EXPLORATION AND APPLICATION OF "1+2+3" TEACHING MODE USING VIRTUAL REALITY ENVIRONMENTS FOR GEOMATICS UNDERGRADUATE STUDENTS

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KEY WORDS: Combination of virtual simulation and reality; Surveying and mapping; Innovative and practical; Teaching reform; Remarkable reform results

ABSTRACT:

Since the beginning of this century, mapping and geographic information technology has been deeply integrated with virtual reality, artificial intelligence and other technologies, the mapping industry has entered the "intelligent mapping era", how to train innovative and practical mapping talents is urgent. The teaching team takes the cultivation of innovative and practical talents in surveying and mapping as the core goal, and focuses closely on the cultivation of students' innovation ability and large (complex) project implementation ability. Relying on Guangxi Spatial Information and Mapping Virtual Simulation Experimental Teaching Center and Southern Mapping Virtual Simulation Teaching Platform, the team carries out teaching reform and practice. The team proposes the training mode of "one goal, two synergy, three integration", which will use VR/AR, GIS and other technologies to teach major projects and scientific research achievements through virtual simulation, and adopt online + offline methods to enhance students' innovative practical ability. Through scientific assessment and incentive mechanism, students' initiative and enthusiasm will be improved, thus solving the problem of difficulty in cultivating students' innovation and practice ability. After years of reform and practice, students' innovation and practical ability have been improved significantly, and they have won dozens of awards such as the silver prize of "Internet+" national competition, the second prize of "Challenge Cup" national competition, and the national mapping skills competition. The teaching reform methods have been well promoted.

1. INTRODUCTION

With the development of technology, mapping and geographic information technology gradually and the Internet of Things, virtual reality, 5G, artificial intelligence and other technologies deep integration, the surveying and mapping industry has played an extremely important supporting role in social and economic development (Kholoshyn et al., 2016; Petsch et al., 2019; Phantuwongraj et al., 2021; Zhou, 2021). In 2016, the Guangxi government issued the Implementation Plan for Promoting the Development of Geographic Information Industry ([2016] No. 23), which clearly pointed out the geographic information industry as a strategic emerging industry, high-tech industry and a hundred billion yuan industry. But subject to the influence of the old, young and poor areas of Guangxi, it was difficult to retain all kinds of talent, surveying and mapping talents were very short. In addition, the number of colleges and universities in Guangxi offering surveying and mapping-related majors was limited, with only Guilin University of Technology (surveying and mapping, geomatics, remote sensing), Nanning Normal University (surveying and mapping, geomatics), Beibuwan University (surveying and mapping, geomatics), etc. The training quality of surveying and mapping talents seriously restricts the demand of high quality service of geospatial information in Guangxi, and cannot meet the demand of national strategy construction such as "One Belt and One Road", "New Western Land and Sea Corridor" and "Guilin International Tourism Resort". The innovative capacity of mapping and geographic information services for ASEAN is also restricted because of these, affecting Guangxi's position as a bridgehead in ASEAN. Therefore, how to use the existing teaching resources (Rubino-Hare et al., 2016; Shin, 2006;), combined with the teaching means of information technology in the new era, to cultivate innovative and practical surveying and mapping talents to meet the rapid development of Guangxi and the strategic needs of the country is an imminent problem that needs to be solved.

The teaching reform is closely focused on the cultivation of students' innovation ability, large instrument operation, software application development, large (complex) project implementation and other abilities, and the use of high-tech information technology to reform practical teaching methods. Using VR/AR, GIS and other technologies to develop excellent cases of enterprises and scientific research achievements of universities into virtual simulation teaching scenes with strong operability and good demonstration, to create a teaching mode combining reality and imagination (Collins et al., 2019; Dékány et al., 2019; Mukherjee et al., 2019). Creating a "comprehensive, quantifiable and multi-level" teaching evaluation and incentive mechanism to enhance students' enthusiasm for independent learning and practical ability. The development of this project is conducive to innovating the talent training system of surveying and mapping majors, improving the innovation and comprehensive ability of students, and promoting the "double first-class" construction of surveying and mapping majors of Guilin University of Technology.

2. DIFFICULTIES IN TEACHING REFORM

Guilin University of Technology has the longest surveying and mapping discipline in Guangxi, and the only first-class surveying and mapping discipline in Guangxi. However, compared with the central and eastern parts of the country, the education funding for the discipline is very limited, there is a shortage of high-level talents, and the education resources and teaching methods are relatively single and backward due to the limitation of funding. At present, the main problems faced in the training process of surveying and mapping professionals are as follows：① The traditional talent training system mainly focuses on teaching and learning through the classroom, and the traditional teaching and learning mode was mainly offline and online, which was relatively dull, uniform and single case, and cannot meet the needs of students' fragmented, mobile and personalized learning styles. ② Traditional surveying and mapping personnel training system is mainly through the centralized face-to-face theoretical and practical teaching. This model does not take into account the differences of different

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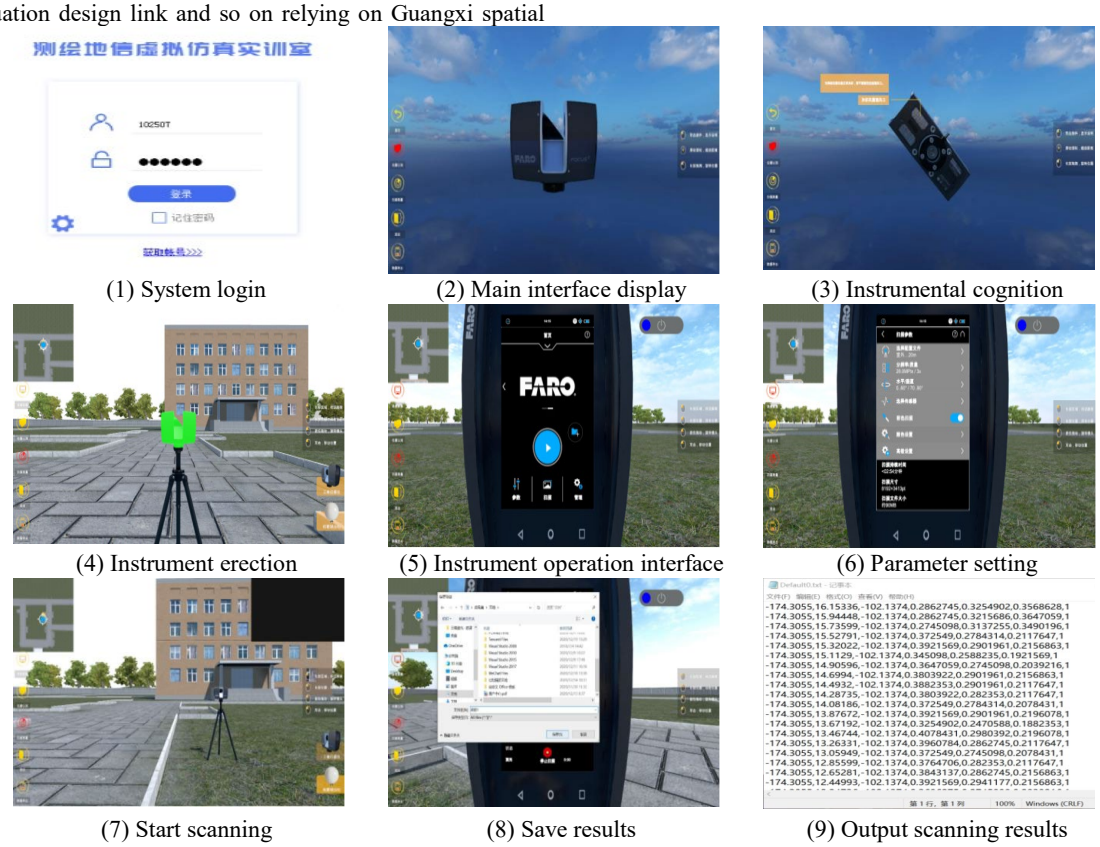
students, centralized indoctrination teaching and on-campus practice. It is difficult to cultivate a high level, high-quality innovative and practical talents to solve the needs of large, complex engineering projects. ③ For a long time, the traditional teaching evaluation system has a series of problems such as emphasizing results rather than process, qualitative rather than quantitative, common rather than individual, and single evaluation factor, etc. This evaluation system cannot effectively help students improve their abilities, and it is difficult to effectively test the effect of teaching quality and achieve continuous improvement.

3. TEACHING REFORM PROCESS

The teaching team takes the curriculum as the unit and takes cultivating innovative and practical talents as the core goal (1 goal). With the syllabus as the leader, information technology as the means, and the virtual simulation training platform as the basis, the team constructs the "one goal, two synergy, three integration" mode of training innovative and practical talents in surveying and mapping.

Adopt the teaching resource integration method of "teaching and scientific research collaboration, practice and production collaboration" (2 synergy), combine with information technology, and innovate teaching content. The advantageous scientific research results are transformed into teaching materials and vividly, imaginatively and interestingly integrated into the teaching process in the form of virtual simulation. Students get training of research ability in the process of mastering theoretical knowledge of the discipline, and develop scientific worldview and methodology. At the same time, through the transformation of scientific research results, the faculty can be urged to always be at the forefront of science and technology, to ensure the continuous updating and improvement of teaching content and quality, and to achieve "teaching and research synergy" of excellent teaching content update. After the students have the initial innovation practice ability, around the industry demand, in the production practice link and graduation design link and so on relying on Guangxi spatial information and mapping virtual simulation experimental teaching center to build virtual engineering production project, from the selection of the topic, design, virtual implementation and other aspects of training students' innovation ability and level. Teachers evaluate and guide students according to the virtual production projects they have completed, forming a "practice and production synergy" effect, promoting further improvement of students' innovative and practical abilities, and meeting the application needs of employers.

Relying on Guangxi Spatial Information and Mapping Virtual Simulation Experimental Teaching Center, Southern Mapping Virtual Simulation Teaching Platform, etc., we reform the teaching means, innovate the teaching content, and put forward the "virtual and real integration, online and offline integration, centralized and fragmented integration (3 integration)" mode of training talents in mapping. Through the virtual simulation to the real scene teaching can not be large-scale on-site teaching of large complex engineering, high-risk scenes, such as virtual reconstruction of the scene. And the spirit of mapping people, Guangxi national boundary mapping, South China Sea islands interpretation and other elements of the course thinking into the teaching case, the formation of "virtual and real integration" teaching method reform, and then enhance the comprehensive ability of students. Combining traditional offline face-to-face teaching with online teaching such as rain classroom and cell phone APP classroom to achieve "online and offline integration" and make full use of students' fragmented time. Through modern information technology (such as 5G, Internet of Things, etc.) to meet students' personalized learning needs, so that students' interest in learning and ability to acquire knowledge can be greatly enhanced, so as to facilitate students' personalized training and realize the "integration of concentration and fragmentation" of students' teaching.



(1) System login (2) Main interface display (3) Instrumental cognition

(4) Instrument erection (5) Instrument operation interface (6) Parameter setting

(7) Start scanning (8) Save results (9) Output scanning results

Figure 1 Case: 3D LIDAR virtual simulation experiment project flow

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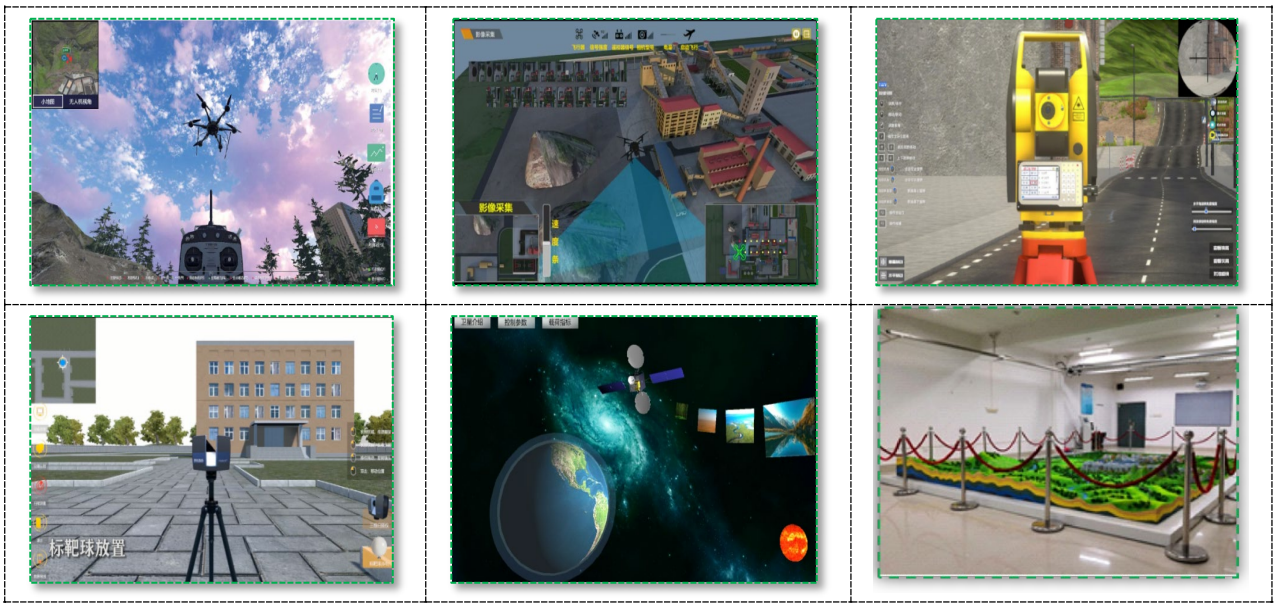

Figure 2 Part of the virtual simulation teaching scene

In order to test the nurturing effect of teaching reform methods, the teaching team has also built a scientific evaluation and incentive mechanism that is "all-round, quantifiable and multi-level", and provides timely feedback on the evaluation results to strive for continuous improvement. Through quantitative evaluation of students' comprehensive ability, combined with qualitative evaluation in the teaching process, we can make timely and scientific teaching evaluation of students' comprehensive ability, and then check the gaps and provide support basis for continuous improvement of course teaching. The internal evaluation of teaching process quality control is realized by the evaluation of supervisors, teachers and students, and the external evaluation is obtained by the feedback of graduates and employers' research. Based on the evaluation results of each student and the feedback information of internal and external evaluation, the teaching mode of "one goal, two synergy and three integration" is fine-tuned and revised in time. Based on the results of internal and external evaluations, the practical teaching methods are optimized, revised, re-implemented and re-evaluated for continuous improvement.

4. TEACHING REFORM RESULTS

Relying on Guangxi Spatial Information and Mapping Virtual Simulation Experimental Teaching Center, Guangxi Spatial Information and Mapping Collaborative Education Platform, et al., the teaching team takes the teaching syllabus as the leader, information technology as the means, and virtual simulation training platform as the basis, and constructs "innovative and practical talents training as the core goal" (one goal), "teaching and scientific research collaboration, practice and production collaboration" as the main teaching resources integration method (two synergy), and "virtual and real integration, online and offline integration, centralized and fragmented integration" as the main teaching means (three integration) for teaching reform and practice. Through reform and practice, a set of complete, scientific and feasible new mode of training innovative and practical talents in surveying and mapping has been constructed. Realize multi-mode teaching, learning and practice using information technology, and innovate teaching methods and approaches. The innovative and practical ability of students to solve large (complex) projects has been significantly improved to meet the needs of the industry and provide high quality surveying and mapping talents for various industries.

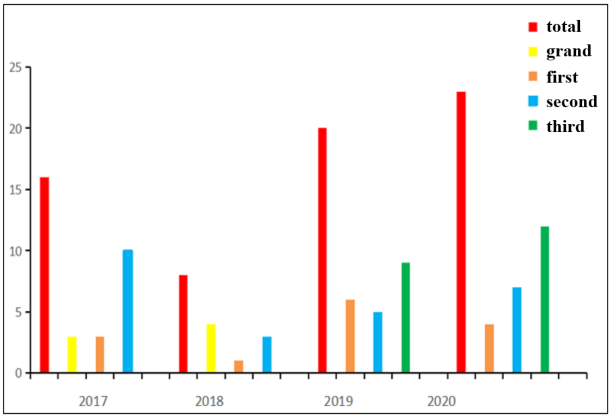

Figure 3 Steady progress in student science and technology competition awards

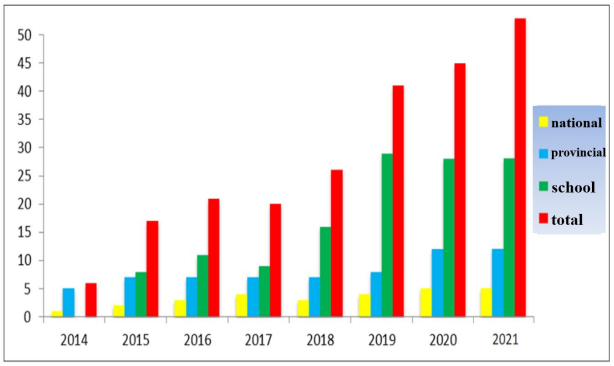

Figure 4 Steady increase in the number of student science and technology projects

After years of reform exploration and practice, the teaching effectiveness was obvious, and students' innovative and practical ability has been significantly improved. In recent years, surveying and mapping students have published 28 scientific and technical papers, won 37 awards in national science and technology competitions, "Internet+" innovation and entrepreneurship competition, "Challenge Cup" competition and other national events, and won more than 100 awards in various competitions at the

provincial and ministerial levels. The practical and innovative ability of students has been significantly enhanced. In addition, after the teaching reform, Guangxi Big Data Enterprise Alliance was formed, which gave birth to Guangxi District University Drone Alliance and held several drone competitions, which greatly promoted the practical innovation ability of surveying and mapping students. The teaching method is promoted and applied in ASEAN universities through the "China-ASEAN Industry-Education Integration Dialogue" to achieve the integration and sharing of transnational resources and cultivate a number of surveying and mapping talents urgently needed for the construction of "One Belt, One Road".

A high-level teaching team has been established through teaching reform. The teachers of the team include "National Specially Appointed Experts", "Candidates of Guangxi Academician Reserve Training Project", "Ba Gui Scholars", "Excellent Talents of Guangxi Universities The teaching team includes "National Distinguished Experts", "Candidates of Guangxi Academician Training Project", "Ba Gui Scholars", "Excellent Talents of Guangxi Universities" and "Top Ten Teachers" and "Top Ten Young Teachers" of the university. The teaching and research ability of teachers has also been further improved. Experimental Teaching Demonstration Center of Guangxi District for "Surveying and Mapping Engineering" and the website of Guangxi District Teaching Team for "Surveying and Mapping Engineering", and more than 10 teaching papers were published in " Bulletin of Surveying and Mapping" and other publications, which had a positive impact on surveying and mapping education and greatly enhanced the visibility of the surveying and mapping profession of Guilin University of Technology. It has had a positive impact on surveying and mapping education and greatly enhanced the visibility of the surveying and mapping profession of Guilin University of Technology.

5. CONCLUSIONS

The teaching reform takes the cultivation of students' practical ability as the fundamental, and builds a practical teaching platform combining reality and imagination. The new mode of collaborative education is realized, in which the advantageous resources of school and school-enterprise are complementary and shared, and the eastern courses are taught in the west. The new teaching method of virtual simulation is explored and practiced for the cultivation of students' practical ability in large and complex projects, and the course thinking and political elements such as the spirit of surveying and mapping (such as Everest mapping) are integrated into the teaching cases, creating a new way of virtual simulation practice teaching led by the course thinking and political. After the reform and practice of teaching methods, the practical ability of students has been significantly improved.

ACKNOWLEDGEMENTS

This work was supported by Guangxi Higher Education Undergraduate Teaching Reform Project (the grant #: 2022JGA214, 2021JGA195 and 2022JGZ135), Guangxi Degree and Graduate Education Reform Project (the grant #: JGY2021105). (Corresponding author: Guoqing Zhou.)

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