Research on the Innovation Platform of Digital Intelligence Technology Skills for Vocational Education in Ethnic Areas

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Abstract. Currently, the problems of lack of teaching resources, backward equipment and facilities, outdated teaching contents and detachment of talent training from industrial development in vocational schools in ethnic areas need to be solved. Building a digital intelligence technology skills innovation platform for vocational education in ethnic areas, which consists of interaction layer, functional layer, framework layer, data layer and system layer. The platform adopts virtual simulation technology to create the working environment and scenes of real jobs, break the limitation of teaching time and space, reduce the investment in laboratory facilities and equipment and teaching venues, share high-quality educational resources, and provide a reference path for solving the problems of unsatisfactory conditions of vocational education in ethnic areas and insufficient investment in vocational education.

Keywords: Ethnic areas · Vocational education · Digital intelligence · Innovation platform

1 Introduction

In China, ethnic regions are mostly economically underdeveloped areas due to many factors such as regional location, natural conditions and resource endowment, and the problem of uneven educational development remains prominent. Vocational education is an important cornerstone to promote economic development, social stability and poverty alleviation in ethnic areas. Currently, the problems of lack of teaching resources, backward equipment and facilities, outdated teaching contents and detachment of talent training from industrial development in vocational schools in ethnic areas need to be solved. Building a digital intelligence technology skills innovation platform for vocational education in ethnic areas, sharing high-quality rich online teaching resources and immersive virtual simulation teaching and training is an effective way to develop vocational education in ethnic areas, cultivate comprehensive innovative talents with regional characteristics and promote education parity.

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2 Architecture of Digital Intelligence Technology Skills Innovation Platform for Vocational Education in Ethnic Areas

The innovation platform of digital intelligence technology skills for vocational education in ethnic areas adopts a multi-layer architecture, which consists of interaction layer, functional layer, framework layer, data layer and system layer [1]. The platform architecture is shown in Fig. 1.

The interaction layer involves different authority users and functions such as teachers, students, administrators and visitors [2].

The function layer follows the underlying technical architecture and adopts the standard of interactive function and communication interface for function development, covering the auxiliary teaching function and teaching interaction function. The auxiliary teaching function includes the basic configuration of the course and the monitoring function of the learning and training process [3]. The teaching interaction function includes working scene display, instrument and equipment interaction, multi-person interaction, virtual simulation effect presentation, real-time communication, data collection and recording, teaching effect evaluation, online data communication and other functions.

The framework layer includes message processing, logic processing, resource management, user guidance, device interaction, scene management, etc. The message processing function realizes the communication between platform modules by sending and receiving messages, which can minimize the coupling between platform modules [4].

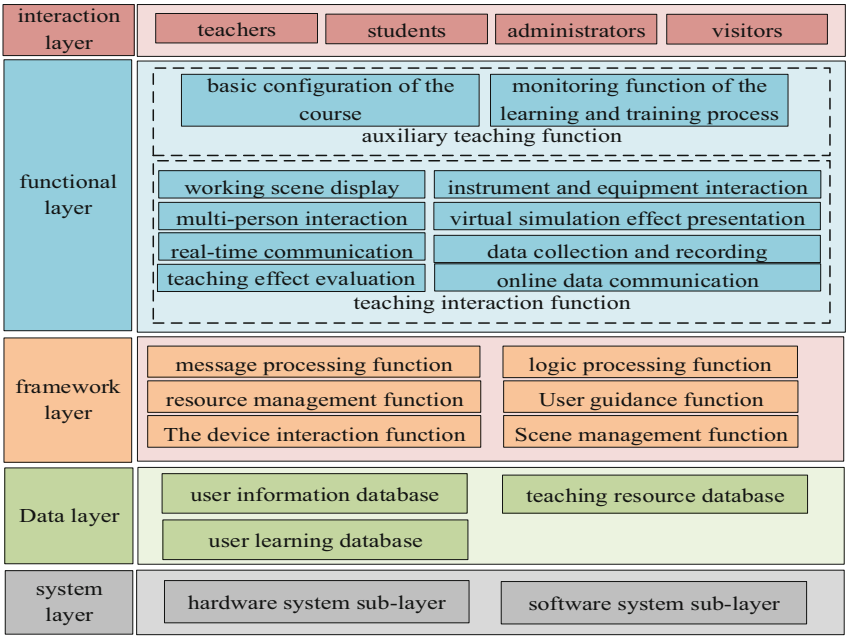

Fig. 1. Architecture of Digital Intelligence Technology Skills Innovation Platform for Vocational Education in Ethnic Areas

The logic processing function is responsible for reading and writing the state of all logical units of the platform, and notifying the situation of logic changes. The resource management function is responsible for the loading, caching and unloading of all kinds of teaching and training resources. User guidance function is responsible for reading, parsing, driving and running control of teaching and training configuration script process. The device interaction function is responsible for the interactive operation functions of platform instruments and equipment such as touching, moving, picking up and putting down. Scene management function is responsible for loading, caching, unloading of all teaching practical training scenes and notification of the situation when the scene state is changed [5].

The data layer consists of user learning database, teaching resource database and user information database, which are used to save and manage all the data received and generated by the platform.

The system layer consists of software system sub-layer and hardware system sub-layer. The software system sub-layer covers all kinds of software needed to realize the functional modules of the platform, such as function development software, modeling software and virtual simulation software. The hardware system sub-layer covers all kinds of hardware required for the operation of the system software [6].

3 Functional Modules of the Innovation Platform of Digital Intelligence Technology Skills for Vocational Education in Ethnic Areas

The platform function module consists of four parts: course resource module, virtual simulation training module, intelligent monitoring module and course evaluation module.

Theoretical knowledge module: breaking the traditional teaching form and curriculum design logic of sub-disciplinary courses, the vocational education subject courses are decomposed into several gridded knowledge topics, each of which has specific teaching objectives and syllabus, and the knowledge topics are arranged in accordance with the inner disciplinary logic of the knowledge system, creating spiral progressive learning tasks and realistic work tasks for students. After students log in for the first time, the platform analyzes their existing knowledge base through a multi-dimensional questionnaire, understands their learning needs, and intelligently recommends personalized learning programs; students independently select the grid knowledge topics and grasp the learning process; the platform intelligently monitors students' learning situation and provides timely online tutoring when they have learning difficulties [7].

Virtual simulation training module: immersion teaching is carried out with students as the center, and the core work of real positions is used to create practical training projects. Dismantling professional group industry jobs, each practical training task consists of a number of job skill packages, each job skill package is composed of learning requirements, assessment standards, theoretical basic knowledge, job skills, operation demonstration, virtual simulation work scenarios, virtual role interaction and so on. With the help of virtual simulation training can accelerate the process of experimental training, such as crop growth, chemical reaction speed, etc., shorten the training time, in the same

training time virtual simulation can repeat the experimental training, and there is no loss of experimental materials, equipment and facilities, effectively improve the efficiency of practical training, strengthen the students' mastery of technical skills. Through virtual simulation training can create real experimental training does not have or difficult to complete the teaching environment, for high-risk extreme environment, irreversible inaccessible operation, high cost and high loss of materials and equipment training projects to provide a safe, efficient, economic and reliable training environment [8]. Students in the scenario of practical training through virtual simulation can operate to master the role requirements of different occupational positions. The serious consequences caused by improper operation of students will be through the platform equipment from the visual, tactile, auditory, olfactory, pain and other aspects of the students to truly feel to improve the rigor of student operations and strengthen the cultivation of professionalism.

Intelligent monitoring module: through stereo depth camera, operation sensor, skin sensor, eye tracker and other devices multi-dimensional collection of students in the learning process of facial expression, eye movement frequency, action posture, body language, heart rate changes, voice dialogue, operation process and other multi-dimensional information data, it can perceive of student learning attitude, learning emotions, operation, learning content concerns, attention duration, learning progress to form and constantly update students' personal learning model. According to the students' personal learning model, the Digital Intelligence Technology Skill Innovation Platform adjusts the presentation of theoretical learning and practical training contents, and adopts diverse knowledge and skill presentation forms such as language statement, intelligent questioning, text presentation, video and audio, 3D animation, holographic projection and virtual simulation with the help of big data, AI, AR/VR, MR, 3D and other technologies to meet the differentiated learning needs of students. When the platform senses that students encounter learning difficulties from details such as students' facial expressions, eye gaze and body movements, the teaching monitoring module will give timely learning guidance and help through intelligent guidance and notification to the teacher in charge of the class.

4 Teaching Implementation

4.1 Teaching Process

A professional core course in vocational education was selected, and two teaching classes of the same grade, the same major and the same level were divided into a control group and an experimental group, both with 50 students, with no significant differences in gender, mean scores of professional courses and practical training courses.

Students in the experimental group first mastered the theoretical knowledge through the theoretical knowledge module of the innovation platform of vocational education digital intelligence technology in ethnic areas and formed the preliminary project design and operation ideas. With the help of the virtual simulation training module, the project is implemented based on the operation idea of personal project design, and the platform gives timely feedback and intelligent tips to students according to their operation situation. Teachers through the platform can observe all students operating live, guide students

to improve the operation design and implementation. According to their personal learning situation, students can try, observe and rehearse the content from multiple angles to improve their learning effectiveness. After the course is taught, students independently complete chapter theory tests and operation tests.

The control group adopted the traditional teaching method, in which the teacher completed theoretical knowledge lecture and project operation demonstration in the classroom, and students completed their individual practical training projects with reference to the teacher's demonstration, and the teacher patrolled the classroom, checked the progress of students' practical training project operation, and guided and helped students to solve the difficult problems in the operation process. After the course teaching, students complete the chapter theory test and operation test independently.

4.2 Teaching Effectiveness Assessment

The teaching effect assessment consists of students' self-assessment of learning effect and chapter theory and operation test. The self-assessment of students' learning effect covers the richness of learning content, understanding of learning content, attention to learning process, improvement of learning ability and learning effectiveness. 100 questionnaires were distributed to the control group and experimental group through questionnaire star, and the return rate was 100%. The chapter theory and operation tests were scored 100 out of 100.

The statistical software SPSS 26.0 was used to analyze the teaching effect measurement data, and the experimental data of the experimental group and the control group were expressed as mean ± standard deviation (χ- ± s) after the normal distribution test. And the independent sample t was used, and $P < 0.05$ was considered to be statistically different.

The statistical results of students' learning effectiveness self-assessment are shown in Table 1. From Table 1, it can be seen that there is no statistical difference between the experimental group and control group using different teaching methods in several aspects of learning content richness, learning content comprehension, learning process attention, and learning ability enhancement, and there is a statistical difference in learning effectiveness ($P < 0.05$).

The results of students' chapter theory tests and operational tests are shown in Table 2. From Table 2, it is clear that there is a statistical difference between the control and experimental groups in both chapter theory and operational tests ($p < 0.05$).

Table 1. Statistics Form of Student Learning Effectiveness Self-Assessment

grouping	content richness	content comprehension	process attention	ability enhancement	effectiveness	overall score
experimental group	18.7	18.4	19.3	19.5	19.6*	95.5
control group	18.2	18.8	18.5	18.7	18.1	92.3

Note: $P < 0.05$ for * compared with the control group

Table 2. Chapter theory test and operation test score statistics form

grouping	theory tests	operational tests
experimental group	92.7*	93.4*
control group	87.9	88.6

Note: $P < 0.05$ for * compared with the control group

4.3 Application Effect Analysis

Analysis of the teaching effect evaluation shows that through the vocational education in ethnic areas digital intelligence technical skills innovation platform for students to build a set of theoretical learning and virtual simulation practice simulation teaching environment. Students can be independent, intuitive and efficient to complete the course learning, teachers through the platform can grasp the students real-time learning, practical training situation, the teaching content of the important and difficult points to give timely guidance. Although there is no statistical difference between the experimental group and the control group in terms of learning content richness, learning content understanding, learning process attention, and learning ability enhancement during the course learning process, there are differences in learning effectiveness, and subjective evaluation of students is objectively verified by theoretical and operational tests.

5 Conclusion

Vocational education shoulders the important tasks of improving the quality of workers, cultivating diversified technical skills and innovative talents. Building a digital intelligence technical skills innovation platform for vocational education in ethnic areas creates a rich, diverse, intuitive and in-depth immersive learning space for students, who can learn theoretical knowledge in depth several times based on the important and difficult points of the curriculum and the weak parts of personal learning, and repeatedly and multi-anglely design and practice operations to effectively Improve their knowledge and skills system. The platform adopts virtual simulation technology to create the working environment and scenes of real jobs, break the limitation of teaching time and space, reduce the investment in laboratory facilities and equipment and teaching venues, share high-quality educational resources, and provide a reference path for solving the problems of unsatisfactory conditions of vocational education in ethnic areas and insufficient investment in vocational education.

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