem

1.1.1 Development Status of new energy vehicle in China

With the rapid development of social economy, environmental pollution, energy shortage and other issues have gradually become the focus of attention. Under the constant impact of these changes, traditional cars are changing; In recent years, China has been focusing on the development of new energy automobile industry and providing policy support. Green, low-carbon, intelligent, fashionable, low cost advantages, making new energy vehicles more popular with consumers. After years of hard work and development and promotion, the sales market of new energy vehicles in China has enjoyed a rapid growth, made certain progress in some key technical areas, and established a relatively complete and stable industry system. Since 2022, China's new energy vehicle production, sales and exports have steadily increased. In recent years, the sales of new energy vehicles, as shown in Figure 1.1, especially under the support of various government policies, the production and sales of new energy vehicles in China in 2022 have completed more than 6 million and nearly 5 million, respectively, an increase of more than 1 times. China has more than 12 million new energy vehicles, accounting for 30% of China's auto sales. However, the shortage of talents in the post-market of new energy vehicles is an important factor affecting its development, which puts forward that colleges and universities that train talents in related fields of new energy vehicles must make corresponding changes to meet the needs of the market and enterprises.

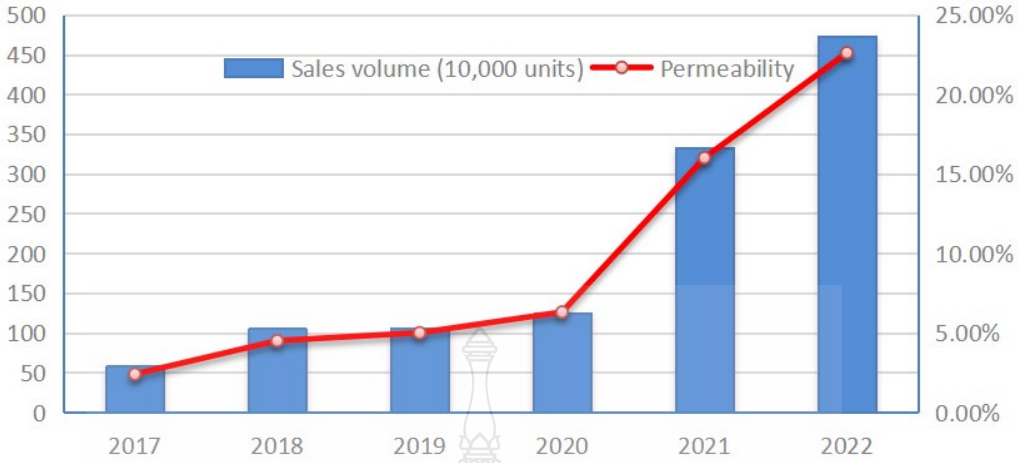

Figure 1.1 Sales and Market penetration of new energy vehicles in China from 2017-2022

1.1.2 New energy vehicle professional development status

1) The strength of teaching staff is relatively weak

Due to the late setting of the new energy vehicle major in our country, many teachers, in the actual teaching process of the practice teaching consciousness is not strong, nor do they have special practice instructors, lack of "double teacher" teachers. In addition, there is no in-depth exploration of this course. The teaching form in class is relatively simple and tends to be theoretical, which makes students feel very boring in the process of learning. Although the school will also invite some new energy vehicle professionals to give guidance to the students. However, these teachers are limited to lectures and individual guidance, and they are not able to teach in schools for a long time.

2) Students' enthusiasm in teaching is not high

At present, in the process of learning, students in many schools only passively accept professional knowledge to complete their required courses. They lack practice and interaction in learning, and have low participation in class, unable to deeply understand professional knowledge and other related content. In the actual teaching process, teachers did not actively guide students to take the initiative to participate in practice, resulting in poor classroom efficiency and low enthusiasm for participating in activities. In addition, the practice teaching offered by many schools is only limited to classroom learning, and students are not involved in after-school practice. The creation of practice bases and training platforms is also relatively lacking.

3) The practice teaching are less arranged

The current teaching situation of the new energy vehicle major can be found that theoretical knowledge accounts for more in the actual teaching process, and there are fewer targeted skills practice links. As a result, students' knowledge is not comprehensive enough and their flexibility is poor. At present, there is a general situation of poor professional skills in colleges and universities, and many students have few opportunities to participate in practice in the process of learning, cannot participate in the process of automobile practice, and rarely touch the actual operation, resulting in poor practical ability. This is also a prominent problem in the training of new energy vehicle professionals in current colleges and universities, which requires colleges and universities to take measures to solve it.

1.1.3 Application of Mix Reality Technology in the teaching of new energy vehicles

Mixed reality (MR) technology is a new technology that merges the real world and the virtual world, which can integrate virtual things into the real world and provide users with a visual vision combining virtual and real. The application of Mix Reality Technology has realized the efficient and collaborative development of education and market, which can present a more three-dimensional world, eliminate the cognitive block caused by space and time, and provide students with a realistic and vivid learning environment. For example, building car models, disassembling cars, displaying internal structures, etc., Mix Reality Technology can provide students with unlimited real experience in the field of new energy vehicles. As shown in Figure 1.2, in the test drive activity of BMW i3, BMW deeply integrated the real scene with the virtual environment through Mix Reality to create a new visual digital environment, so as to conduct a comprehensive simulation demonstration and explanation of the chassis structure, power drive system, body materials, aerodynamics and driving assistance of the new BMW i3. In the near future, it is believed that Mix Reality Technology can transport a large number of elites for the field of new energy vehicles.

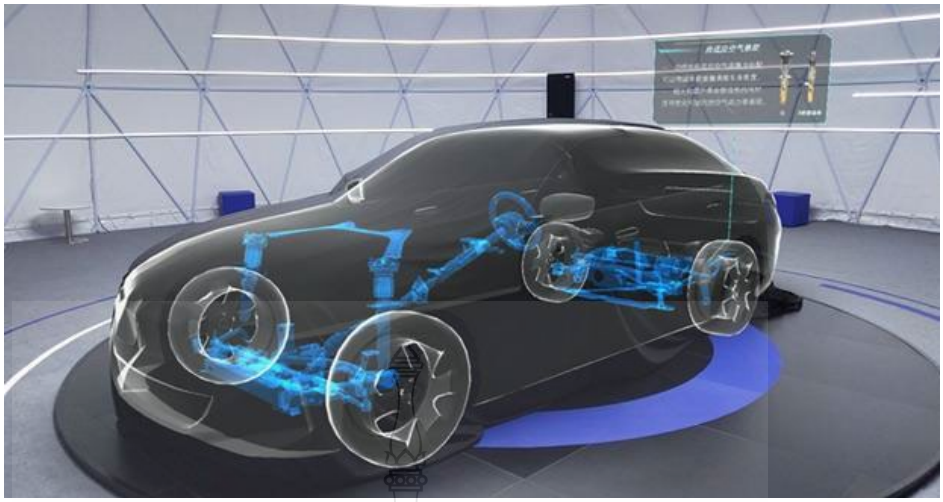

Figure 1.2 Based on Mix Reality Technology, Create a visual digital Environment for BMW i3

In summary, in the new energy vehicle major education, Mix Reality Technology is applied to design teaching activities related to new energy vehicle courses, and a new set of professional teaching mode is constructed to stimulate and extend students' professional interest, improve students' learning efficiency, and realize the comprehensive development of students' professional ability. To achieve the effective integration of new energy vehicle curriculum teaching with students' practical training interests, teacher training, and practical training equipment investment, it also provides a set of effective reference means for promoting the training of talents in the new energy vehicle aftermarket.

1.2 Purpose of this study

1.2.1 Develop of learning platform with Mix Reality Technology in New Energy Vehicle Teaching for undergraduate student.

1.2.2 To compare the pre-test and post-test scores of students after learning with learning platform with Mix Reality Technology in New Energy Vehicle Teaching for undergraduate student.

1.2.3 To determine students’ satisfaction towards learning platform with Mix Reality Technology in New Energy Vehicle Teaching.

1.3 Research Questions and Hypothesis

There are three research hypotheses as to the following:

1.3.1 Students who study with learning platform with Mix Reality Technology in New Energy Vehicle Teaching can increase their academic achievement.

1.3.2 It is assumed that in the investigation of application effect, students' professional quality, theoretical basis and acceptance ability are at the same level.

1.3.3 In this paper, after proposing the teaching model of new energy vehicle major courses based on Mix Reality Technology and completing the framework design, it is assumed that the selection of teaching cases, research objects and data collection during the implementation of the verification process will not affect the research results.

1.4 Scope and Limitations of the Study

1.4.1 Scope of the study

1.4.1.1 Teaching mode

The American classic textbook Teaching Mode emphasizes that the so-called teaching training mode in the field of education is a concrete implementation model composed of basic curriculum, textbook application, teaching and practice and other teaching activities. China’s in-depth research on teaching mode began in the mid-1980s. For example, scholar Ye LAN believes that teaching mode can be simply regarded as teaching mode, which is mainly based on the principle, content, goal; task and other elements of a certain teaching activity. It can be seen that teaching mode is a kind of intermediate medium, which is used to embody a series of teaching ideas and theories. At the same time, it needs to directly face and guide teaching practice and training, and is a bridge between teaching theory and teaching practice.

To form a scientific and systematic teaching model in the field of education, it needs to include the following five core links:

1) Teaching theories guided by philosophical views and certain educational and teaching theories or ideas;

2) The teaching objectives of scientific evaluation of teachers' effectiveness in the teaching process and the setting of important measurement standards for students' learning activities;

3) Various teaching support conditions to promote the smooth development of teaching mode in education and teaching activities;

4) Teaching methods that specify what teachers and students should do first and then, and what tasks should be completed according to each step in teaching activities;

5) Teaching evaluation. The training of new energy vehicle professionals should focus on employment and ability, and cater to the needs of enterprises and the market. In terms of teaching modes, most of them are based on professional teachers' teaching knowledge, mechanized teaching methods, passive acceptance of students' procedures, and simple assessment methods. The second is dual-system education, which originates from German vocational education. It refers to the cooperative education between schools and enterprises. Students have dual identities, learning professional theoretical knowledge in schools and receiving practical training and practice of skills in enterprises. Another is modular skill training, that is, "MES" teaching mode, which enables students to learn a skill in the shortest time and in the most effective way, and develops different combinations of training modules for different combinations of teaching forms.

1.4.1.2 New energy vehicle professional courses

According to the definition of professional courses in Teacher Lin Chong de's book "Teaching Encyclopedia Education Volume", the definition of professional courses can be summarized into two characteristics: first, for vocational education, professional courses are targeted at professional personnel training objectives; Second, compared with the basic courses of culture, the content of specialized courses is about the relevant theories and skills of the major.

With the increasing job vacancy of new energy vehicle after market professionals, all kinds of colleges and universities have set up new energy vehicle related majors or related professional courses. After graduation, most of the students are engaged in new energy vehicle service, parts or vehicle assembly and manufacturing enterprises, which can be further subdivided according to the students' expertise. In order to enable students to master the professional skills to meet the needs of enterprise positions, they have to learn the new energy vehicle professional courses.

Therefore, combining the viewpoints of all parties, it can be concluded that, for the cultivation of students of new energy vehicles, whether it is professional theoretical knowledge or professional skills, the corresponding courses of new energy vehicles corresponding to the basic courses of culture should provide students with professional quality, professional basic ability, core ability and expansion ability required for enterprise jobs.

1.4.2 Population scope and sample

1) Population Class

The population is 1901 and Class 1902 of New Energy Vehicles of Mechanical Engineering College of Sichuan University of Light Chemical Industry were selected as Mix Reality classes, with a total of 30 students.

1.4.3 Study variables

1) Independent variable is learning platform with Mix Reality Technology in New Energy Vehicle Teaching:

2) Dependent variables are the results after learning with learning platform with Mix Reality Technology in New Energy Vehicle Teaching**:**

(2.1) Academic achievements.

(2.2) Satisfaction.

1.4.4 Definition of terms

1) Definition and types of new energy vehicles

New energy vehicles refer to the use of unconventional vehicle fuel as a power source (or the use of conventional vehicle fuel, but the use of new on-board power devices), integrated vehicle power control and drive advanced technology, the formation of advanced technology principle, with new technology, new structure of the vehicle. The unconventional fuel of automobile refers to other vehicle fuels besides gasoline and diesel, including hydrogen fuel, bio-fuel, ethanol gasoline, methanol, dim ethyl ether, electric energy and other fuels.

If divided according to the source of power, electric vehicles can be divided into pure electric vehicles, hybrid electric vehicles and fuel cell electric vehicles. Currently, the global pure electric vehicles are affected by battery technology, and the power battery pack of pure electric vehicles can hardly meet the driving range of electric

vehicles. The development and popularity of electric vehicles have been limited by battery technology. Therefore, developed countries in the automobile industry such as the United States, Japan and France are committed to the research and development of hybrid electric vehicles which are powered by motor and internal combustion engine. The power source of hybrid electric vehicles has two paths, one is the power provided by traditional internal combustion engine, the other is the power provided by motor. It has the advantages of both traditional vehicles and electric vehicles, which ensures efficient driving while reducing vehicle emissions, conforming to the current new requirements of green, environmental protection and energy saving development. With the continuous research on hybrid electric vehicles, new energy vehicle enterprises of various countries have found that it cannot only rationally utilize resources and ensure driving distance, but also make internal combustion engine and electric motor reach the best working state at the same time. From the perspective of global development, the current hybrid electric vehicle industry is just in a transitional stage. In comparison with traditional fuel cars, the development of hybrid electric vehicles in our country is relatively small, and our national automobile industry is also doing well in the independent innovation.

2) Mix Reality Technique

Mix Reality Technology continues to develop and extend on the basis of VR technology. Mix Reality Technology can superimpose the real world and the virtual world built in the computer, so as to better improve the real-time interaction and various sensory feelings of users. Figure 1.3 shows the differences between virtual reality (VR), augmented reality (AR) and mix reality.

Virtual reality (VR)	Mixed reality (MR)	Augmented reality (AR)
Quiet in a virtual space	Real space and virtual space	Virtual data overlaps
Separate from reality	Are integrated and interactive	with the real world

Figure 1.3 The differences between Virtual realities (VR), Augmented reality (AR) and Mixed reality (MR)

The characteristics of Mix reality technology are mainly reflected in the following:

(2.1) Virtual objects can be added to the real world through intelligent display devices, and real objects or scenes can be combined into the virtual world of computers;

(2.2) Each Mix Reality Experience user can realize the interactive feedback of tactile sensation, vision or perception with the constructed mixed reality environment in real time through their own sense and touch;

(2.3) As can be seen from above, the virtual and reality form a three-dimensional mapping in the space of mixed environment, that is, the dynamic stays in the corresponding position in the real world, so as to perceive and experience the changes of the user's orientation and body posture, achieve the integration between the virtual three-dimensional world and the real three-dimensional world, and provide users with a very substantial and perfect immersive experience.

From the above three characteristics, this study believes that the advantages of Mix Reality Technology in the field of education are also very applicable to learners, learning content and learning situation. For example, the combination of virtual and real world of Mix Reality Technology can construct a mixed learning environment and scene indicatively, while the real-time interaction of Mix Reality Technology allows learners to fully mobilize their senses to experience the visualization of learning knowledge, which can quickly help improve the learning effect of learners. In addition, the sense of substitution brought by the three-dimensional space of Mix Reality Technology can be a strong support for learners to develop their interest in learning and remote collaborative learning. Therefore, with the rapid development of technology life cycle, Mix Reality Technology will eventually play an increasingly important strategic position in all walks of life, especially in the teaching of professional courses in vocational education, with its unique charm and potential.

1.5 Conceptual Framework

Shows the paper conceptual framework.

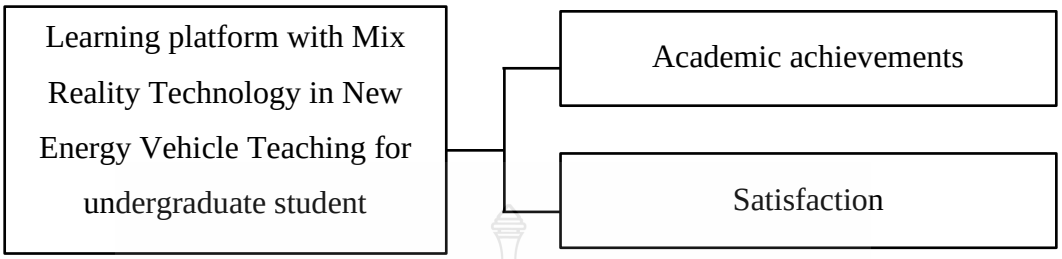

Figure 1.4 Conceptual Frameworks

1.6 Significance of the Study

1.6.1 Theoretical significance

Learning interest affects the quality of teachers' classroom teaching and the learning effect of students. Talking about learning without interest is like mechanical learning or learning for the purpose of assessment standards. Therefore, schools that are holy places of education have become places of production of output factories, which means that attention should be paid to the significant leading effect of interest in the process of education and teaching. Teachers should unify the purpose and process of interest as a whole, integrate various influencing factors related to students' learning interest according to their own characteristics, create external conditions and promote students' development environment, through the careful design of curriculum teaching activities, and give students appropriate learning tasks. Allow students to fully express their creativity, enthusiasm and initiative in the learning process. Only in this way can students' physical and mental development be gradually and comprehensively promoted through voluntary and enjoyable learning activities.

1.6.2 Practical significance

In order to solve the energy crisis and reduce environmental pollution, new energy vehicles are the mainstream of the current automobile industry. In order to cater to the strategic layout of automobile power, cooperate with the transformation and upgrading of the automobile industry and actively make up for the major gap of post-market skilled talents, colleges and universities across the country have opened new

energy vehicle maintenance or new energy vehicle professional courses. However, in the teaching process of the specialized courses of new energy vehicles, there are some problems that need to be further improved, such as the curriculum system, teaching methods and teachers. On the one hand, new energy vehicles cover the majors of machinery, electronics and chemical energy, and target students who are younger, have weak theoretical basis, poor logical thinking, low willingness to learn and lack of self-discipline. There will be great difficulties in its teaching. On the other hand, many new energy automobile teachers in schools are divided from traditional automobile teachers, and their understanding of new theories and technological update need to be further expanded.

CHAPTER 2
LITERATURE REVIEW

In this chapter, the literature relevant to this study will be reviewed, the development of learning platform with Mix Reality Technology in New Energy Vehicle Teaching. As a result, this chapter is divided into the following sections:

2.1 Learning Platform

2.2 Theoretical basis of situational cognition

2.3 Application research of Mix Reality Technology in education and teaching of new energy vehicles

2.4 Relevant researches on the application of Mix Reality Technology in education and teaching

2.1 Learning Platform

2.1.1 Characteristics of learning platform

Learning platform is a new form of media developed after traditional media such as newspapers, newspapers, radio and television. It is a form of communication that provides learning information and services to students through the Internet and other channels through the use of network, digital technology and terminals such as computers, mobile phones and digital equipment. Through the video, students can conduct independent learning practice, find problems and solve problems. In terms of conveying and exchanging information, the expression of video is more intuitive, which is in line with the media usage habits of students "net generation". Micro video teaching media has the general characteristics of teaching media. First, instrumentality. Micro-video teaching media is a kind of teaching tool, which can help people reach the purpose of extending various senses. Second, dependency. The teaching media is subordinate to the teaching goal, and it is a suitable setting for achieving the fixed teaching goal. The use of micro-video teaching media, how long to use and how to use, etc., are subordinate to the teaching objectives. Third, replace ability. In order to make the teaching information more effective, we can choose or replace the more suitable teaching media.

Micro-video teaching media not only has the general characteristics of teaching media, but also has its special advantages. First, present the material clearly in a way that is accessible to the learner's needs. Second, students can learn content independently, self-regulate teaching content and progress, and choose learning needs according to their own learning speed and learning progress. Third, students experience information comprehensively, mobilize different sensory experience materials, and perceive teaching content in a three-dimensional and comprehensive way through videos, text materials, oral descriptions, etc. Fourthly, the teaching content can be repeated and vivid form to attract and keep students' attention. Micro-video teaching media can transcend the limitations of time and space and adapt to the needs of different sizes of classes. Fifth, promote collaborative learning, create real situations, provide rich learning resources, and improve teaching effect.

2.1.2 Research on the application of learning platform in pedagogy

1) Strengthen the control of video teaching practice

In video teaching, students often understand the video, but cannot complete the operation in practice. This is not to say video The teaching function is small, but to think about how to use and effectively control video in teaching. When the teaching content is relatively simple, students can learn independently through videos, record videos for feedback, and constantly master knowledge points. When the content is complicated, students can use the video to preview, learn knowledge points and understand technical details by slowing down or speeding up the playback speed, so as to facilitate learning and mastering. The implementation of online teaching such as video and emphasis on interactive function representation and presentation skills in video design will help students get positive learning results.

2) To realize the organic combination of online and offline teaching activities

Online courses implement online teaching, students learn and consolidate through video; Offline practice, and constantly consolidate and improve the effect. If only rely on online teaching, and the lack of offline practical operation, teaching may exist in the situation of empty vision, fantasy, and talk on paper, resulting in students can not get substantive operation. If you only practice in practice, there is no online

learning cognition and understanding; the lack of standardized and convenient teaching services, the learning effect will be reduced. The combination of online and offline teaching is adopted to help students achieve fast and effective learning and master knowledge.

2.2 Theoretical basis of situational cognition

2.2.1 Concept and connotation of situational cognition theory

Brown, Collins & Duguid's "In the Context of Cognition and Learning Culture" not only laid the foundation for the study of the context cognition theory, but also provided the direction for its further development and improvement. The concept of situational cognition theory refers to the meaning of learning, and in the process of making learning knowledge and real situations in life constantly transform each other. In this theory, the emphasis is on knowledge, cognition and learning, and the evaluation and full understanding of learning knowledge in the process is its fundamental characteristic. In his opinion, to emphasize the unity of knowing and doing in the learning process, knowledge should not only be regarded as the performance of internal mental activities of learning individuals, but should be interleaved and complementary with the real social situation, which means that knowledge cannot be discussed apart from the actual situation, and the real life situation of situational cognition theory is the representation and important component of knowledge and learning.

2.2.2 Teaching view of situational cognition theory

The teaching concept of situational cognition theory is different from the way learners themselves understand knowledge. This is a critical attitude towards traditional teaching methods, because the "indoctrination" learning of conceptual knowledge in traditional teaching methods deviates from practice in real situations, believing that human knowledge is developed in real activities and living situations. The teaching concept of situational cognition theory can be understood from the following three aspects:

1) Knowledge is a situational activity

In the process of learning, people's cognition develops continuously according to contextualized activities, that is, they participate in social practice to

constantly promote knowledge learning and understanding. Knowledge is not only an independent concept or symbolic representation, but only through contact and application with the real environment can its meaning and value be fully understood, and the "pyramid" of knowledge can be built gradually through interaction. The teaching concept of situational cognition theory proposes that in the way of learning knowledge and skills, learners should focus on the learning of general skills, learn something, learn something good, grow something useful, and enable learners to transfer knowledge in different situations by drawing parallels. Either focus on whether learners are learning knowledge and skills in a real working situation or in a highly similar situation that integrates virtual-real knowledge.

2) Development in a community of practice

Community of practice is an important concept in the theory of situational cognition. It emphasizes the participation of learners in an activity system, in which knowledge sharing, understanding sharing and behavior sharing are various interactions of learning situations and the common set constructed by learners to imitate activities with a purpose. Under this collective group, every learner can participate; share and practice constantly, pursue progress together, integrate knowledge step by step in action and practice, develop through teamwork, and improve their own practical ability. Become the belief that every learner should participate in this community of practice. In this community, learners can move from the periphery to the center of the community through constant practice, and gradually develop from a novice to an expert. In this process, learners' enthusiasm is enhanced, and their practical ability is also continuously enhanced.

3) Borderline participation in situational learning is legal

Under the set of community of practice, there is no "edge" land and no "core" area, which also means that learners are fully involved in it. Its significance lies in the ability to treat each learner in the community fairly and equitably, allowing for diversity and uncertainty. By constantly acquiring knowledge and practicing through situational learning, novice learners can gradually move from the edge of the community of practice to the center, and grow from a newcomer to an expert.

2.2.3 The application of situational cognition Theory to the construction of teaching model

The theory of situational cognition emphasizes the real task and its practice, and the teaching of knowledge must be carried out in various situational activities. For teachers' teaching, the design of learning activities must first consider students as the subject of the whole teaching process and teaching effect evaluation, and the arrangement of teaching content and activities should be based on the complex and real situation or task in our current society, so that students can actively participate in the teaching process and fully interact with the surrounding students and situation content. Become the "protagonist" in the process of their own learning knowledge construction, so that students' learning enthusiasm and subjective initiative, especially the ability to solve practical problems, can be maximized. In a word, the continuous development of information technology and intelligent equipment, coupled with the popularization of 5G network, such as virtual-real integration, highly simulated equipment and other emerging digital technologies can bring real life situations into the classroom teaching process. The progress of The Times also means that the application prospect of digital technology in the field of education and teaching is very broad and necessary. The teaching concept of situational cognition theory provides real theoretical support for the construction of the teaching mode of the integration of these emerging technologies, such as the design of teaching objectives, teaching activities, learning situation resources and other aspects.

2.3 Application research of Mix Reality Technology in education and teaching of new energy vehicles

2.3.1 The significance of Mix Reality Technology to the field of new energy vehicle manufacturing

Mix Reality Technology can show the suspension, chassis, interior of the car down to every welding point, the designer can determine the quality of each component, understand the performance of each component. The accuracy of the three-dimensional model is so high that carmakers can use the computer data to go straight to mass production. According to relevant reports, since GM and Chrysler adopted mix

reality technology, the time it takes to develop a new model has been reduced from more than a year to about two months. Not only has the time been shortened, but the cost of developing a new model has also been reduced to one-tenth of the original. In traditional car manufacturing, it takes at least 12 to 18 months to develop an individual new car design. One of Chrysler's most expensive centers is the Mercedes design center, where developers and designers can examine the lines and contours of the entire body, as well as overall performance, in mixed reality. The key means to develop the global mixed reality technology new energy vehicle market, through the virtual environment of mixed reality work, to detect the body, analyze the aerodynamics of the car; understand the car performance, etc. The United States, Japan, Europe and other developed countries regard mix reality technology as a key means of competition in the automobile industry.

2.3.2 The enlightenment of Mix Reality Technology to the course teaching of new energy vehicle specialty

Compared with the relatively dull form of the traditional education mode, Mix Reality Technology is easier to realize the means of cultivating students' educational interest in the teaching process at the present stage. What it expresses is not only boring words and pictures, but vivid dynamic mixed learning environment integrating vision, hearing and touch, which is more three-dimensional and intuitive. For example, a smart toy for English learning for 3-6 years old children produced by domestic Tamie Animation not only increases the entertainment and interaction of traditional teaching materials, but also provides more possibilities for diversified teaching forms. Therefore, in order to meet the talent needs of the new energy automobile enterprises in each link, and vigorously develop and cultivate the interdisciplinary and innovative talents of the new energy automobile major, we must have a full understanding of the teaching of the new energy automobile professional courses, no matter setting up major or adding professional courses. Analyzing the characteristics of students and the teaching methods of teachers for the course, these two points are the key to affect the actual development of teachers' teaching and the improvement of students' learning skills. How to carry out the innovative information teaching of new energy vehicle courses according to the vocational requirements of enterprise posts and the characteristics of students is a big problem nowadays. Mix Reality Technology highlights the learning experience with

high degree of simulation in the three aspects of immersive experience, visual display and real-time interaction. This method can not only increase the interest in the learning process, but also stimulate the learning desire of learners.

2.3.3 Application of Mix Reality Technology to the teaching of new energy vehicle major

1) Application of comprehensive fault diagnosis for new energy vehicles

The mixed reality system can be used for virtual setting of vehicle fault diagnosis. Teaching and evaluation of comprehensive fault diagnosis is also one of the important applications of mixed reality in vehicle maintenance. When the teacher teaches the fault diagnosis of the difficulty of starting the automobile engine, the teacher sets the fault location before class, and the students can use the developed mixed reality software to simulate and analyze the working condition of the vehicle. Students understand the working process of various systems in the starting process of a car through wearable devices, and analyze the influence of steam circuit, circuit, oil circuit and ignition. Mixed reality software with teachers' multimedia explanation, further deepen students' grasp of knowledge points. In the process of use can also set up a variety of problems for training, such as the horn does not sound, insufficient oil supply and exhaust emissions. Through the teacher's explanation, the students complete the troubleshooting in the mixed reality software to realize the normal use of the car.

This is just one example of how students use mixed reality technology in troubleshooting. In the motor poor lubrication, steering failure, brake failure and other fault diagnosis also can use the above methods for teaching. Through the above learning methods, students can practice repeatedly in the process of using, and can carry out some exploratory operations in the process of learning. The application of mixed reality technology not only enables students to master skilled maintenance skills, but also improves their creative ability.

2) Application of new energy vehicle test

After learning the troubleshooting and maintenance of cars, students can also complete experiments on the problems that will be encountered in the driving process in the software produced by mix reality technology. For example, experiments on different roads, car crash experiments and steering experiments when sidesaddle

occurs. Experiment with the power of the car and the performance of the chassis. Before conducting various simulations, students should select a car model in the software in advance and input various parameters needed in the experiment. For example, vehicle weight, wheelbase, battery capacity, battery type, wheel position, etc., mixed reality simulation software is used to simulate experimental data of real vehicles, and driving is simulated through human-computer interaction and wearable devices. The computer analyzes the performance of the vehicle according to various parameters and feedbacks the experimental results to the mixed reality equipment. To give the driver the most direct sensory experience. Let the students experience the performance of the car in the experiment, and have a three-dimensional feeling of it. At the same time, modify the parameters of the car in the experiment, and carry out repeated experiments. According to different experimental parameters, the vehicle performance under different conditions was evaluated. Finally, it is possible to obtain the most stable function condition of different kinds of cars at which parameters.

2.4 Relevant research on the application of Mix Reality Technology in education and teaching

The Horizon Report (Higher Education Edition) released in 2019 pointed out: "Mixed reality is one of the technologies that will promote the development of higher education in the future, and will be implemented in the next 2-3 years. Its key feature is interactivity, which gives great potential for learning and assessment. Learners can construct new cognition through the experience of virtual objects". It can be seen that mixed reality has a wide range of application values in the field of education. As the future development trend of international science and technology, mixed reality has begun to emerge, bringing subversive changes to traditional education.

2.4.1 Mix Reality Technology

Mix Reality is the use of advanced computer technology, image processing technology, human-computer interaction technology and display equipment, for the real world, the virtual world and users to build interactive feedback information loop, generating a new real, interactive visual environment. In this environment, physical (real) objects and digital (virtual) objects coexist and interact naturally in

real time. As shown in Figure 2.1, real environment (RE) and virtual environment (VE) are two endpoints of the continuum, and augmented reality (AR) is located at the real end of the continuum, integrating digital objects into the environment of the real world. The augmented virtual (AV) is located at the virtual end of the continuum, introducing physical objects into the environment of the virtual world. In the continuum, any environment in which real objects and virtual elements seamlessly blend in varying degrees is called mixed reality.

Mix Reality technology is composed of two parts, namely augmented virtual and augmented reality. Mix Reality Technology presents virtual scene information in the real scene. However, it does not simply superimpose virtual information on the real scene. Instead, it can realize real-time natural interaction between the virtual world and the real world, and also achieve feedback with users, so that users can feel that they are in a real environment. This theory evolved from Mediated Reality proposed by Steve Mann. The main features of mixed reality technology are: first, virtual-real integration, which displays the real world and virtual things in the same space; the second is three-dimensional registration, which accurately couples virtual things with the real world. The third is real-time interaction, realizing real-time interaction between people and the real world and virtual things. At the same time, human-computer interaction is also an important support for mixed reality.

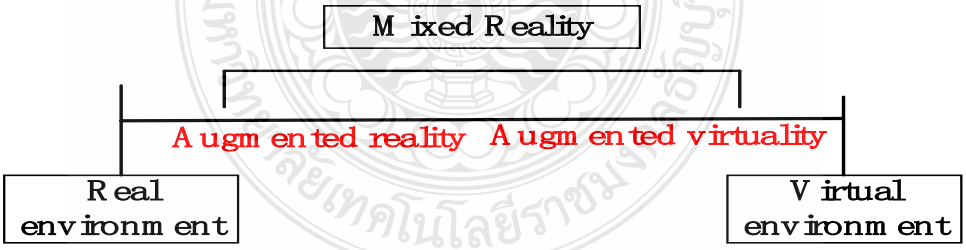

Figure 2.1 The reality-virtual continuum

Because of its excellent experience, Mix Reality Technology has a broad prospect in the design and development of education system. By introducing Mix Reality Technology into teaching and enhancing interactive experience through visual coupling, students can learn immersive and improve their cognitive ability of view interpretation and innovation ability of engineering practice.

At present, Mix Reality Technology has been applied in teaching, digital museum, medical and other fields at home and abroad. In terms of subject classroom teaching, Kai Niu and Yang Lu have applied Mix Reality Technology to PE teaching reform. Rui Wu studied the feasibility of applying Mix Reality Technology and situational awareness in the clinical teaching of cardiac great vascular surgery. In the aspect of intangible cultural heritage education, Jing Zhang discussed the advantages of Mix Reality Technology in the interactive communication of art, and took the beauty of the flow of Dun huang Fei tian art as an example, using Mix Reality Technology to display virtual objects in the real space, and achieve perfect interaction and integration between teachers and students, so that users have an immersive experience. In the medical field, the application of Mix Reality Technology is still in its infancy, especially in neurosurgery and internal medicine. Chao Zhang et al. described the advances in Mix Reality Technology in neurosurgery, including preoperative planning and intra-operative instruction, doctor-patient communication, teaching rotations, and physician training. Rai A T introduced Mix Reality Technology to enable remote teaching of neurological surgery by using an optical head-mounted display for remote monitoring. While wearing the display, the supervisor can see the patient's current condition, while also having the ability to interact virtually with the operator. The specific application is mainly in the following aspects:

1) Teaching reform

Combining mixed reality with traditional teaching can improve learning styles and teaching quality. China Film Creation Technology Group is committed to the research and development of Mix Reality Products. Its promotional video shows the application case of JIMO smart glasses worn by learners. For example, in human geography, the virtual earth stays in mid-air in the form of suspension and dynamically displays the geographical locations of different countries. Learners can analyze and master the internal structure of the earth by means of voice, gesture, drag and click. In auto repair engineering, virtual vehicles are dynamically presented, and learners can intuitively demonstrate the appearance of mechanical equipment, observe the internal structure of different plates of vehicles from various angles, analyze and operate the engine, and understand the working principle of vehicle operation.

Traditional medical teaching uses the apprenticeship model, in which the patient is fully exposed to the entire learning process of the medical student, allowing the student to train in a safe environment without affecting the patient's health. Freschi Parrini et al., University of Pisa, Italy, designed and developed an " Mix Reality -based hybrid interactive system" that simulates ultrasound (US) examination. The system combines physical ultrasonic body models and software applications with 3D virtual scenes to train medical students' spatial perception and hand-eye coordination. The geometric information of its internal structure is obtained by CT scanning and rendering of the body model. A tracker embedded in the virtual probe can track and display the position (direction) of all rendered objects in real time. In the 3D virtual scene, students can observe the section or the whole organ from different angles through human-computer interaction, so as to train the precise location (direction) of the probe and plan its trajectory, which can significantly improve the accuracy of disease diagnosis.

2) Teacher training

In 2018, the Ministry of Education issued Opinions on the Implementation of Excellent Teacher Training Plan 2.0, which pointed out that "virtual reality, augmented reality and mixed reality should be fully utilized to build and develop a batch of interactive and contextualized teacher education curriculum resources". Therefore, using new technology to strengthen teaching skills is the focus of training teachers. Mike Hynes and others from the University of Central Florida developed the "Mix Reality Teaching Training System" specifically for teachers. The system can simulate the real classroom teaching scene and create a teaching environment that integrates virtual students with real class. The experimenter can select "students" who are not in the same class segment according to their own needs, and the virtual students can respond in real time according to the different behaviors and environments of the experimenter. In addition, the experimenter has the right to reset the program at any time to practice repeatedly. The system automatically detects the communication between the experimenter and the "student" and gives timely feedback to the experimenter until the course goes smoothly. This mixed classroom virtual environment provides teachers with a standardized, low-risk and targeted place for skills practice, which helps to train teachers' skills in curriculum teaching, classroom management, teacher and student

behavior, reflect on the teaching process, and enhance teaching confidence. Especially for normal university students and pre-service teachers, " Mix Reality Teaching training system" can help them transfer their acquired teaching skills to real classes, effectively reduce the influence caused by lack of teaching experience during the internship, and greatly improve teachers' teaching practical ability.

3) Venue education

Catalyzed by the idea of informal learning, informal learning environment has increasingly become the focus of attention in the field of education. Venue learning highlights the educational function of the exhibits, emphasizes the sensory experience of the participants in the venue and the interaction with the exhibits, and the venue learning environment represented by the museum has become a typical application of informal learning environment. Museum is a place to collect and display the relics of human history and science, with the mission of spreading culture to the public. However, the current museum exhibition has been a problem of poor user experience. First, because the cultural relics are precious and limited by space, visitors can only take a brief look at them and cannot have in-depth communication with the cultural relics. Second, the current mobile carrier provided by museums has a single interaction mode and imperfect information presentation, which is difficult to meet users' personalized exploration needs. Mixed reality can break through site restrictions and generate three-dimensional images of relevant information about cultural relics so that users can interact with them naturally. In 2018, in the China International Intelligent Industry Expo, the museum applied mixed reality to the map "Augmented Chongqing Geography Map" from the late Qing Dynasty. Users wearing Microsoft's Holo Lens holographic Mix Reality Device can hear clear three-dimensional explanations and see images combining real scenes and dynamic virtual images. It is like being in Chongqing streets, shops, wharves and so on in the late Qing Dynasty. According to the interpretation jump, experience can control the virtual screen through voice and gesture, and have real-time interaction with the virtual characters. Mixed reality makes cultural relics "come alive" and helps visitors to truly understand the historical stories and precious values contained in cultural relics in an all-round and multi-channel way.

4) Laboratory establishment

Laboratory learning can help learners apply theoretical knowledge to practice. Traditional laboratories require sophisticated hardware and software, but financial constraints often inhibit laboratory quality. In addition, learners often need to expend a lot of energy to calibrate and troubleshoot equipment faults, which affects the progress and results of the experiment. In order to solve the problems of traditional laboratories, Jared Frank and others from New York University developed a " Mix Reality Laboratory learning environment" that combines mobile devices with laboratories. By integrating AR technology, visual control and touch screen interaction functions, learners can create a learning place with deep participation anytime and anywhere. The camera function of the mobile device captures the real-time images of the laboratory and projects a 3D virtual scene connected to the experimental platform. Learners can drag and click the touch screen to directly manipulate the virtual experiment. In Mix Reality Environment, the experiment is easy and interesting, which will not cause personal accidents due to operation errors, and reduce the requirements on hardware and software equipment. Laura Lenz and others at RWTH Aachen University in Germany have developed an " Mix Reality Speech lab", a digital construction of a real classroom, which can realistically represent the number of students and the various noises that might be generated. Teachers simulate daily instruction through Mix Reality Displays in virtual environments with specified requirements, such as class size, stereoscopic vision and sound interaction. This immersive lab can help teachers train their voice and master the scientific method of using their voice. The virtual-real integrated learning space constructed by mixed reality not only has a positive impact on the cognitive process of learners, but also provides technical support for the demands of teachers for some skills.

5) Construction and aerospace skills training

Currently, there is a serious shortage of skilled workers in the construction industry. Mix Reality Skills training system can help the new generation of construction workers in the "real" scene hands-on practice, learning while doing, strengthen the application of skills.Wei Wu and others from California State University in the United States conducted an experiment in which trainees were required to wear

personal protective equipment and complete the processing and installation of building materials in the Mix Reality Environment of an outdoor construction laboratory to build a building with three walls, one floor, one window and one door. With the help of Microsoft's Holo Lens holographic Mix Reality Device, trainees can see a 3D design model as it looks in real life. Experiments show that this environment can provide intuitive and real learning experience for trainees, which plays an important role in improving specific vocational skills and promoting understanding of architectural design. Astronauts undergo up to two years of simulated training to adapt to the weightless environment of space and become skilled in various operations, such as spacewalking, carrying equipment on the surface of a planet, adjusting maintenance equipment and rescuing each other in emergencies. Mix Reality Simulation training system can provide real space immersion and presence. Space objects and environmental conditions that do not exist in Earth time and space can directly stimulate the sensory system of trainees. NASA's joint game production team developed an "Mix Reality Simulator for the International Space Station". The simulator has all the elements and instruments of the International Space Station, including the machines and tools needed by the astronauts to carry out equipment maintenance work, which can greatly increase the astronauts' training time, improve their emergency skills, and improve training results.

2.4.2 Advantages of Mix Reality Technology in pedagogy

1) Eliminate knowledge barriers and create vivid scenes

Traditional teaching methods, which usually rely on simple forms such as text, pictures and occasionally video, are fine for answering simple concepts. But for some complex problems, such as macro and micro phenomena, this way will be weak. While knowledge in traditional education is flat, mixed reality technology can present a more three-dimensional world, eliminate the cognitive block caused by space and time, and provide students with a realistic and vivid learning environment. Building model cars, disassembling cars, displaying interior structures, etc., Mix Reality technology can provide students with infinite real experience in the field of electric vehicles. The use of Mix Reality technology can demonstrate some of the internal parts of the complex, abstract concept knowledge. It is not easy to directly observe the

manufacturing of electric vehicles in daily learning, but it can be well completed under Mix Reality technology. In mixed reality technology, learners can enter the interior of objects as large as celestial bodies in the universe and as small as atomic particles for observation. The process of making the car takes months, but it can be demonstrated in a very short time using Mix Reality technology. This kind of all-round and multi-angle display of knowledge greatly enriched the teaching content of the class. Thus accelerate and consolidate their learning process, effectively help students deepen knowledge impression.

2) Flexible teaching and knowledge transfer

Mix Reality technology can provide rich perception and feedback in various aspects (auditory, visual, tactile, etc.) to help learners transfer the content learned in virtual situations to real life and meet the needs of learning new energy vehicles. Mix Reality technology is used to simulate the teaching scenes which are difficult for teachers to explain in the teaching process, so that the classroom learning can be visualized and participatory, and some boring numbers, procedures, principles and processes can be made vivid and interesting. Students can interact with the scene, teachers and students, and master the knowledge of automobile manufacturing more vividly in the Mix Reality technology. In the same mixed reality teaching scene, each student will have different experiences. That is to say, in the same mixed reality teaching scene, simulation can be conducted in different situations according to the differences of each student. This provides a broad teaching space for exploratory learning and interactive learning.

3) Save school costs, avoid real harm

The use of traditional education for teaching is easy to be restricted by equipment, funds, venues and other aspects in the teaching process. Many experiments in operation are dangerous and difficult to carry out in the teaching process. Mix Reality technology can be used to virtual various experimental equipment, training environment and operation process, so that most courses can be carried out in the laboratory, and most skills can be trained in the training workshop, so there is no need to buy expensive experimental and training equipment. And these virtual training systems are not dangerous. Students can practice them over and over again until they master the skills.

Virtual training can avoid the damage of experimental training equipment, the consumption of training materials and other problems, so as to effectively save the cost of education. Mix Reality technology can simulate real scenes, so that students can complete various experiments in the classroom, and get the same feeling as real experience in mixed reality technology. It can be said that, on the premise of ensuring the teaching effect, Mix Reality technology reduces the possible accidents and injuries caused by experimental operation, and greatly reduces the experimental cost for schools.

For example, there will be high voltage electric shock risk in the teaching and maintenance process of new energy vehicles. In order to prevent electric shock risk in the maintenance teaching of new energy vehicles in many colleges and universities, a lot of practical operation projects are eliminated. In the teaching of new energy vehicles using Mix Reality technology, all practical training projects are carried out in the virtual environment without live operation, which is safe and reliable. The practical training operation in Mix Reality teaching system does not disassemble the real parts, which also avoids the damage of parts in the learning process and saves the teaching cost. A set of system can be operated by many people multiple times to save the teaching equipment. The core of virtual reality technology is computer software, which can realize the practical training and teaching function of various environments in the same venue, greatly reducing the teaching cost. It also improves the quality of teaching in schools.

4) Arouse students' interest and increase their participation

Mix Reality technology uses its personalized way, colorful media form and strong sensory experience to promote learners to generate active emotions in the learning process. The mixed reality system can create a humanized learning environment in the middle of any character you can imagine, so that distance education students can learn in a relaxed and friendly atmosphere. Mix Reality technology can prove a large number of virtual cases that mixed reality can bring students a relaxed and pleasant learning environment and stimulate their motivation for learning. In addition, Mix Reality technology can create realistic scenes, provide dynamic and highly interactive Settings, and enable learners to show a high level of learning engagement in them.

2.4.3 Application prospect of Mix Reality Technology in education and teaching

1) Promoting the development of distance education under 5G communication

In 2019, China was the first country to officially enter the 5G era. Compared with previous generations of mobile communication technology, the fifth generation of mobile communication technology, due to its characteristics of high speed, ubiquitous network, low power consumption, low delay, Internet of everything and reconstruction security, will promote the transformation of educational concepts and teaching forms, and will also provide network delay free technology support for mixed reality. For example, the "5G+ Mix Reality Holographic classroom" created by Shadow creation Technology Group provides high-quality display pictures and synchronous interactive effects for teachers and students' teaching and learning, and transforms obscure and abstract knowledge (such as astronomical motion, physical concepts, etc.) into dynamic Mix Reality Holographic 3D models that teachers and students can operate in front of, helping students to obtain intuitive three-dimensional content perception and increasing knowledge retention. In terms of distance education, the combination of 5G and mixed reality will present a new form of classroom teaching, where teachers and students can see both the real environment they are in and 3D virtual teaching content. Teachers and students in different places enter the same holographic space to interact and communicate through hologram generated by Mix Reality technology, realize synchronous teaching with the help of 5G, and improve students' cooperation ability based on remote division of labor. In addition, the wide application of 5G can promote educational equity, increase educational opportunities, high-speed transmission and share educational resources. Uploading the teaching process to the "cloud" terminal through 5G can promote the cultural exchange and learning exploration between teachers and students in different places. The recycling of precipitated knowledge not only reduces the cost of education, but also enables students in areas lacking teaching equipment, resources and funds to enjoy quality education resources equally. In the future, the combination of 5G and mixed reality will contribute to the leapfrog innovation-driven development of Chinese education informatization and improve the timeliness of education and teaching.

2) Support the practice of STEAM education

STEAM is the product of deep integration of science (S), technology (T), engineering(E), art (A) and mathematics (S). It has the characteristics of interduce culinary, collaboration, experience and technology. It advocates the cultivation of students' innovative imagination, collaborative exploration and problem-solving ability, which is the development trend of future education. However, STEAM education encountered a bottleneck after it entered the practice stage. Due to the lack of teachers, curriculum resources and funds, STEAM teaching activities in many schools could not be carried out smoothly. The advantage of mixed reality is that the real thing can be visualized and superimposed onto the virtual world, so that the two exist in the same space and interact in real time. MIX REALITY+STEAM not only provide physical training virtualization, remote coaching and real-time collaborative solutions, but also reduces the need for quality teachers. Teachers from different regions with STEAM education qualifications can teach students through the Mix Reality System in the form of remote guidance to promote the sustainable export of STEAM talents. STEAM requires learners to practice in person. The tools and equipment used in the learning process can generate 3D virtual models through mixed reality. With the help of Mix Reality Display, teachers, students and students can communicate "face to face" in the virtual and real interwoven scenes. MIX REALITY+STEAM can reduce the risk while reducing the cost of education. If the operation of some STEAM related dangerous experiments fails in the Mix Reality System, the consequences will not be presented in the real world, so as to protect the personal and property safety of teachers and students. It can be seen that STEAM education supported by mixed reality can break through the limitations of time, space and conditions and help students complete knowledge construction and skills mastery in a "real" scene.

3) Break the shackles of gamified learning

Gamification learning is to integrate play into learning and use the form of games in teaching activities so that students can easily master knowledge and acquire skills. There are two forms of gamified learning: offline and online. Offline refers to face-to-face games between teachers, students and students indoors or outdoors; Online means that students play autonomously or cooperatively through network devices. However, due

to the cost of game design, the difficulty of setting, the lack of materials and the limitation of environment, the current educational games are mostly suitable for primary school students and young children, and lack of challenging games suitable for college students. With the continuous progress of technological tools, mixed reality, as a new generation of human-computer interaction technology, not only makes gamified learning favored by educators and game designers again, but also provides a new idea for the organic combination of education and game. In offline learning, teachers use mixed reality to reproduce real scenes. For example, when learning the history of The Three Kingdoms Period, by wearing Mix Reality Devices, students can see palaces, battlefields and figures of The Three Kingdoms in 3D virtual form, and students can participate in historical events as game characters. Personal experience and real operation help students "apply what they learn", and multiple students can communicate with each other without obstacles, cooperate and help each other to complete the game tasks, and promote the all-round development of emotion, social interaction, cognition and other aspects. In online learning, educators and game designers develop games corresponding to students' cognitive development rules based on mixed reality. Students mobilize their sensory systems through natural interaction with other game characters or players, breaking the limitation of traditional games that only use mouse, keyboard and other tools to complete the interaction, and encourage students to constantly explore the game process, so as to achieve learning goals. In addition, MIX REALITY+ gamified learning provides a good environment for students' "trial and error". The virtual and real game situations and real tactile operation enable students to dare to try, fail and innovate, so as to realize the emotional transformation from "I want to learn" to "I want to learn".

According to Jonathan, contextual learning only makes sense in a given context. Inspired by situational learning, Herrington proposed a modern teaching concept called "real learning", which places learning in a specific context, often using role playing, case studies, and participation in virtual communities of practice to develop students' comprehensive abilities. According to Herod, the materials and activities of real learning are structured around the context of real life. However, it is difficult for most science and engineering departments to create real scenes to carry out activities, such as Mount Everest in geography and atomic movement in chemistry. Teachers mostly use

pictures and videos to present them, making it difficult for students to enter the country. Mixed reality can "move" the real world into the classroom. Teachers use Mix Reality technology to impact the sensory system of students in the form of 3D virtual extreme environment or invisible abstract knowledge, so as to increase the sense of reality and the sense of substitution, breaking through the practical dilemma of traditional real learning. Collaborative learning is an essential skill proposed for learners in the 21st century with the theme of digital and intelligent education. It requires participants to have a strong sense of teamwork and constantly solve and improve learning tasks. At present, although online education can realize participants' synchronous learning anytime and anywhere, it cannot satisfy the sharing experience of participants in different places. Mix Reality technology can build a complete learning community and provide "face to face" intermediary space for remote participants in collaborative learning. No matter where they are, by wearing an Mix Reality Display, participants are immersed in the same virtual and real space in the form of an avatar to collaborate in real time. In addition, language differences do not matter; the Mix Reality System is capable of simultaneous interpretation. This "what you see is what you get "Mix Reality Environment of human-computer interaction breaks the traditional collaborative learning only relying on visual and auditory transmission of information, especially in the process of engineering design and product manufacturing, "real" haptic feedback can greatly improve the learning efficiency of participants.

CHAPTER 3
RESEARCH METHODOLODY

The research on The development of learning platform with Mix Reality Technology in New Energy Vehicle Teaching for undergraduate student by the researcher follows the following steps:

3.1 Research Design

3.2 Population and Sample

3.3 Research Instrument

3.4 Instruments Development and Evaluation

3.5 Data Collection

3.6 Data Analysis

3.1 Research Design

3.1.1 Investigation and analysis of the teaching status and problems of new energy vehicle courses. Through the investigation, we understand the existing problems in the teaching process of new energy vehicle specialized courses in similar colleges and universities, and the understanding degree, application degree and prospect attitude of fellow teachers towards Mix Reality Technology, which provides a realistic basis for the subsequent teaching design and improvement based on Mix Reality Technology.

3.1.2 Construction of teaching mode of new energy vehicle major courses based on Mix Reality Technology. Based on Mix Reality Technology, the teaching design of the new energy vehicle course is improved, and the action-oriented theory is flexibly applied to the teaching of this major, so as to improve students' self-learning ability and innovative thinking ability, and let students systematically master theoretical knowledge and master practical skills. Taking "Mix Reality New Energy Vehicle simulation training System" as the platform, the teaching case design of "Power train Disassembly and Testing" was completed.

3.1.3 Mix Reality Teaching mode was used to implement teaching. Two parallel classes of Sichuan Light Chemical Engineering University were selected as Mix Reality Class and ordinary class, and specific cases of "Power battery Pack Disassembly and

testing" in the professional course of" New energy vehicle power train technology" were selected for teaching practice. And through the student "questionnaire star" questionnaire and random interviews with students and teachers, the results were analyzed, fully verify the implementation effect of the teaching mode of new energy vehicle major based on Mix Reality Technology.

3.2 Population and Sample

The population is 1901 and Class 1902 of New Energy Vehicles of Mechanical Engineering College of Sichuan University of Light Chemical Industry were selected as Mix Reality classes, with a total of 30 students, which adopt the traditional integrated teaching mode of engineering, science and practice.

3.3 Research Instrument

3.3.1 Questionnaire survey: Visit some representative schools to understand the development, teaching status and existing problems of professional courses related to new energy vehicles, and investigate professional teachers' understanding of Mix Reality Technology, application and prospect attitude, and find out the current problems faced by new energy vehicles in the teaching of professional courses, students' learning needs and teachers' teaching needs.

3.3.2 Complete the teaching design with the software of "Mix Reality New Energy Vehicle Simulation Training System" (Figure 3.1) as the platform. The system software was produced by Unity3D, including the whole vehicle principle display, electric drive system principle, drive motor principle system, power battery system principle, motor control system principle, etc. (Figure 3.2).

Figure 3.1 Mix Reality New energy vehicle simulation training system

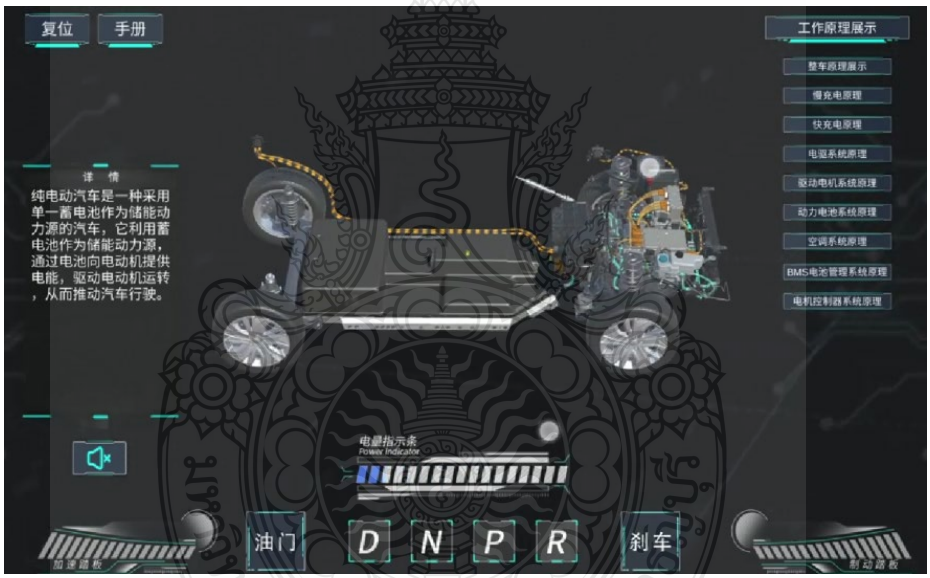

Figure 3.2 Simulation training system working interface

3.3.3 Based on the questionnaire data on "Questionnaire Star", combined with the interview evaluation of students and professional teachers in Mix Reality Class, the result statistics and result analysis were carried out to fully verify the implementation effect of the teaching mode of new energy vehicle major courses based on Mix Reality Technology.

3.4 Instruments Development and Evaluation

3.4.1 Teaching objective design

The famous contemporary American educators divide the cognition field of educational goal into six levels: knowledge, comprehension, application, analysis, synthesis and evaluation. The first level is the most basic learning goal. This kind of knowledge is acquired by memorizing simple concepts, pictures, and phenomena. The second level of comprehension is the lowest level of understanding, which means that an individual does not have to relate a material to other material, but simply understands the meaning of the material. Application of the third pole requires the understanding of the method being applied. A theory, principle, or abstract concept. The fourth level is to analyze the logical relationship and the way of composition of each part. The fifth level of synthesis refers to the combination of various elements and components to form a whole, understanding the process of processing and integration of various elements and components, and the sixth level refers to the correct judgment of works, answers, methods, etc. for a certain purpose. The level of understanding and requirements for different knowledge is an important part of the course objectives.

In the implementation of the following specific courses, different learning objectives should be proposed for each course according to the above teaching objectives, as shown in Table 3.1:

Table 3.1 New energy vehicle course teaching development goals

Course title	Teaching Assessment method	Capability localization	Teaching method	Learning task
Cognition and Safety of New Energy Vehicles	Knowledge objective MIX REALITY Virtual operation assessment	Identify common power electronic devices and high voltage systems of new energy vehicles, correctly use personal and workshop protective equipment of new energy vehicles; learn to deal with electric shock, fire accidents and other emergency treatment of new energy vehicles.	MIX REALITY Virtual teaching	Guided by action, students are guided to make plans to understand the composition and structure of pure electric vehicles. According to the safety regulations of pure electric vehicle maintenance operation and the requirements of vehicle maintenance manual, they are guided to make electric vehicle power-on and power-off working plan.
Disassembly and Testing of Battery and Management System for Pure Electric	Analysis objective MIX REALITY Virtual operation assessment	Identify the power battery, master its characteristics, can correctly detect and maintain the power battery, master the role and characteristics of the main components of the vehicle high voltage system.	MIX REALITY Virtual teaching	Be familiar with the charging process of pure electric vehicles, observe the working principle of high voltage distribution, replace the on-board charger, and replace the DCDC converter.

Table 3.1 New energy vehicle course teaching development goals (Cont.)

Course title	Teaching Assessment method	Capability localization	Teaching method	Learning task
Disassembly and Testing of Electric Motors and Transmission Systems for Pure Electric Application objective	MIX REALITY Virtual operation assessment	Able to identify permanent magnet synchronous motor, induction motor. Proficient in replacing permanent magnet synchronous motor, correct disassembly and testing of motor controller, disassembly and testing of transmission system	MIX REALITY Virtual teaching	Standardize the replacement of synchronous motor, observe the working principle of motor, and disassemble the motor controller to replace the electric water pump, and disassemble and install the transmission system of pure electric vehicle.
Maintenance and Maintenance of New Energy Vehicles Understand the goal	MIX REALITY Virtual operation assessment	Identify the system composition and installation position of pure electric vehicles, standardize the operation of power-on and power-off of pure electric vehicles, and replace the coolant. Battery electric vehicle charging operation.	MIX REALITY Virtual teaching	Replace the oil and coolant of the drive axle and check the insulation resistance of the vehicle.

Table 3.1 New energy vehicle course teaching development goals (Cont.)

Course title	Teaching	Assessment method	Capability localization	Teaching method	Learning task
Disassembly and Testing of Battery and Management System for Pure Electric Vehicles	Comprehensive objective	MIX REALITY Virtual operation assessment	Charging fault diagnosis and troubleshooting, motor overheating fault diagnosis and troubleshooting, insulation fault diagnosis and troubleshooting, high voltage power-on fault diagnosis and troubleshooting.	MIX REALITY Virtual teaching	Abnormal charging, motor overheating, abnormal sound of driving motor, etc.

3.4.2 Teaching activities design

Different teaching modes have their differences, and specific teaching logic and teaching procedures and processes, teaching activities can be said to define teachers and students, what should be completed first, what needs to be completed later and other steps and corresponding tasks under the teaching mode. Based on the teaching mode of Mix Reality Technology course, the principle of student-subject and teacher-led must still be adhered to, so as to truly realize the "seamless connection" between the cultivated students and the new energy automobile enterprises' requirements for application-oriented skilled talents, the teaching activities designed in this study include six links, the relationship of which is shown in Figure 3.3.

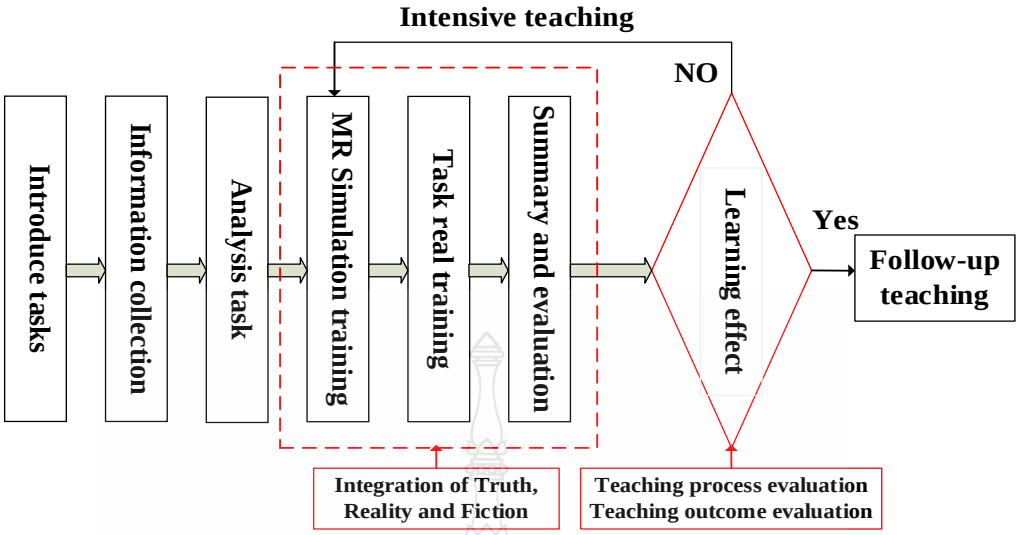

Figure 3.3 Teaching activities based on Mix Reality Technology New energy vehicle curriculum teaching mode

1) Introduce tasks

That is, teachers use pre-record "teaching video" or micro-class resources, or use "teaching training car" real car simulation and other means to show a certain fault phenomenon in the course of new energy vehicles to better give students a full understanding of the knowledge task points of the class.

2) Information collection

After fully understanding the task point, students collect relevant information about the task point by consulting relevant materials, such as training vehicle maintenance manuals, user manuals, teaching materials, mobile phones and computers, as well as network resource libraries.

3) Analysis task

Based on the collected information, the team worked together to develop a solution to the training task, and the plan discussed should be illustrated, clear, comprehensive, operable and scientific.

4) Mix Reality Simulation training

The students worked out the final training plan according to the group and conducted the simulation training on the Mix Reality Equipment to verify the effectiveness of the training plan, and made cognitive preparation for the practical

training in advance. The teacher mainly played the role of supervision and guidance in the simulation operation of the multi-person collaborative mixed reality scene.

5) Task real training

Students verify good practical training solutions according to Mix Reality Simulation training, carry out virtual and real transfer of knowledge, and can apply the perfect idea of task solving and operational skills to real practical training equipment, such as new energy practical training vehicle or teaching building block platform. In this process, the role of teachers is still supervision and guidance.

6) Summary and evaluation

According to the classroom performance of each group in the first five aspects, the teacher carries out self-evaluation, mutual evaluation and teacher evaluation, and finally obtains the results comprehensively. However, students should reflect on and improve themselves according to the teacher's evaluation and feedback. If the teacher thinks that the students' mastery of knowledge points and skills is not good, intensive teaching can be carried out until the students' learning feedback is good or even excellent.

3.4.3 Teaching conditions design

Teaching model to play its important effect of various conditions and factors, such as the situation of teachers and students, teaching specific content, teaching methods or means, teaching environment and teaching duration and so on. The key condition to achieve the teaching mode based on Mix Reality Technology course is the integrated application of hardware and software required in the teaching process.

1) Teaching "soft" conditions.

For example, the preparation of teaching materials, maintenance manuals, series of micro lessons, material files, working pages, PPT and supporting exercises and other resources required in the teaching process.

2) Teaching "hard" conditions.

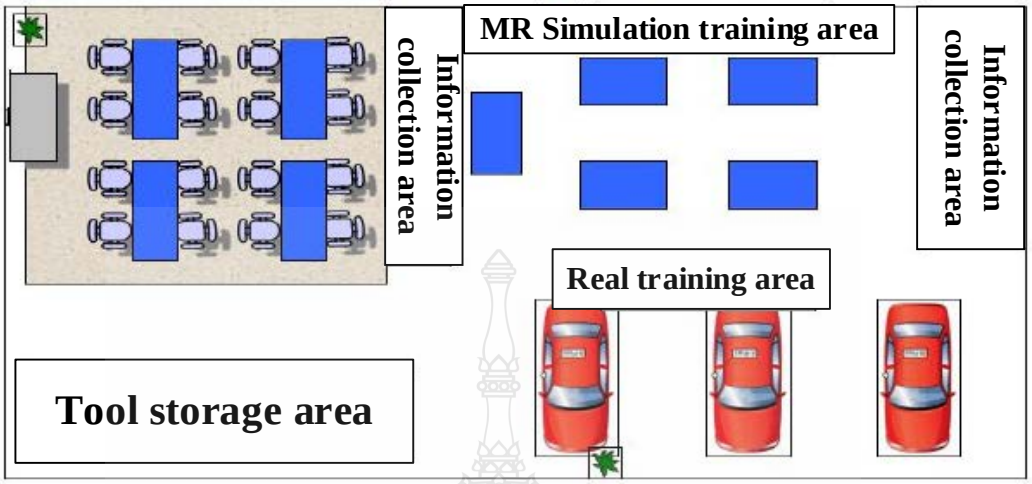

Figure 3.4 To realize the teaching layout of Mix Reality Technology new energy vehicle major courses

The required "hard" conditions are the core of successfully integrating Mix Reality Technology into course teaching, including Mix Reality Intelligent equipment that can realize "virtual", new energy practical training vehicle or teaching building block platform that can realize "real", and teaching environment that can realize "virtual and real" at the same time, as shown in Figure 3.4. None of the three conditions is necessary.

3.4.4 Teaching evaluation design

The evaluation of the teaching model of Mix Reality Technology integrated into the teaching of new energy vehicle is a necessary means to adjust and improve the teaching quality. According to the new requirements of the current teaching evaluation reform, the integration of engineering and technology can still be implemented based on Mix Reality Technical courses: Teaching evaluation mainly highlights students' skills assessment for learning new energy vehicles. In this teaching mode, schools and enterprises jointly develop teaching content, schools take the lead in teaching, enterprises assist, teaching evaluation is mainly based on teachers, and students' self-evaluation and mutual evaluation are combined. In the comprehensive skills training, that is, the internship stage, the teaching content is set according to the needs of the enterprise position, so the enterprise dominates the teaching of students, the

school plays an auxiliary role, and the teaching evaluation is jointly evaluated by the enterprise and the school. Process evaluation, including moral education, professional quality and cultural accomplishment, is adopted in every activity link of Mix Reality Technology integrated into the teaching of new energy vehicle major. Finally, result evaluation, such as theoretical knowledge assessment and skill training assessment, is carried out. If the students are qualified, both the process and the result examination need to meet the qualification standard.

3.5 Data Collection

3.5.1 Questionnaire survey of "Teaching Status of New Energy Vehicle Professional Courses"

This study visited Yibin Vocational and Technical College, Yibin College, Sichuan Light Chemical Engineering University, Xihua University (Yibin Campus), and Xingwen Vocational and Technical School, and collected data by stratified random sampling among students majoring in automotive. Questionnaires were distributed on site (see Appendix A). 40 questionnaires were distributed in each college, totaling 200. Students give anonymous answers on the spot and collect them on the spot in order to collect accurate and effective data sources. A preliminary review was conducted on the collected questionnaires, among which 14 were invalid (because the answers did not meet the requirements of the questionnaire), and the remaining 186 were valid questionnaires, which were summarized and sorted out.

3.5.2 Questionnaire on the Application of Mix Reality Technology in the teaching of new energy Major Courses

From the perspective of professional teachers in colleges and universities, the questionnaire (see Appendix B) is prepared for the teaching application of new energy vehicle courses. Through the questionnaire survey of teachers with 10 questions, it is hoped that the current situation and existing problems of the application of Mix Reality Technology by new energy vehicle teachers in teaching can be learned, and the foundation can be laid for the subsequent optimization practice research of teaching mode.

This study is carried out in the form of "Question star" network questionnaire, which is distributed in the wechat group (85 people) of the backbone training class for new energy automobile major teachers in the past two years, and forwarded to each other by fellow teachers who know each other. This network questionnaire is set up, and each person can only fill in the report once, and the universities of the survey objects have a wide coverage and certain representativeness. This can fully guarantee the authenticity and validity of the survey data.

3.5.3 Questionnaire on Teaching Effect of "Power train Disassembly and Testing" Project

In order to have a more effective and accurate understanding of the teaching effect and quality of the new energy vehicle major course based on Mix Reality Technology, a post-class follow-up survey was conducted among the students and professional teachers in the form of "questionnaire star" questionnaire survey (see Appendix C) and interview evaluation. A total of 10 single choice questions were prepared for the questionnaire, which was designed and collected mainly according to six basic conditions of the two classes' teaching objectives, teaching activities, link design, teaching conditions and environment, teaching evaluation methods, teaching interest and teaching satisfaction.

3.6 Data Analysis

3.6.1 Questionnaire Data Analysis. The paper version questionnaire and "questionnaire star" questionnaire were distributed on the spot to understand the demand of Mix Reality Teaching system for college teaching and the recognition degree of teachers and students; Through sorting out and analyzing the data collected by the questionnaire, regularities and problems are found from the survey results.

3.6.2 Reliability test analysis.

Reliability refers to the reliability of the test results and is usually expressed in terms of internal consistency. The higher the reliability coefficient, the more reliable the test is.

The Cronbach Alpha reliability coefficient is currently the commonly used reliability test. Generally, we consider that when the Cronbach Alpha coefficient is above 0.7, the questionnaire has good internal consistency, i.e. it passes the reliability test.

If it is between 0.5 and 0.7, the reliability result is barely acceptable; if it is below 0.5, it fails the reliability test. The statistical software excel was used here to test the reliability of the pre-test and post-test data of the questionnaire.

3.6.3 Validity test analysis.

Validity refers to the degree of validity of a measure, i.e., the degree to which the instrument is able to measure the trait it is intended to measure. The study began with KMO test and a Bartlett's spherical hypothesis test to determine the validity of the questionnaire data by determining whether the questionnaire was suitable for factor analysis.

According to the scholar Kaiser (1974), if the KMO value is greater than 0.9, it is considered to be well suited for factor analysis, if the KMO value is greater than 0.6, it is considered to be more suitable, and if the KMO is less than 0.5, it is considered to be unsuitable for factor analysis.

CHAPTER 4
RESEARCH RESULT

In line with the research aims, this chapter is designed to show and discuss the results of the experiment by following the structure below.

4.1 Results of learning platform with Mix Reality Technology in New Energy Vehicle Teaching for undergraduate student to have quality.

4.2 Results of comparison of the pre-test and post-test scores of students after learning with learning platform with Mix Reality Technology in New Energy Vehicle Teaching for undergraduate student.

4.3 Results of determine students' satisfaction towards learning platform with Mix Reality Technology in New Energy Vehicle Teaching.

4.1 Results of learning platform with Mix Reality Technology in New Energy Vehicle Teaching for undergraduate student to have quality.

4.1.1 Media quality assessment results.

Quality assessment results from media experts as shown in Table 4.1

Table 4.1 Quality assessment results from media experts

Option	$\bar{X}$	S.D.	Meaning
1. The knowledge structure design of Mix Reality Technology is very reasonable.	5.00	0.00	excellent
2. The organization mode and interface design of the Mix Reality Technology platform is very convenient.	5.00	0.00	excellent
3. The communication and sharing function of the Mix Reality Technology platform is very useful.	4.67	0.58	excellent
4. The course video explanation is comprehensive and clear.	4.00	0.00	good
5. Course video has high picture quality and smooth viewing.	4.33	0.58	good
6. The Mix Reality Technology course navigation interface is properly designed and easy to click.	4.33	0.58	good

Table 4.1 Quality assessment results from media experts (Cont.)

Option	$\bar{X}$	S.D.	Meaning
7. The Mix Reality Technology courses are rich in resources and can attract interest from learners to learn.	4.67	0.58	excellent
8. Can quickly and easily browse the Mix Reality Technology course content.	5.00	0.00	excellent
9. The Mix Reality Technology course content is simple and suitable for learners to study independently.	5.00	0.00	excellent
10. The Mix Reality Technology course page has a reasonable layout, coordinated color collocation, and moderate page information.	5.00	0.00	excellent
Total	4.70	0.23	excellent

Form table 4.1 presents the results of media quality assessments of learning platform; overall, it was found that the quality is excellent level ($\bar{X}$= 4.70). When considering each item, it was found that the knowledge structure design, the organization mode and interface design, the browse the mix reality Technology course content, simple and suitable for learners to study independently, the course page layout, coordinated color collocation, and moderate page information, are excellent level ($\bar{X}$= 5.00).

4.1.2 Content quality assessment results

Quality assessment results from content experts as shown in Table 4.2

Table 4.2 Quality assessment results from content experts

Option	$\bar{X}$	S.D.	Meaning
1. The Mix Reality Technology courses can arouse strong learners' interest in learning.	5.00	0.00	excellent
2. The Mix Reality Technology courses are simple and knowledge-specific.	5.00	0.00	excellent
3. The Mix Reality Technology courses are moderately difficult.	4.67	0.58	excellent
4. Concordance between Mix Reality Technology courses and learning objectives.	5.00	0.00	excellent
5. The Mix Reality Technology course arranges the content for easy understanding.	4.67	0.58	excellent
6. The Mix Reality Technology courses activities are consistent with the content.	5.00	0.00	excellent
7. The Mix Reality Technology courses is very interesting.	5.00	0.00	excellent
8. The Mix Reality Technology courses resources are very rich.	5.00	0.00	excellent
9. The chapters of the Mix Reality Technology courses are properly connected.	4.67	0.58	excellent
10. The chapters of the Mix Reality Technology courses are properly integrity.	4.67	0.58	excellent
Total	4.87	0.23	excellent

From table 4.2 presents the results of content quality assessments of learning platform, overall, it was found that the quality of video media on social media is at an excellent level ($\bar{X}$= 4.87). When considering each item, it was found that consistency between content and learners' interest in learning, content are simple and knowledge-specific, content consistent with learning objectives, content with activities, content design, content resources is complete were excellent level ($\bar{X}$= 5.00).

4.2 Results of comparison of the pre-test and post-test scores of students after learning with learning platform with Mix Reality Technology in New Energy Vehicle Teaching for undergraduate student.

Table 4.3 Results of comparison of the pre-test and post-test scores of student's after learning with learning platform with Mix Reality Technology in New Energy Vehicle Teaching for undergraduate student

Items	n	$\bar{X}$	S.D.	t-test	Sig. (2-tailed)
Pre-test	30	12.25	2.02	2	0.00**
Post-test	30	15.95	1.43		

**p< .05

From table 4.3 the results of the pre-test and post-test tests of the students had an average score of 12.25 points and 15.95 points, respectively. When comparing the pre-test and post-test scores, it was found that the post-test scores were higher than pre-test scores, with statistical significance at the level. The result after applying the mic reality Technology in New Energy Vehicle Teaching constituted a substantial improvement in students which translated into a high post-test 15.95, and t-test analysis before and after the treatment 2 which demonstrated a considerable difference was statistically significant at the 0.05 level.

4.3 Results of determine students' satisfaction towards learning platform with Mix Reality Technology in New Energy Vehicle Teaching.

Table 4.4 Results of study the satisfaction of students who learned with learning platform with Mix Reality Technology in New Energy Vehicle Teaching for undergraduate student

Option	X	S.D.	Meaning
1. The Mix Reality Technology course content creates a strong interest in learning.	4.67	0.58	Highest
2. The Mix Reality Technology courses enable me to learn better skills and knowledge.	4.33	0.58	High
3. The Mix Reality Technology courses can learn more efficiently.	4.67	0.58	Highest
4. This course is helpful to improve my ability of independent learning.	4.00	0.00	High
5. The knowledge structure of the course is reasonably designed.	4.67	0.58	Highest
6. The Mix Reality Technology courses are concise and knowledge-specific.	4.67	0.58	Highest
7. The Mix Reality Technology course videos explanation is comprehensive and clear.	4.67	0.58	Highest
8. The Mix Reality Technology course navigation interface is reasonably designed and easy to click.	4.33	0.58	High
9. The Mix Reality Technology course videos have high picture quality and smooth viewing.	4.67	0.58	Highest
10. The Mix Reality Technology course has appropriate difficulty.	4.33	0.58	High
Total	4.50	0.52	Highest

From table 4.4 it is found that the students are overall satisfied with learning platform with Mix Reality Technology in New Energy Vehicle Teaching Overall, it was found that the quality of the students' satisfaction is at an excellent level ($\bar{X}$ = 4.50). When considering each item, it was found that learning interest, learning efficiency, knowledge structure design, videos have high picture quality and smooth viewing are at an excellent level ($\bar{X}$ = 4.67) and learning Professional course through Mix Reality Technology creates a good atmosphere in the classroom.

CHAPTER 5
CONCLUSIONS DISCUSSION AND RECOMMENDATION

The development of learning platform with Mix Reality Technology in New Energy Vehicle Teaching for undergraduate student. The researcher has conclusions, discussion and recommendations are as follows.

5.1 Conclusions

5.2 Discussions

5.3 Recommendations

5.1 Conclusions

5.1.1 Results of learning platform with Mix Reality Technology in New Energy Vehicle Teaching for undergraduate student to have quality are as follow;

5.1.1.1 Media quality assessment results

The results of media quality assessments of learning platform; overall, it was found that the quality is excellent level ($\bar{X}$= 4.70). When considering each item, it was found that the knowledge structure design, the organization mode and interface design, the browse the mix reality Technology course content, simple and suitable for learners to study independently, the course page layout, coordinated color collocation, and moderate page information, are excellent level ($\bar{X}$= 5.00).

5.1.1.2 Content quality assessment results

The results of content quality assessments of learning platform, overall, it was found that the quality of video media on social media is at an excellent level ($\bar{X}$= 4.87). When considering each item, it was found that consistency between content and learners' interest in learning, content are simple and knowledge-specific, content consistent with learning objectives, content with activities, content design, content resources is complete were excellent level ($\bar{X}$= 5.00).

5.1.2 Results of comparison of the pre-test and post-test scores of students after learning with learning platform with Mix Reality Technology in New Energy Vehicle Teaching for undergraduate student.

3 the results of the pre-test and post-test tests of the students had an average score of 12.25 points and 15.95 points, respectively. When comparing the pre-test and post-test scores, it was found that the post-test scores were higher than pre-test scores, with statistical significance at the level. The result after applying the mic reality Technology in New Energy Vehicle Teaching constituted a substantial improvement in students which translated into a high post-test 15.95, and t-test analysis before and after the treatment 2 which demonstrated a considerable difference was statistically significant at the 0.05 level.

5.1.3 Results of determine students' satisfaction towards learning platform.

the students are overall satisfied with learning platform with Mix Reality Technology in New Energy Vehicle Teaching Overall, it was found that the quality of the students' satisfaction is at an excellent level ($\bar{X}$= 4.50). When considering each item, it was found that learning interest, learning efficiency, knowledge structure design, videos have high picture quality and smooth viewing are at an excellent level ($\bar{X}$= 4.67) and learning Professional course through Mix Reality Technology creates a good atmosphere in the classroom.

5.2 Discussions

This paper is a full construction practice of the application of Mix Reality Technology in the teaching mode of new energy vehicle professional courses: First of all, starting from the market development needs of domestic new energy vehicles and the position ability of enterprises, combined with the investigation and analysis of students' own characteristics and the teaching status of new energy vehicles professional courses, under the guidance of Action-oriented theory, In line with the analysis and research of the application status, feasibility, demands of teachers and students, and technical support of national policies and enterprises of Mix Reality Technology in the teaching of new energy vehicle professional courses, a set of teaching mode of new energy vehicle professional courses based on Mix Reality Technology is constructed. A specific case of

"Disassembly and testing of power battery pack" was selected for teaching verification, and the survey results and interviews with teachers and students were analyzed, which initially confirmed the rationality and effectiveness of the proposed teaching model for new energy vehicle courses based on Mix Reality Technology. The research results can be discussed as follows.

5.2.1 Study the preliminary work

Through the relevant literature research: Micro-video has its special advantages: First, present the material clearly in a way that is accessible to the learner's needs. Second, students can learn content independently. Third, students experience information comprehensively, mobilize different sensory experience materials, and perceive teaching content in a three-dimensional and comprehensive way through videos, text materials, and oral descriptions. Fourthly, the teaching content can be repeated and vivid form to attract and keep students' attention. Through research of Mix Reality Technology in education and teaching of new energy vehicles: Mix Reality Technology have many advantages: First, eliminate knowledge barriers and create vivid scenes; Second, flexible teaching and knowledge transfer; Third, save school costs, avoid real harm; Fourthly, arouse students' interest and increase their participation.

5.2.2 Research later work

In this study, the new energy vehicle course teaching model based on Mix Reality Technology was proposed; the later work is mainly to implement the teaching mode of new energy vehicle courses based on Mix Reality Technology, and analyze the effect of its application in practice. In order to verify the practicability and effectiveness of the teaching mode of integrating Mix Reality Technology into new energy vehicle major courses designed by this research institute, this paper selected two parallel classes of Sichuan Light Chemical Engineering University as Mix Reality Technology Class and ordinary class, and selected a specific case of "Disassembly and testing of power battery pack" for teaching design, working pages and other practices. Finally, through the questionnaire of students' teaching effect combined with the interviews of students and teachers, the results are analyzed. The research shows that the teaching mode of new energy vehicle courses based on Mix Reality Technology designed in this paper can

effectively improve the teaching effect and learning quality of students, and is highly anticipated and favored by students and teachers.

5.2.3 New energy vehicle curriculum teaching model results analysis based on Mix Reality Technology.

The teaching model of new energy vehicle major course based on Mix Reality Technology is reasonable and feasible. By applying the teaching mode of the new energy vehicle major course based on Mix Reality Technology to the teaching process of the specific case "Power battery Pack disassembly and detection" of the core course "New Energy Vehicle Power Battery Technology", six teaching activities can be found under this teaching mode. That is to say, "task introduction - information collection - task analysis -Mix Reality Simulation training - real task training - summary evaluation" has a complete process and teaching effect. Especially with the support of Mix Reality Technology, when teachers think that students' grasp of knowledge and skills is not good, intensive teaching of Mix Reality Simulation training can be carried out. The design of these six activities It can reasonably guide the teaching design and concrete practice of each teaching content. In addition, from the questionnaire survey of students participating in the implementation cases and randomly selected interviews with teachers and students, the overall satisfaction of the teaching model shows that although there may be some imperfections in the application process of the teaching model of the new energy automobile course based on Mix Reality Technology, it is generally reasonable and feasible. However, in the process of practical teaching, although the course resources supported by Mix Reality Technology can fully arouse students' learning interest and teamwork consciousness, the real-time performance of the interaction process needs to be improved. Therefore, more in-depth research is needed on the design of teaching links of this teaching mode.

5.3 Recommendations

5.3.1 Recommendations from the research results

5.3.1.1 Research results analysis

As for this study, after proposing the teaching mode of new energy vehicle major courses based on Mix Reality Technology and completing the framework

design, there is a shortage in the selection of teaching cases for the implementation of the verification process and the selection of teachers and students. It is expected that in the follow-up practical teaching, students in other courses, grades and classes of the new energy vehicle major can be taken as the object of the research, and the influencing factors of the teaching mode can be considered in various aspects, so as to further improve and supplement the research, so as to more completely verify the optimization effect of Mix Reality Technology in the teaching application of the new energy vehicle major.

5.3.1.2 Recommendations from students

Mix Reality Technology uses its personalized way, colorful media form and strong sensory experience to promote learners to generate active emotions in the learning process. first, the students who participate in this teaching mode think that classroom teaching is more interesting and vivid, which can stimulate their learning interest and keep it. Second, after students participate in the teaching mode, they are more inclined to continue to make friends with Mix Reality Technology to improve their professional knowledge and skills. Third, the teaching activities designed in this teaching mode are more in line with the needs of students, such as psychology, interest or age characteristics.

5.3.1.3 Recommendations from teachers

Through the analysis of the investigation and interview of the evaluation content of the application teaching mode of the new energy automobile course based on Mix Reality Technology, it can be believed that the construction practice of the teaching mode is real and effective, and has more excellent effects on the evaluation indicators: first, this teaching mode is more conducive to helping students clearly define the teaching objectives in the classroom. Second, the integrated teaching of Mix Reality Technology makes the teaching environment and conditions of the whole new energy vehicle course more advanced. Third, the combination of process assessment and result assessment of this teaching model reflects a fairer and reasonable teaching evaluation.

5.3.2 Suggestions for Future Research

Further extension and promotion of the teaching model of new energy vehicle courses based on Mix Reality Technology. The research in this paper is based on the teaching mode of Mix Reality Technology in the new energy vehicle major course.

Due to the problems in the construction resources of Mix Reality Equipment and training room in schools, practical teaching is somewhat difficult. The high cost of Mix Reality Equipment and the current situation of school capital investment are also a major obstacle to this research. However, we should firmly believe that the era of Mix Reality Mixed reality will eventually usher in, and will inevitably bring great changes to human life and production. Therefore, even though there is still a long way to go before the application of Mix Reality Technology in education and teaching, we need to further extend and promote this advance preparation. For example, this paper only researches in the teaching field of new energy vehicle professional courses. However, Mix Reality Technology can also be extended to the teaching of general courses in compulsory education or secondary vocational education, which is not only limited to the courses of new energy vehicles, but also can be vigorously promoted to other majors, such as building construction, landscape technology, e-commerce, etc., to carry out professional course teaching model reform based on Mix Reality Technology and provide reference. Thus, the teaching reform of national education curriculum was promoted.

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APPENDIX

APPENDIX A

- List of experts reviewing research instruments

- Invitation Letter to experts to examine research instruments

List of experts reviewing research instruments

Measurement and evaluation name Specialists

1. Assoc. Prof. Dr. Pimolpun. Phetsombat, Lecturer in Educational Administration Department Faculty of Technical Education, Rajamangala University of Technology Thanyaburi, Thailand.
   e-mail: pimolpun_p@rmutt.ac.th
2. Asst. Prof. Dr. Sorasak Chiewchan , Department of Liberal Arts, Faculty of Business Administration and Liberal Arts,
   Rajamangala University of Technology Lanna, Thailand.
   e-mail: dorakeng@hotmail.co.th
3. Asst. Prof. Dr. Wiroj Mongkolthep, Major of Applied Statistics, Department of Science, Faculty of Science and Agricultural Technology,
   Rajamangala University of Technology Lanna Nan, Thailand
   e-mail: wiroj@rmutl.ac.th

Content Specialists

1. Professor Jianping Tian , Mechanical Engineering, School of Mechanical Engineering, Sichuan Light Chemical Engineering University, Yibin, China.
   e-mail: 409507648@qq.com
2. Asst. Prof. Bo Huang, Mechanical and Electronic Engineering, School of Mechanical Engineering, Sichuan Light Chemical Engineering University, Yibin, China.
   e-mail: 670708517@qq.com
3. Asst. Prof. Jin Hao, School of Mechanical Engineering, Vehicle Engineering, Sichuan Light Chemical Engineering University, Yibin, China.
   e-mail: 844205860@qq.com

List of experts reviewing research instruments

Media Specialists

1. Asst. Prof. Dr. Narumon Rodniam, The Faculty of Education,
   National Sports University, Chumphon Campus, Thailand.
   e-mail: patumariya@gmail.com
2. Asst. Prof. Dr. Kampanat Kusirirat, Department of Animation Game and Digital Media, Faculty of Science and Technology, Bansomdejchaopraya Rajabhat University, Thailand.
   e-mai : ajdankampanat@gmail.com
3. Asst. Prof. Dr. Surakij Prangsorn. Lecturer of Department of Communication Arts Technology Faculty of Architecture and Design,
   Rajamangala University Technology of Rattanakosin, Thailand
   e-mail: surakij.s@gmail.com

Invitation letter to experts to examine research instruments

MHESI 1401/2023

Office of the Dean, Faculty of Technical Education
Rajamangala University of Technology Thanyaburi
Klong Luang, Pathum Thani 12110 Thailand
Tel:+66-2-549-4710 Fax:+66-2-577-5049

8 November, 2023

Dear Assoc. Prof. Dr.Pimolpun. Phetsombat, Lecturer in Educational Administration Department Faculty of Industrial Education Rajamangala University of Technology Thanyaburi

Subject: Respectfully Requesting for letter of Invitation of Experts for M.Ed.Thesis

I am writing to request your assistance as an honorary external research reviewer in evaluating the research instruments of Ms. Jie Feng, Master of Education Program in Technology and Learning Innovation Rajamangala University of Technology Thanyaburi, who has been working on the thesis titled "Application and Research of MR Technology in New Energy Vehicle Teaching". under the supervision of Assistant Professor Dr.Naruemon Thepnuan. In this regard, I would like to request your valuable time to evaluate the research instruments as I strongly believe that your expertise will be of great value in improving the research instruments.

If you have any questions or need further information, please feel free to contact Ms. Jie Feng, on the e-mail: jie_f@mail.rmutt.ac.th

Yours sincerely,

(Assistant Professor Arnon Niyomphol)
Dean of Faculty of Technical Education

MHESI 1401.1/2023

Office of the Dean, Faculty of Technical Education
Rajamangala University of Technology Thanyaburi
Klong Luang, Pathum Thani 12110 Thailand
Tel:+66-2-549-4710 Fax:+66-2-577-5049

8 November, 2023

Dear Asst. Prof. Dr.Sorasak Chiewchan ,Department of Liberal Arts, Faculty of Business Administration and Liberal Arts, Rajamangala University of Technology Lanna
Subject: Respectfully Requesting for letter of Invitation of Experts for M.Ed.Thesis

I am writing to request your assistance as an honorary external research reviewer in evaluating the research instruments of Ms. Jie Feng, Master of Education Program in Technology and Learning Innovation Rajamangala University of Technology Thanyaburi, who has been working on the thesis titled "Application and Research of MR Technology in New Energy Vehicle Teaching", under the supervision of Assistant Professor Dr.Naruemon Thepnuan. In this regard, I would like to request your valuable time to evaluate the research instruments as I strongly believe that your expertise will be of great value in improving the research instruments.

If you have any questions or need further information, please feel free to contact Ms. Jie Feng, on the e-mail: jie_f@mail.rmutt.ac.th

Yours sincerely,

(Assistant Professor Arnon Niyomphol)
Dean of Faculty of Technical Education

MHESI 1401.2/2023

Office of the Dean, Faculty of Technical Education
Rajamangala University of Technology Thanyaburi
Klong Luang, Pathum Thani 12110 Thailand
Tel:+66-2-549-4710 Fax:+66-2-577-5049

8 November, 2023

Dear Asst. Prof. Dr.Wiroj Mongkolthep, Major of Applied Statistics, Department of Science, Faculty of Science and Agricultural Technology, Rajamangala University of Technology Lanna Nan

I am writing to request your assistance as an honorary external research reviewer in evaluating the research instruments of Ms. Jie Feng, Master of Education Program in Technology and Learning Innovation Rajamangala University of Technology Thanyaburi, who has been working on the thesis titled "Application and Research of MR Technology in New Energy Vehicle Teaching". under the supervision of Assistant Professor Dr.Naruemon Thepnuan. In this regard, I would like to request your valuable time to evaluate the research instruments as I strongly believe that your expertise will be of great value in improving the research instruments.

If you have any questions or need further information, please feel free to contact Ms. Jie Feng, on the e-mail: jie_f@mail.rmutt.ac.th

Yours sincerely,

(Assistant Professor Arnon Niyomphol)
Dean of Faculty of Technical Education

MHESI 1401.3/2023

Office of the Dean, Faculty of Technical Education
Rajamangala University of Technology Thanyaburi
Klong Luang, Pathum Thani 12110 Thailand
Tel:+66-2-549-4710 Fax:+66-2-577-5049

8 November, 2023

Dear Professor Jianping Tian , Mechanical Engineering, School of Mechanical Engineering, Sichuan Light Chemical Engineering University, Yibin, China.

I am writing to request your assistance as an honorary external research reviewer in evaluating the research instruments of Ms. Jie Feng, Master of Education Program in Technology and Learning Innovation Rajamangala University of Technology Thanyaburi, who has been working on the thesis titled "Application and Research of MR Technology in New Energy Vehicle Teaching". under the supervision of Assistant Professor Dr.Naruemon Thepnuan. In this regard, I would like to request your valuable time to evaluate the research instruments as I strongly believe that your expertise will be of great value in improving the research instruments.

If you have any questions or need further information, please feel free to contact Ms. Jie Feng, on the e-mail: jie_f@mail.rmutt.ac.th

Yours sincerely,

(Assistant Professor Arnon Niyomphol)
Dean of Faculty of Technical Education

MHESI 1401.4/2023

Office of the Dean, Faculty of Technical Education
Rajamangala University of Technology Thanyaburi
Klong Luang, Pathum Thani 12110 Thailand
Tel:+66-2-549-4710 Fax:+66-2-577-5049

8 November, 2023

Dear Asst. Prof. Bo Huang, Mechanical and Electronic Engineering, School of Mechanical Engineering, Sichuan Light Chemical Engineering University, Yibin, China

I am writing to request your assistance as an honorary external research reviewer in evaluating the research instruments of Ms. Jie Feng, Master of Education Program in Technology and Learning Innovation Rajamangala University of Technology Thanyaburi, who has been working on the thesis titled "Application and Research of MR Technology in New Energy Vehicle Teaching". under the supervision of Assistant Professor Dr.Naruemon Thepnuan. In this regard, I would like to request your valuable time to evaluate the research instruments as I strongly believe that your expertise will be of great value in improving the research instruments.

If you have any questions or need further information, please feel free to contact Ms. Jie Feng, on the e-mail: jie_f@mail.rmutt.ac.th

Yours sincerely,

(Assistant Professor Arnon Niyomphol)
Dean of Faculty of Technical Education

MHESI 1401.5/2023

Office of the Dean, Faculty of Technical Education
Rajamangala University of Technology Thanyaburi
Klong Luang, Pathum Thani 12110 Thailand
Tel:+66-2-549-4710 Fax:+66-2-577-5049

8 November, 2023

Dear Asst. Prof. Jin Hao, School of Mechanical Engineering, Vehicle Engineering, Sichuan Light Chemical Engineering University, Yibin, China.

I am writing to request your assistance as an honorary external research reviewer in evaluating the research instruments of Ms. Jie Feng, Master of Education Program in Technology and Learning Innovation Rajamangala University of Technology Thanyaburi, who has been working on the thesis titled "Application and Research of MR Technology in New Energy Vehicle Teaching". under the supervision of Assistant Professor Dr.Naruemon Thepnuan. In this regard, I would like to request your valuable time to evaluate the research instruments as I strongly believe that your expertise will be of great value in improving the research instruments.

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Yours sincerely,

(Assistant Professor Arnon Niyomphol)
Dean of Faculty of Technical Education

MHESI 1401.7/2023

Office of the Dean, Faculty of Technical Education
Rajamangala University of Technology Thanyaburi
Klong Luang, Pathum Thani 12110 Thailand
Tel:+66-2-549-4710 Fax:+66-2-577-5049

8 November, 2023

Dear Asst. Prof. Dr.Kampanat Kusirirat, Ph.D. Department of Animation Game and Digital Media, Faculty of Science and Technology, Bansomdejchaopraya Rajabhat Universit

I am writing to request your assistance as an honorary external research reviewer in evaluating the research instruments of Ms. Jie Feng, Master of Education Program in Technology and Learning Innovation Rajamangala University of Technology Thanyaburi, who has been working on the thesis titled "Application and Research of MR Technology in New Energy Vehicle Teaching". under the supervision of Assistant Professor Dr.Naruemon Thepnuan. In this regard, I would like to request your valuable time to evaluate the research instruments as I strongly believe that your expertise will be of great value in improving the research instruments.

If you have any questions or need further information, please feel free to contact Ms. Jie Feng, on the e-mail: jie_f@mail.rmutt.ac.th

Yours sincerely,

(Assistant Professor Arnon Niyomphol)
Dean of Faculty of Technical Education

MHESI 1401.6/2023

Office of the Dean, Faculty of Technical Education
Rajamangala University of Technology Thanyaburi
Klong Luang, Pathum Thani 12110 Thailand
Tel:+66-2-549-4710 Fax:+66-2-577-5049

8 November, 2023

Dear Asst. Prof. Dr.Narumon Rodniam, The Faculty of Education, Thailand National Sports University, Chumphon Campus.

I am writing to request your assistance as an honorary external research reviewer in evaluating the research instruments of Ms. Jie Feng, Master of Education Program in Technology and Learning Innovation Rajamangala University of Technology Thanyaburi, who has been working on the thesis titled "Application and Research of MR Technology in New Energy Vehicle Teaching". under the supervision of Assistant Professor Dr.Naruemon Thepnuan. In this regard, I would like to request your valuable time to evaluate the research instruments as I strongly believe that your expertise will be of great value in improving the research instruments.

If you have any questions or need further information, please feel free to contact Ms. Jie Feng, on the e-mail: jie_f@mail.rmutt.ac.th

Yours sincerely,

(Assistant Professor Arnon Niyomphol)
Dean of Faculty of Technical Education

MHESI 1401.8/2023

Office of the Dean, Faculty of Technical Education
Rajamangala University of Technology Thanyaburi
Klong Luang, Pathum Thani 12110 Thailand
Tel:+66-2-549-4710 Fax:+66-2-577-5049

8 November, 2023

Dear Asst.Prof.Surakij Prangsorn, Ph.D, Lecturer of Department of Communication Arts Technology Faculty of Architecture and Design Rajamangala University Technology of Rattanakosin

I am writing to request your assistance as an honorary external research reviewer in evaluating the research instruments of Ms. Jie Feng, Master of Education Program in Technology and Learning Innovation Rajamangala University of Technology Thanyaburi, who has been working on the thesis titled "Application and Research of MR Technology in New Energy Vehicle Teaching". under the supervision of Assistant Professor Dr.Naruemon Thepnuan. In this regard, I would like to request your valuable time to evaluate the research instruments as I strongly believe that your expertise will be of great value in improving the research instruments.

If you have any questions or need further information, please feel free to contact Ms. Jie Feng, on the e-mail: jie_f@mail.rmutt.ac.th

Yours sincerely,

(Assistant Professor Arnon Niyomphol)
Dean of Faculty of Technical Education

APPENDIX B

Index of item objective congruence (IOC) form

Index of item objective congruence (IOC) form to create a quality assessment form for the new energy vehicle course teaching mode based on Mix Reality Technology for undergraduate student: content (For measurement and evaluation experts)

Explain:

Please place a check mark (✓) in the quality level box that corresponds to your opinion. The quality levels are as follows:

+1 item is considered congruent with the objectives.

0 item is considered neutral in terms of whether it was congruent with the objectives.

-1 item is considered not congruent with the objectives.

Option	Consistency value			Suggestions
	+1	0	-1	
1. The Mix Reality Technology courses can arouse strong learners' interest in learning.				
2. The Mix Reality Technology courses are simple and knowledge-specific.				
3. The Mix Reality Technology courses are moderately difficult.				
4. Concordance between Mix Reality Technology courses and learning objectives.				
5. The Mix Reality Technology course arranges the content for easy understanding.				
6. The Mix Reality Technology courses activities are consistent with the content.				
7. The Mix Reality Technology courses is very interesting.				
8. The Mix Reality Technology courses resources are very rich.				
9. The chapters of the Mix Reality Technology courses are properly connected.				
10. The chapters of the Mix Reality Technology courses are properly integrity.				

Suggestion

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Index of item objective congruence (IOC) form to create a quality assessment form for the new energy vehicle course teaching mode based on Mix Reality Technology for undergraduate student: media (For measurement and evaluation experts)

Explain:

Please place a check mark (✓) in the quality level box that corresponds to your opinion. The quality levels are as follows:

+1 item is considered congruent with the objectives.
0 item is considered neutral in terms of whether it was congruent with the objectives.
-1 item is considered not congruent with the objectives.

Option	Consistency value			Suggestions
	+1	0	-1	
1. The knowledge structure design of Mix Reality Technology courses is very reasonable.				
2. The organization mode and interface design of the Mix Reality Technology platform is very convenient.				
3. The communication and sharing function of the Mix Reality Technology platform is very useful.				
4. The Mix Reality Technology course video explanation is comprehensive and clear.				
5. The Mix Reality Technology course video has high picture quality and smooth viewing.				
6. The Mix Reality Technology course navigation interface is properly designed and easy to click.				
7. The Mix Reality Technology courses are rich in resources and can attract interest from learners to learn.				
8. Can quickly and easily browse the Mix Reality Technology course content.				
9. The Mix Reality Technology course content is simple and suitable for learners to study independently.				
10. The Mix Reality Technology course page has a reasonable layout, coordinated color collocation, and moderate page information.				

Suggestion

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Index of item objective congruence (IOC) form to create an assessment of student satisfaction who learned with the new energy vehicle course teaching mode based on Mix Reality Technology for undergraduate student (For measurement and evaluation experts)

Explain:

Please place a check mark (✓) in the quality level box that corresponds to your opinion. The quality levels are as follows:

+1 item is considered congruent with the objectives.
0 item is considered neutral in terms of whether it was congruent with the objectives.
-1 item is considered not congruent with the objectives.

Option	Consistency value			Suggestions
	+1	0	-1	
1. The Mix Reality Technology course content creates a strong interest in learning.				
2. The Mix Reality Technology courses enable me to learn better skills and knowledge.				
3. The Mix Reality Technology courses can learn more efficiently.				
4. This course is helpful to improve my ability of independent learning.				
5. The knowledge structure of the course is reasonably designed.				
6. The Mix Reality Technology courses are concise and knowledge-specific.				
7. The Mix Reality Technology course videos explanation is comprehensive and clear.				
8. The Mix Reality Technology course navigation interface is reasonably designed and easy to click.				
9. The Mix Reality Technology course videos have high picture quality and smooth viewing.				
10. Mix Reality Technology course has appropriate difficulty.				

Suggestion

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Index of item objective congruence (IOC) form to create academic achievement test (pre-test and post-test) on the new energy vehicle course teaching mode based on Mix Reality Technology for undergraduate student
(For measurement and evaluation experts)

Explain:

Please place a check mark (✓) in the quality level box that corresponds to your opinion. The quality levels are as follows:

+1 item is considered congruent with the objectives.
0 item is considered neutral in terms of whether it was congruent with the objectives.
-1 item is considered not congruent with the objectives.

Option	Consistency value			Suggestions
	+1	0	-1	
1. Charging the power battery pack of pure electric vehicles by direct current refers to ( )? A. Charger B. DC charging C. AC charging D. Charging plug				
2. The following is correct about the secondary maintenance of the drive system. A. Secondary maintenance projects can be completed by secondary technicians B. The maintenance of the drive system is a high-voltage electrical operation and requires a guardian C. The focus of maintenance is insulation resistance test D. The focus of maintenance is installation inspection				
3. when the motor is running under the rated working state, the stat-or circuit added ( ) is called the rated voltage. A. Line voltage B. Phase voltage C. Peak voltage D. External voltage				
4. The Atkinson cycle engine was invented in ( )? A. 1880 B. 1788 C. 1882 D. 1862				

Option	Consistency value			Suggestions
	+1	0	-1	
5.The drawback of fuel cells is not ( )? A. High security requirements B. Require high quality sealing C. High efficiency D. The cost is too high				
6. The wire in the electric line of new energy vehicles can be divided into ( )and high voltage lines according to the voltage level. A. Low pressure line B. Take the wire C. Signal cable D. Power cord				
7. The role of thermal relay in three-phase asynchronous motor circuit is ( ). A. Under voltage protection B. Overload protection C. Short circuit protection D. Over-voltage protection				
8. The fixed tooth speed ratio reducer is more normal gear oil capacity ( ). A. 2 liters B. 4 liters C. 4.5 liters D. 5 liters				
9. When replacing the motor coolant, where is the motor coolant generally released ( ). A. Motor drain bolt port B. cooling water tank drain valve C. motor outlet pipe D. cooling water tank outlet pipe				
10. The warranty period of new energy vehicles is generally ( ). A. 100,000 kilometers in 3 years B. 150,000 kilometers in four years C. 5 years 200,000 kilometers D. 300,000 kilometers in 6 years				
11. The high voltage wire harness insulation inspection, the use of instruments ( ). A. Digital megohm meter B. Multimeter C. Ground resistance tester D. Electric bridge				

Option	Consistency value			Suggestions
	+1	0	-1	
12. Qingdao Laixi Beiqi new energy vehicle EC180 single charge range is ( ). A. 180KM B. 280KM C. 380KM D. 500KM				
13. Power coupling meets both torque coupling conditions, and ( ) coupling conditions of electromagnetically devices called power coupling system. A. Speed B. Power C. Speed D. None of the above is true				
14. Electric vehicles, ternary lithium battery commonly used cooling methods are ( ). A. air cooling B. water cooling C. oil cold D. Air cooling				
15. Compared with pure electric vehicles, extended-range electric vehicles can use ( ) capacity of the power battery pack, which is conducive to reducing the cost of the power battery pack. A. General B. Larger C. Small D. None of the above is true				
16. In order to ensure the safety of the use of the battery pack, the SOC of the battery pack is often used to define the SOC of the battery pack( ). A. The best B. The worst C. Average level D. Any one				
17. The following do not belong to the conventional charging method ( ). A. Constant current charging mode B. Pulse charging method C. Constant voltage charging method D. Stage charging method				

Option	Consistency value			Suggestions
	+1	0	-1	
18. BS system motor for the starter/generator integrated motor, used to control the engine stop and ( ), thus canceling the idle speed of the engine, reducing fuel consumption and emissions. A. Start B. Idle speed C. Accelerate D, Slow down				
19. The use of hybrid vehicles ( ) can achieve the power superposition of different power sources. A. The best A. Hydraulic torque converter B. Hydraulic coupler C. Clutch D. Power coupler				
20. The human body is standing on the ground or other grounded body, and the electric shock caused by a part of the human body touching a phase of the charged body is called ( ). A. Single-phase electric shock B. Two-phase electric shock C. Step voltage shock D. Contact voltage shock				

Suggestion

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APPENDIX C

Expert Assessment Reports

Table appc.1 Results of the Index of Conformity (IOC) evaluation to create a quality assessment form for the new energy vehicle course teaching mode based on Mix Reality Technology for undergraduate student: content (For measurement and evaluation experts)

No.	Experts			Total	IOC	Meaning
	1	2	3			
1	+1	+1	+1	3	1.00	Can be used
2	+1	+1	+1	3	1.00	Can be used
3	+1	+1	+1	3	1.00	Can be used
4	+1	+1	+1	3	1.00	Can be used
5	+1	+1	+1	3	1.00	Can be used
6	+1	+1	+1	3	1.00	Can be used
7	+1	+1	+1	3	1.00	Can be used
9	+1	+1	+1	3	1.00	Can be used
10	+1	+1	+1	3	1.00	Can be used
Total average					**1.00**	

From Table appc.1, it is found that every question has an index of consistency between the test and learning objectives in the range of 1.00 can be used to create content quality assessment form.

Table appc.2 Results of the Index of Conformity (IOC) evaluation to create a quality assessment form for the new energy vehicle course teaching mode based on Mix Reality Technology for undergraduate student: media (For measurement and evaluation experts)

No.	Experts			Total	IOC	Meaning
	1	2	3			
1	+1	+1	+1	3	1.00	Can be used
2	+1	+1	+1	3	1.00	Can be used
3	+1	+1	+1	3	1.00	Can be used
4	+1	+1	+1	3	1.00	Can be used
5	+1	+1	+1	3	1.00	Can be used
6	+1	+1	+1	3	1.00	Can be used
7	+1	+1	+1	3	1.00	Can be used
9	+1	+1	+1	3	1.00	Can be used
10	+1	+1	+1	3	1.00	Can be used
Total average					**1.00**	Can be used

From Table appc.2, it is found that every question has an index of consistency between the test and learning objectives in the range of 1.00 can be used to create media quality assessment form.

Table appc.3 Results of the Index of Conformity (IOC) form to create an assessment of student satisfaction who learned with the new energy vehicle course teaching mode based on Mix Reality Technology for undergraduate student (For measurement and evaluation experts)

No.	Experts			Total	IOC	Meaning
	1	2	3			
1	+1	+1	+1	3	1.00	Can be used
2	+1	+1	+1	3	1.00	Can be used
3	+1	+1	+1	3	1.00	Can be used
4	+1	+1	+1	3	1.00	Can be used
5	+1	+1	+1	3	1.00	Can be used
6	+1	+1	+1	3	1.00	Can be used
7	+1	+1	+1	3	1.00	Can be used
9	+1	+1	+1	3	1.00	Can be used
10	+1	+1	+1	3	1.00	Can be used
Total average					1.00	Can be used

From Table appc.3, it is found that every question has an index of consistency between the test and learning objectives in the range of 1.00 can be used to create an assessment of student satisfaction form.

Table appc.4 Results of the Index of Conformity (IOC) evaluation to create academic achievement test (pre-test and post-test) on the new energy vehicle course teaching mode based on Mix Reality Technology for undergraduate student (For measurement and evaluation experts)

No.	Experts			Total	IOC	Meaning
	1	2	3			
1	+1	+1	+1	3	1.00	Can be used
2	+1	+1	+1	3	1.00	Can be used
3	+1	+1	+1	3	1.00	Can be used
4	+1	+1	+1	3	1.00	Can be used
5	+1	+1	+1	3	1.00	Can be used
6	+1	+1	+1	3	1.00	Can be used
7	+1	+1	+1	3	1.00	Can be used
9	+1	+1	+1	3	1.00	Can be used
10	+1	+1	+1	3	1.00	Can be used
11	+1	+1	+1	3	1.00	Can be used
12	+1	+1	+1	3	1.00	Can be used
13	+1	+1	+1	3	1.00	Can be used
14	+1	+1	+1	3	1.00	Can be used
15	+1	+1	+1	3	1.00	Can be used
16	+1	+1	+1	3	1.00	Can be used
17	+1	+1	+1	3	1.00	Can be used
18	+1	+1	+1	3	1.00	Can be used
19	+1	+1	+1	3	1.00	Can be used
20	+1	+1	+1	3	1.00	Can be used
Total average					1.00	Can be used

From Table appc.4, it is found that every question has an index of consistency between the test and learning objectives in the range of 1.00 can be used to create academic achievement test (pre-test and post-test) form.

APPENDIX D

A quality assessment form

A quality assessment form for the new energy vehicle course teaching mode based on Mix Reality Technology for undergraduate student: content

Explain

Please place a check mark (✓) in the quality level box that corresponds to your opinion. The quality levels are as follows:

Level 5 means excellent
Level 4 means good
Level 3 means moderate
Level 2 means sufficient
Level 1 means improvement

Option	Consistency value					Suggestions
	5	4	3	2	1	
1. The Mix Reality Technology course content can arouse strong learners' interest in learning.						
2. The Mix Reality Technology courses are simple and knowledge-specific.						
3. The Mix Reality Technology courses are moderately difficult.						
4. Concordance between Mix Reality Technology course content and learning objectives.						
5. The Mix Reality Technology course arranges the content for easy understanding.						
6. The Mix Reality Technology course activities are consistent with the content.						
7. Mix Reality Technology course content design is very interesting.						
8. Mix Reality Technology course teaching content resources are very rich.						
9. The chapters of the Mix Reality Technology courses are properly connected.						
10. The chapters of the Mix Reality Technology courses are properly integrity.						

Suggestion

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A quality assessment form for the new energy vehicle course teaching mode based on Mix Reality Technology for undergraduate student: media

Explain:

Please place a check mark (✓) in the quality level box that corresponds to your opinion. The quality levels are as follows:

Level 5 means excellent
Level 4 means good
Level 3 means moderate
Level 2 means sufficient
Level 1 means improvement

Option	Consistency value					Suggestions
	5	4	3	2	1	
1. The knowledge structure design of Mix Reality Technology is very reasonable.						
2. The organization mode and interface design of the Mix Reality Technology platform is very convenient.						
3. The communication and sharing function of the Mix Reality Technology platform is very useful.						
4. The Mix Reality Technology course video explanation is comprehensive and clear.						
5. The Mix Reality Technology course video has high picture quality and smooth viewing.						
6. The Mix Reality Technology course navigation interface is properly designed and easy to click.						
7. The Mix Reality Technology courses are rich in resources and can attract interest from learners to learn.						
8. Can quickly and easily browse the Mix Reality Technology course content.						
9. The Mix Reality Technology course content is simple and suitable for learners to study independently.						
10. The Mix Reality Technology course page has a reasonable layout, coordinated color collocation, and moderate page information.						

Suggestion

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Assessment of student satisfaction who learned with assessment of student satisfaction who learned with the new energy vehicle course teaching mode based on Mix Reality Technology for undergraduate student
(For students)

Explain:
Please place a check mark (✓) in the quality level box that corresponds to your opinion. The quality levels are as follows:

Level 5 means highest
Level 4 means high
Level 3 means moderate
Level 2 means poor
Level 1 means very poor

Option	Consistency value					Suggestions
	5	4	3	2	1	
1. The Mix Reality Technology course content creates a strong interest in learning.						
2. The Mix Reality Technology courses enable me to learn better skills and knowledge.						
3. The Mix Reality Technology courses can learn more efficiently.						
4. This course is helpful to improve my ability of independent learning.						
5. The knowledge structure of the course is reasonably designed.						
6. The Mix Reality Technology courses are concise and knowledge-specific.						
7. The Mix Reality Technology course video explanation is comprehensive and clear.						
8. The Mix Reality Technology course navigation interface is reasonably designed and easy to click.						
9. The Mix Reality Technology course videos have high picture quality and smooth viewing.						
10. The Mix Reality Technology course has appropriate difficulty.						

Suggestion
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Academic achievement test (pre-test and post-test) on the new energy vehicle course teaching mode based on Mix Reality Technology for undergraduate student

Explain: choose the single most correct answer.

1. Charging the power battery pack of pure electric vehicles by direct current refers to ( ).

A. Charger
B. DC charging
C. AC charging
D. Charging plug

2. The following is correct about the secondary maintenance of the drive system.

A. Secondary maintenance projects can be completed by secondary technicians
B. The maintenance of the drive system is a high-voltage electrical operation and requires a guardian
C. The focus of maintenance is insulation resistance test
D. The focus of maintenance is installation inspection

3. when the motor is running under the rated working state, the stat-or circuit added ( ) is called the rated voltage.

A. Line voltage
B. Phase voltage
C. Peak voltage
D. External voltage

4. The Atkinson cycle engine was invented in ( )?

A. 1880
B. 1788
C. 1882
D. 1862

5.The drawback of fuel cells is not ( )?

A. High security requirements
B. Require high quality sealing
C. High efficiency
D. The cost is too high

6. The wire in the electric line of new energy vehicles can be divided into ( ) and high voltage lines according to the voltage level.

A. Low pressure line
B. Take the wire
C. Signal cable
D. Power cord

7. The role of thermal relay in three-phase asynchronous motor circuit is ( ).

A. Under voltage protection
B. Overload protection
C. Short circuit protection
D. Over-voltage protection

8. The fixed tooth speed ratio reducer is more normal gear oil capacity ( ).

A. 2 liters
B. 4 liters
C. 4.5 liters
D. 5 liters

9. When replacing the motor coolant, where is the motor coolant generally released ( ).

A. Motor drain bolt port
B. cooling water tank drain valve
C. motor outlet pipe
D. cooling water tank outlet pipe

10. The warranty period of new energy vehicles is generally ( ).

A. 100,000 kilometers in 3 years
B. 150,000 kilometers in four years
C. 5 years 200,000 kilometers
D. 300,000 kilometers in 6 years

11. The high voltage wire harness insulation inspection, the use of instruments ( ).

A. Digital megohm meter
B. Multimeter
C. Ground resistance tester
D. Electric bridge

12. Qingdao Laixi Beiqi new energy vehicle EC180 single charge range is ( ).

A. 180KM
B. 280KM
C. 380KM
D. 500KM

13. Power coupling meets both torque coupling conditions, and ( ) coupling conditions of electromagnetically devices called power coupling system.

A. Speed
B. Power
C. Speed
D. None of the above is true

14. Electric vehicles, ternary lithium battery commonly used cooling methods are ( ).

A. air cooling
B. water cooling
C. oil cold
D. Air cooling

15. Compared with pure electric vehicles, extended-range electric vehicles can use ( ) capacity of the power battery pack, which is conducive to reducing the cost of the power battery pack.

A. General
B. Larger
C. Small
D. None of the above is true

16. In order to ensure the safety of the use of the battery pack, the SOC of the battery pack is often used to define the SOC of the battery pack ( ).

A. The best
B. The worst
C. Average level
D. Any one

17. The following do not belong to the conventional charging method ( ).

A. Constant current charging mode
B. Pulse charging method
C. Constant voltage charging method
D. Stage charging method

18. BS system motor for the starter/generator integrated motor, used to control the engine stop and ( ), thus canceling the idle speed of the engine, reducing fuel consumption and emissions.

A. Start
B. Idle speed
C. Accelerate
D, Slow down

19. the use of hybrid vehicles ( ) can achieve the power superposition of different power sources.

A. Hydraulic torque converter
B. Hydraulic coupler
C. Clutch
D. Power coupler

20. The human body is standing on the ground or other grounded body, and the electric shock caused by a part of the human body touching a phase of the charged body is called ( ).

A. Single-phase electric shock
B. Two-phase electric shock
C. Step voltage shock
D. Contact voltage shock

APPENDIX E

Teaching documents

The new energy vehicle course teaching mode based on Mix Reality Technology

By Ms. Jie Feng

Thesis Title: The development of learning platform of Mix Reality Technology in New Energy Vehicle Teaching for undergraduate student

1. Selection of implementation cases “Disassembly and testing of power battery pack" project based on Mix Reality Technology

In the teaching and implementation of Mix Reality Technology application new energy vehicle courses, the selection of teaching cases must ensure that they are representative and have practical significance. In this study, I chose "New Energy Vehicle Power Battery Technology”, as shown in Figure 1.1, in the new energy vehicle major course, which is one of the core courses of the major. In the construction of new energy vehicles, the most core component is the power battery pack, which has its own high voltage. For example, the voltage of the power battery pack in BYD e5 in the practical training teaching car is as high as 633.6V. When students learn this course, there are certain security risks in the teaching of practical training projects, so the hands-on opportunities of students have been "reduced", resulting in poor learning results. In this course, the project "Disassembly and testing of power battery pack" is selected as the implementation content of the case. This project includes the basic knowledge of power battery pack, disassembly, appearance inspection and installation, which requires students to participate in the whole process of knowledge, disassembly and monitoring of power battery pack. Therefore, the project "Disassembly and testing of power battery pack" is a good case choice for applying Mix Reality Technology to teaching.

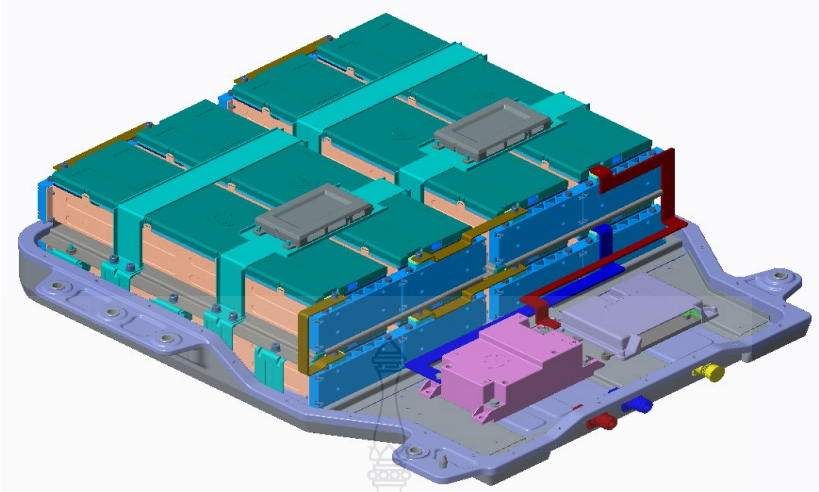

Figure appe.1 New energy vehicle power battery pack

2. Teaching design of "Disassembly and Testing of Power Battery Pack" project

1) Preparation before class

Release micro-class videos and electronic materials related to this class using the Super Star Learning platform before class; Monitoring students' learning effect and online tutoring through Learning Link; Collect students' difficulties and comments on preview. Preparation before class is shown in Table 1.

Table 1 The preparation phase before class

Teaching link	Teacher activity	Student activity	Aid and function of information technology
Teachers publish work pages and related learning resources before class, and students preview and complete the exercises on the work pages independently	(1) Before class, the teacher will use the Super Star Learning platform to publish working pages and micro-lesson videos and electronic materials related to this class; (2) Monitoring students' learning effect and online tutoring through learning group chat; (3) Collect students' difficulties and comments on preview.	(1) Students receive working pages on the Superstar Learning platform before class, watch micro-class videos, PPT and related learning resources through the self-learning platform, and conduct self-learning before class; (2) Complete the working page of the Superstar learning platform; (3) The knowledge points that have not been mastered are asked and communicated through group chat.	(1) By releasing the preview task list before class on the learning communication platform, teachers and students can communicate quickly and instantaneously, which improves the communication efficiency between teachers and students (2) Self-learning platform micro-class videos and excellent network resources expand students' learning time and space, and realize fragmented learning. (3) Make analysis and statistics on the effect of students' preview, and prepare for the follow-up teaching by focusing on the knowledge points that students fail to grasp.

2) Classroom implementation

Including: task introduction, information collection, task analysis, Mix Reality Simulation training, task real training, summary evaluation, etc. Preparation before class is shown in Table 2.

Table 2 Classroom implementation stage

Teaching link	Teacher activity	Student activity	Aid and function of information technology
(1) Introduce tasks (15 minutes)	(1) The teacher opens the learning platform to set up the sign-in; (2) Teachers use micro-video to explain work tasks, reflecting the combination of teaching and practice, and developing new tasks by task; (3) Emphasize the safety rules of operation in the training room.	(1) Students open the learning platform and start to sign in; (2) Students work in groups to understand the content and requirements of work tasks (3) After-school development and communication.	(1) Use the learning-pass platform to sign in and improve attendance efficiency; (2) Micro-video task-driven teaching extends students' learning interest and desire, and enables them to have a further simple understanding of the project task; (3) Design intention: to imitate the working environment and tasks of corporate posts, let students take the role of corporate employees, arouse students' interest in the learning process, and promote students to develop good job responsibilities and qualities.
(2) Collect information (30 minutes)	Set a "group task" related to the content of this lesson on the learning platform, and explain the duration of the task and group assessment Division rules.	Students work in small groups by consulting maintenance manuals and teaching Materials, network resource library and other ways to complete the super star learning platform Group task.	(1) The class activity "group task" on the Learn pass platform is used to consolidate students' basic knowledge, and the group scoring system stimulates students' learning interest. (2) Design intention: to promote the development of independent learning and the ability to consult relevant materials, so that students can understand the relevant knowledge of the task.
(3) Task analysis (15 minutes)	(1) The task given by the teacher, set up "theme discussion" activities on the learning platform; (2) Display students' analysis process of the task through mobile screen projection technology, and make comments and summaries.	Students take groups as units, from the perspective of work tasks, analyze the solutions and ways of work tasks, and publish the answers to the "topic discussion" on the learning platform.	(1) Guide students to think and discuss problems and understand the solution process of the task through the "topic discussion" activity of the task on the learning communication platform. (2) Design intention: to promote problem analysis ability; Independent learning will be carried out after the practical training operation plan is developed and perfected, so that students can understand how to complete the task.

Table 2 Classroom implementation stage (Cont.)

Teaching link	Teacher activity	Student activity	Aid and function of information technology
(4) MIX REALITY Simulation training (80 minutes)	(1) Teachers play a supervisory and guiding role in the simulation operation of students' multi-person collaborative MIX REALITY Scenarios. (2) Wear MIX REALITY Equipment to pay attention to the safety of practical students	The students worked out the final practical training plan according to the group and carried out the simulated practical training on the MIX REALITY Equipment, verified the effectiveness of the practical training plan and made cognitive preparation for the practical training in advance.	(1) The use of MIX REALITY Equipment among various groups can realize multi-person collaborative mixed reality scene simulation operation, which can better resolve difficult knowledge; (2) Design intention: allow students to transform the intangible theoretical knowledge into a "virtual" tangible entity, while getting familiar with the operation and cognition of learning tasks, and promote the cultivation of hands-on ability and practical problem solving ability; Simulate the real work tasks and work processes of enterprise positions, so that students can understand the job responsibilities and norms.
(5) Task real training (80 minutes)	(1) The teacher assigned the project practical operation task and explained the practical training safety rules; (2) Project practical operation guidance.	(1) Students can verify good practical training solutions according to MIX REALITY Simulation training, carry out virtual and real transfer of knowledge, and apply the perfect ideas and operational skills to solve tasks on real practical training equipment, such as new energy practical training vehicles or vehicles (2) The implementation is assisted by two-dimensional code of teaching materials, resource inquiry of teaching platform, and screen projection technology of mobile phone camera.	(1) After the simulated practical training on the MIX REALITYE quipment, the teacher's real practical operation guidance and information technology assisted teaching enable the students to better complete the project tasks, and realize the integrity and effect of the students' practical operation. (2) Design intention: to promote the cultivation of hands-on ability and practical problem solving ability; Simulate the real work tasks and work processes of enterprise positions, so that students can understand the job responsibilities and norms.
(6) Summary evaluation (15 minutes)	(1) The teacher will make comments according to the practical training performance of each group; (2) Statistical summary of project task teaching results	(1) Each group will send a representative to the stage to explain the results of the group; (2) Conduct self-evaluation and inter-group mutual evaluation according to the evaluation indicators given by the teacher, and fill in the "Group Evaluation Feedback Form".	(1) The ternary evaluation standards of self-assessment, mutual assessment and teacher comments highlight the main position of students' learning and make the evaluation more scientific. (2) Design intention: Develop students' self-evaluation ability through self-evaluation, mutual evaluation and teacher comments, and consolidate students' awareness of practical training norms for learning tasks in the final teacher summary.

3) After-class development and communication

Publish the "discussion" task through the learning platform, such as the learning extension of this course or the missing points of this course to leave a message; Keep abreast of students' project and task learning. Preparation before class is shown in Table 3.

Table 3 After-class development and communication stage

Teaching link	**Teacher activity**	**Student activity**	**Aid and function of information technology**
After-school outreach and communication	(1) The teacher releases "discussion" tasks through the learning platform after class, such as about the learning extension of the class or the "discussion" The missing points of the next class doubt points to leave a message; (2) Timely understanding of students' project task learning.	(1) Students complete the task of "discussion" on the learning platform Learning extension and doubt message; (2) For questions or interested questions posted learning Learn the platform and communicate with teachers.	Through the "discussion" section of the learning communication platform, the project tasks are further summarized, students' awareness of learning extension is cultivated, and students' learning situation of learning the content of this course is timely understood, so as to enhance the interaction between teachers and students after class.

3. The teaching design with the software of "Mix Reality New Energy Vehicle Simulation Training System" as the platform.

The system software (Figure 3.1-3.8) was produced by Unity3D; The new energy vehicle Mix Reality Training system includes new energy steam structure and principle cognition system, Mix Reality Driving system, Mix Reality Disassembly system, Mix Reality Fault detection system, virtual maintenance and other comprehensive practical training, etc.

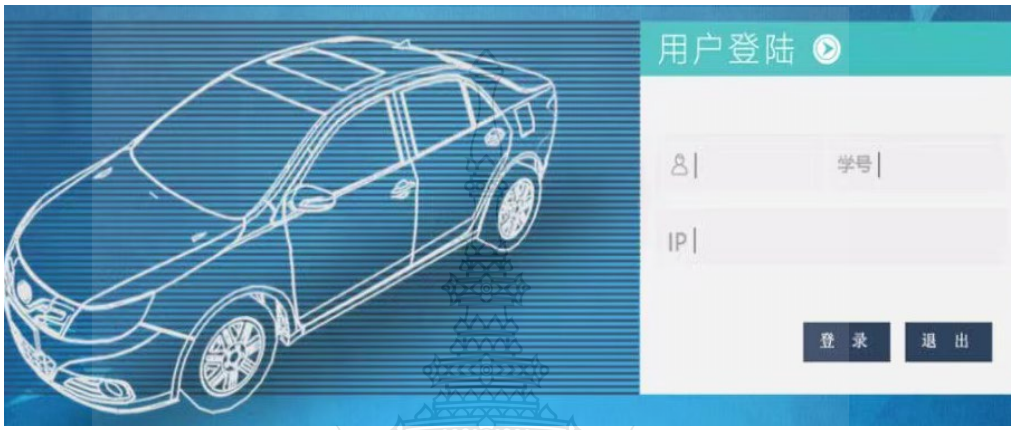

Figure 1 Mix Reality New energy vehicle simulation training system

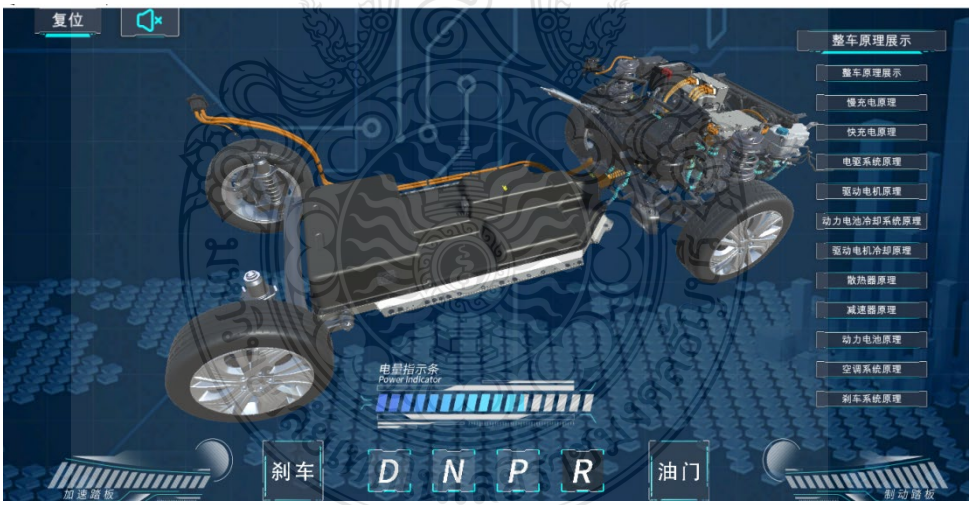

Figure 2 New energy vehicle structure schematic

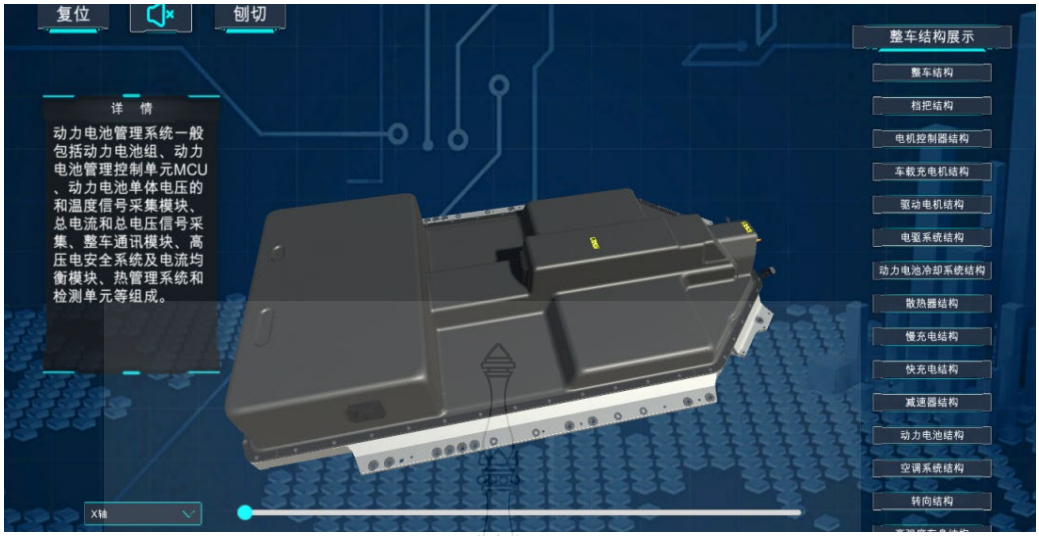

Figure 3 New energy vehicle power battery assembly structure schematic diagram

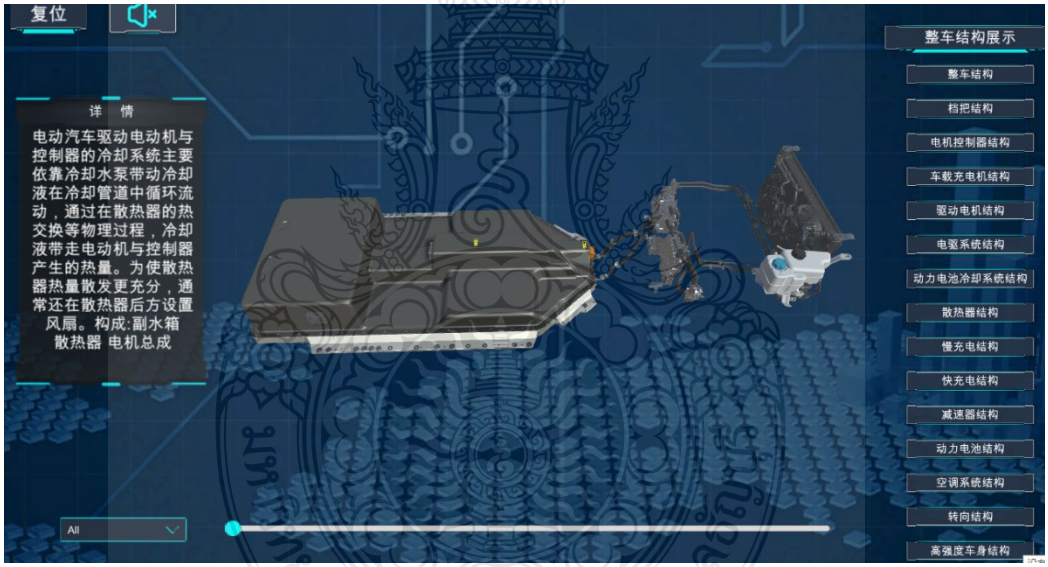

Figure 4 New energy vehicle power battery cooling system

Figure 5 New energy vehicle power battery charging system

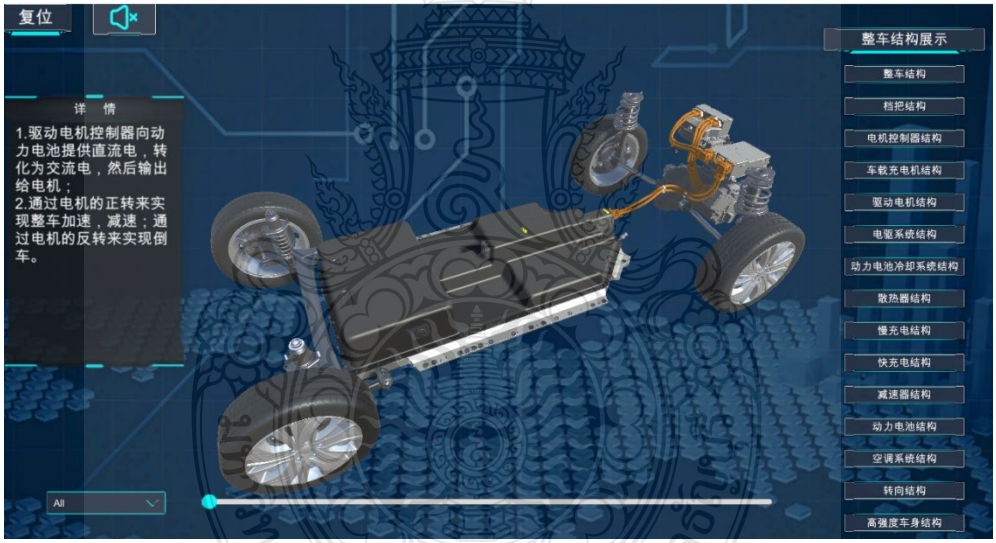

Figure 6 New energy vehicle power battery installation layout

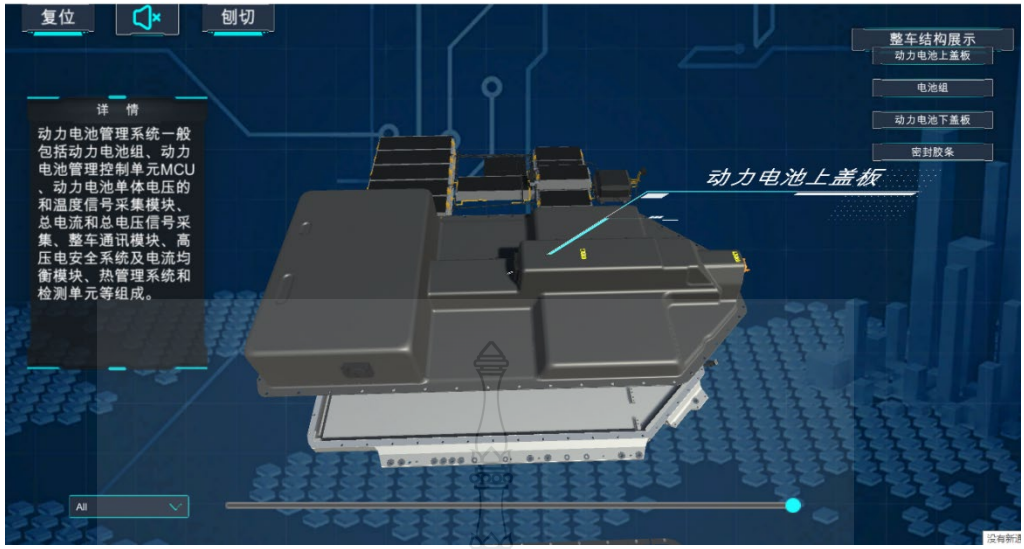

Figure 7 New energy vehicle power battery cover plate

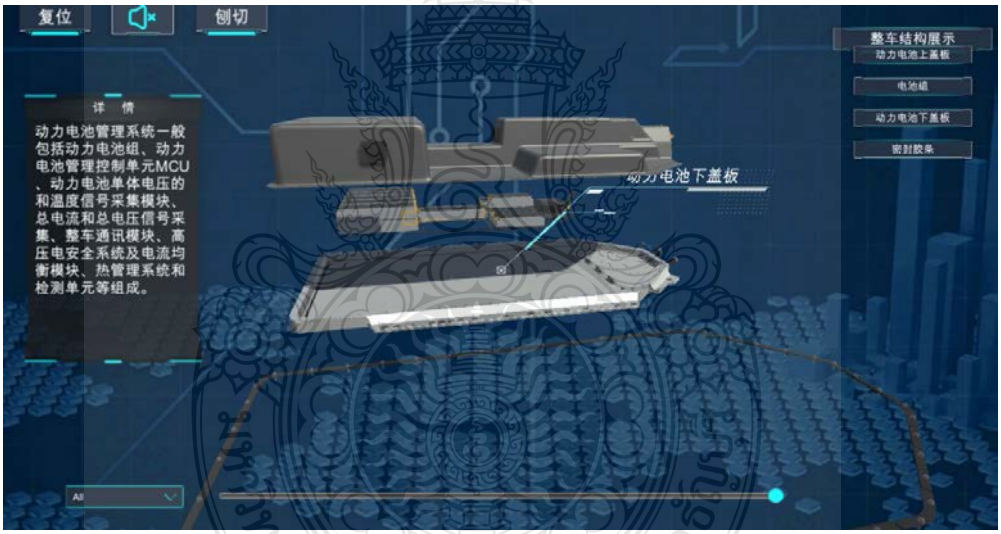

Figure 8 New energy vehicle power battery lower cover plate

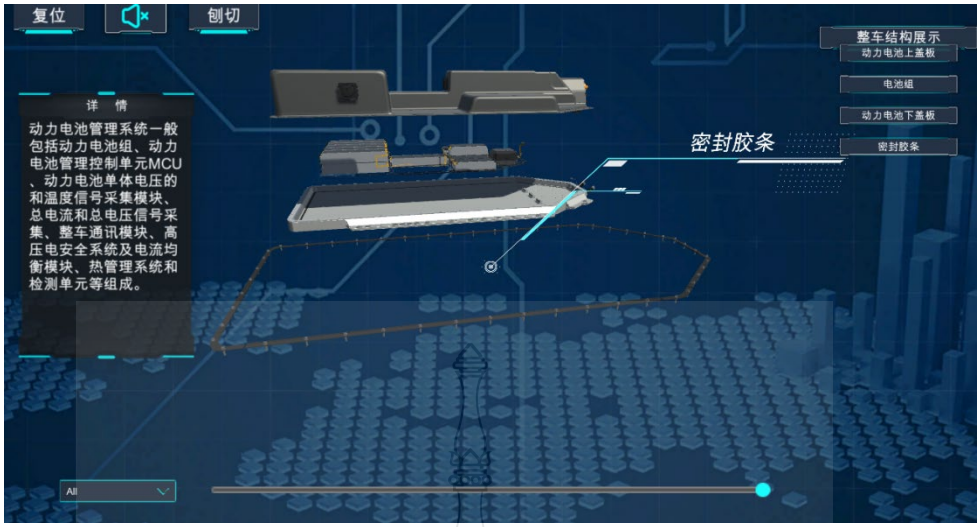

Figure 9 New energy vehicle power battery seal strip

【Example practice】

【Practice 1】The superiority of new energy vehicle battery system?

【Practice 2】Please explain the power battery in the use process must pay attention to what safety parameters?

【Practice 3】Set the voltage of each battery to 3.2V and the capacity to 1AH. Connect the single battery in the following figure to meet the requirements of 16V4AH. (Figure 10)

Figure 10 Power battery pack connection diagram

【Practice 4】The nominal charge of the battery is 110AH, and the battery is in a fully charged state at t0. Constant discharge of the battery begins. The discharge process is shown in Figure 11, where, t1=1200s, t2=2400s, t3=3000s, I1=50A, I2 =70A, I3=60A, and T1 =1200s. The charge accumulation method was used to calculate the SOC of the battery at t3 time.

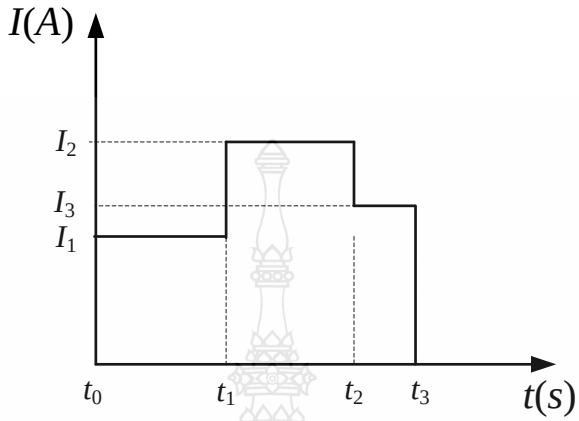

Figure 11 Battery discharge current variation diagram

【Homework】

(1) Please compare the specific forms and advantages and disadvantages of the power battery pack first and then and then?

(2) For the power battery sealing problem, should pay attention to what matters?

Questionnaire on the teaching status of new energy major

Research of Objectives:

The Questionnaire on the Teaching Status of New Energy Major Courses is based on the investigation on the teaching status of new energy automobile major courses from the perspective of students in colleges and universities. The objective is to collect the following five aspects:

（1）teachers' teaching methods;

（2）students' learning attitude;

（3）Content of teachers;

（4）Teaching conditions;

（5）Teaching evaluation content.

Directions: Through the self-evaluation questionnaire survey of students with 20 questions in five structured parts, we hope to find the existing problems in the teaching status quo of the new energy vehicle major course, investigate the causes, and point out the direction and provide factual support for the subsequent practice research on teaching model optimization.

Dear students, hello!

This is a questionnaire to understand the teaching status of new energy major in secondary vocational schools. There is no right or wrong answer to the question; you only need to choose the option that is consistent with your real feeling or similar to it. This questionnaire is conducted anonymously and will not have any impact on your academic performance or teacher's evaluation of you. The survey results are only used for this study. Thank you for your support and help to secondary vocational new energy vehicle course teaching reform research!

1. Teachers' teaching methods and contents

1.1 (Optional) in the teaching of theoretical knowledge of new energy vehicle courses, the teaching methods adopted by most teachers (　　).

A. Write on a tablet;

B. PPT courseware multimedia projection;

C. Physical observation combined with practical training equipment.

1.2 The main practical forms of the new energy vehicle courses you have studied are (　　).

A. On-campus training base;

B. Enterprise internship;

C. No training arrangement.

1.3 (Optional) The training and practice process of the new energy vehicle major course, most teachers adopt the teaching method of (　　).

A. Give guidance to individual students;

B. Work in groups;

C. Focus on teaching;

1.4 In the practical teaching of new energy vehicle courses, the general order of teachers' regular classes is ( ).

A. Teaching theoretical knowledge first, and then practical operation training;

B. Teaching practical operation demonstration first, and then inductive explanation of theoretical knowledge;

C. Teach theoretical knowledge first, then practice training, and then summarize theoretical knowledge;

D. Practical operation training first, then explain the theoretical knowledge and consolidate the practical operation ability.

2. Students' learning attitude content

2.1 What is your overall evaluation of the new energy vehicle courses you have learned so far? ( )

A. Satisfied; B. Mostly satisfied; C. General; D. Not satisfied.

2.2 In the learning process of the new energy vehicle major course, in most cases, your concentration in class is ( ).

A. Good learning effect completely immersed in class;

B. Relatively focused, but occasionally distracted;

C. Poor learning effect, often in one ear and out of the other;

D. Not interested, basically cannot listen to.

2.3 At present, how difficult do you think it is to learn the training program of new energy vehicles ( ).

A. Too big; B. Large; C. Average; D. Simple.

2.4 Which of the following teaching modes do you think is consistent with your current major courses on new energy vehicles ( ).

A. Practical integration teaching; B. Project-based teaching;

C. Process-oriented teaching; D. Unclear.

3. The content of teachers

3.1 In the teaching of all new energy vehicle courses, is the theoretical knowledge and practical guidance taught by the same teacher? ( )

A. All; B. Some C. Very few D. None

3.2 What do you think of the attitude of the teachers of your new energy vehicle courses towards the classroom? ( )

A. All of them are conscientious; B. Some of them are conscientious;

C. Very few of them are conscientious; D. They are not responsible.

3.3 Are you satisfied with your new energy vehicle course teacher? ( )

A. Satisfied; B. Mostly satisfied; C. General; D. Not satisfied.

3.4 (Multiple options) If there is dissatisfaction, the reason is ( ).

A. The lecture is too boring to arouse your interest;

B. The explanation of professional knowledge is not clear and clear, and it is often difficult to understand;

C. The teacher's professional level and professional knowledge are not high enough to solve the problem you raised;

D. Others: _

_____.

4. Teaching conditions and contents

4.1 Are you satisfied with the existing training base of new energy vehicle courses in the school? ( )

A. Satisfied; B. Relatively satisfied; C. Average; D. Not satisfied.

4.2 Whether information means or resources are involved in the teaching of new energy vehicle courses ( )

A. Always; B. often; C. Occasionally; D. Never.

4.3 Position Situation of the training site of the new energy Vehicle Major Course in the school ( )

A. Sufficient enough to meet one person and one workstation;

B. Sufficient enough to realize 2~3 people share a workstation;

C. It is in short supply and 6~8 people are needed to share the work station;

D. It is in short supply, and groups need to take turns to work at the work station.

4.4 The current training equipment required by the school for new energy vehicle courses ( ).

A. They are basically the latest and most advanced;

B. Some of the equipment is more advanced, and some of the equipment is obsolete;

C. They are basically old goods that have been phased out;

D. Do not understand.

5. Teaching evaluation content

5.1 How do you feel about the improvement of your professional skills in the practical teaching of new energy vehicle courses ( ).

A. Significant improvement; B. Modest improvement;

C. Only slight improvement; D. No improvement at all.

5.2 How your interest in learning is stimulated by the teaching methods and means of your current teachers in the courses of new energy vehicles ( ).

A. Very stimulating; B. Some effect; C. Not much; D. Not at all.

5.3 (Optional) The current conventional assessment methods of theoretical knowledge of new energy vehicle courses are as follows: ( ).

A. Final exam; B. Periodic test

C. Homework; D. In-class test

5.4 (Multiple options) the conventional assessment methods of the current new energy vehicle professional courses are as follows: ( ).

A. Self-evaluation of students;

B. mutual evaluation of group members;

C. Teacher evaluation;

D. Evaluation of practical training report.

Questionnaire survey on the application status of Mix Reality Technology In new energy major course teaching

Research of Objectives:

Questionnaire on the status quo of the application of Mix Reality Technology in the teaching of new energy major courses, with the goal of collecting the following three aspects:

(1) teachers' understanding of Mix Reality Technology.

(2) Teachers' application of Mix Reality into teaching。

(3) Teachers' attitude towards the application prospect of Mix Reality Mix Reality Technology.

Directions: Through the questionnaire survey of teachers with 10 questions in the three parts, we hope to learn the current situation and existing problems of the application of Mix Reality Technology in teaching by teachers of new energy automobile majors, and lay a foundation for the subsequent practice research on the optimization of teaching mode.

Dear teachers, hello!

This is a questionnaire to understand the application of Mix Reality Technology in the teaching of new energy major courses. I hope you can get your support and cooperation. You only need to choose the option that is consistent with or close to your real situation. This questionnaire is conducted anonymously and will not have any impact on your daily work. It is strictly confidential, and the survey results are only used for this study. Thank you for your support and help to the teaching reform research of new energy vehicle major in secondary vocational schools!

1. Your basic information

1.1 Gender: Male (female)

1.2 Age:

1.3 The new energy vehicle courses you taught are as follows:

2. Questionnaire content

2.1 Your understanding of Mix Reality Technology:

A. Know and have used; B. Learn about it through online resources

C. Only heard of it; D. No idea.

2.2 (Optional) What is your understanding of Mix Reality Technology?

A. Holographic teaching images that can interact in real time;

B. It is a new digital network teaching resource package;

C. It is a combination of VR and AR technologies;

D. Can see the real environment and virtual objects at the same time.

2.3 Have you ever used Mix Reality Technology in teaching?

A. Used; B. Never used.

2.4 Compared with traditional classroom teaching of new energy vehicle courses, do you think Mix Reality Technology applied teaching is better for students' learning process Potential?

A. Very advantages; B. some advantages;

B. No advantage; D. no idea.

2.5 (Optional) In your opinion, what are the main advantages of Mix Reality Technology applied to the teaching of new energy vehicle major courses for students' learning?

A. It helps students to clarify their learning objectives;

B. It helps students understand the content;

C. It is conducive to students' independent learning before and after class;

D. It is good for improving students' interest in learning.

2.6 (Optional) If you have not used Mix Reality Technology for applied teaching, what are the possible reasons?

A. The application of Mix Reality Technology in teaching will increase the teaching burden;

B. I don't think I can achieve the desired teaching effect;

C. It does not conform to the current teaching content;

D. Existing Mix Reality Technology network resources are too few;

E. The school conditions are not allowed, and the cost is high;

2.7 If you use Mix Reality Technology in the actual classroom teaching of new energy vehicle courses, which teaching link do you prefer to use it in?

A. Preview tasks before class;

B. Task import;

C. Teaching of theoretical knowledge;

D. Students' practical training practice.

2.8 (Multiple options) in your opinion, what reform role does MIX REALITY Technology play in the teaching of new energy vehicle major in secondary vocational schools?

A. Help to highlight the principal position of students;

B. Help teachers to update and use teaching methods and teaching models;

C. Help to improve the efficiency of classroom teaching;

D. Help to improve the information literacy and professional development of secondary vocational teachers.

2.9 Do you think Mix Reality Technology can improve students' learning interest in the course of new energy vehicle in secondary vocational schools?

A. It will improve a lot; B. It will improve a lot;

C. No improvement; D. no idea.

2.10 What do you think about the application prospect of MIX REALITY Technology in the teaching of new energy vehicle major in secondary vocational schools?

A. will disappear quickly and; B. will be popular for a while;

C. will be widely used in the future; D. doesn’t know

.

Questionnaire on teaching effect of the project
“Disassembly and Testing of Power Battery Pack"

Research of Objectives:

This paper adopts the form of "questionnaire star" questionnaire survey and interview evaluation to carry out after-class follow-up survey on the students and professional teachers who participated in this study respectively. Through data analysis: It verifies that the teaching mode of Mix Reality Technology applied to the new energy vehicle major courses has better optimization effect.

Directions: The Questionnaire on the Teaching Effect of "Power Battery Pack Disassembly and Testing" project is based on the students' learning effect of "Power Battery Pack Disassembly and testing" project. A total of 10 single choice questions are prepared for the questionnaire. The goal is to design and collect based on the six basic conditions of the two classes' teaching objectives, teaching activities, link design, teaching conditions and environment, teaching evaluation methods, teaching interest and teaching satisfaction.

Dear students, hello!

This is a questionnaire to understand the teaching effect of "Power Battery Pack Disassembly and testing" project. There is no right or wrong answers to the questions. Just choose the option that matches or is close to how you really feel. This questionnaire is conducted anonymously and will not affect your academic performance. It will not affect the teacher's evaluation of you. The results of the survey will only be used for this study.

Thank you for your support and help to secondary vocational new energy vehicle course teaching reform research!

1. You think the teaching objectives of this project are clear
   A. Quite agree B. agree C. generally D. disagree
2. Do you think the teaching activity design of this project meets your needs?
   A. Quite agree B. agree C. generally D. disagree
3. Do you think the teaching conditions and environment of this project are very advanced and have a sense of "new"
   A. Quite agree B. agree C. generally D. disagree
4. Do you think the teaching evaluation method in the teaching process of this project is fair and reasonable?
   A. Quite agree B. agree C. generally D. disagree
5. You like the teaching method of this project
   A. Quite agree B. agree C. generally D. disagree
6. Do you think the teaching process of this project is generally interesting and practical?
   A. Quite agree B. agree C. generally D. disagree
7. Through this teaching program, you have become more interested in the new energy vehicle courses you have learned
   A. Quite agree B. agree C. generally D. disagree

8. Through this teaching program, you have gained full professional knowledge and skills.

A. Quite agree B. agree C. generally D. disagree

9. Do you think the teaching effect of this project and your learning quality are successful

A. Quite agree B. agree C. generally D. disagree

10. Finally, you hope that the teacher will continue to use this teaching model in the future teaching of new energy vehicle courses

A. Quite agree B. agree C. generally D. disagree

Biography

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