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Teaching Reform of "Remote Sensing Principles and Applications" in the Surveying and Mapping Major

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Abstract: "Remote Sensing Principles and Applications" is a core course for the surveying and mapping major, featuring theoretical depth, practicality, and a cutting-edge nature. As a key link connecting basic surveying and mapping theories with modern spatial information technologies, it directly impacts students' professional core literacy and employability. Based on this, this paper conducts research on the teaching reform of "Remote Sensing Principles and Applications" in the surveying and mapping major, systematically analyzes the existing problems in course teaching, elaborates on the important value of teaching reform, and proposes targeted implementation strategies. The aim is to optimize the teaching system, improve teaching quality, cultivate high-quality surveying and mapping professionals who meet the needs of industrial development, and provide references for the teaching reform of similar courses.

Keywords: Surveying and mapping major; Remote Sensing Principles and Applications; Teaching reform; Practical teaching

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1. Introduction

With the rapid development of spatial, computer, and information technologies, remote sensing (RS) has become a core technology in the surveying, mapping, and geographic information industry. It plays an irreplaceable role in various fields such as territorial spatial planning, natural resource surveys, ecological environment monitoring, disaster prevention and mitigation, and urban construction. "Remote Sensing Principles and Applications," offered by the Xinjiang Institute of Engineering, is a core professional course for the surveying and mapping major, covering multiple modules, including remote sensing physical foundations, imaging principles, image processing, and interpretation applications. It serves as an important carrier for students to master modern surveying and mapping technologies and enhance their comprehensive application capabilities. The teaching quality of this course is directly related to the achievement of talent training goals for the surveying and mapping major and whether students can meet the requirements of industrial positions [1].

Therefore, conducting research on the teaching reform of "Remote Sensing Principles and Applications" in the surveying and mapping major is of great significance.

2. Existing problems in the teaching of "Remote Sensing Principles and Applications" in the surveying and mapping major

2.1. Disconnection between teaching content and industrial development

At present, the teaching content of "Remote Sensing Principles and Applications" in the surveying and mapping major of our university is outdated and cannot adapt to the rapid development of remote sensing technology. On the one hand, the update speed of textbook content is slow. Most textbooks still focus on traditional remote sensing technologies, mainly teaching conventional remote sensing imaging principles and basic image processing methods. The introduction of cutting-edge technologies such as high-resolution remote sensing, UAV remote sensing, and Synthetic Aperture Radar (SAR) is relatively simple or even absent. With the advancement of sensor technology, hyperspectral and high-spatial-resolution remote sensing satellite data continue to emerge, and algorithms for remote sensing image processing and quantitative inversion methods are constantly innovated. However, the update of teaching content is slow and cannot keep up with the pace of remote sensing technology development [2]. On the other hand, the connection between teaching content and the practical application of the surveying and mapping industry is not close enough, making it difficult to support the application of surveying and mapping in fields such as regional natural resources, ecology, mines, 3D real scenes, and disaster monitoring in Xinjiang. There is an overemphasis on the systematic teaching of theoretical knowledge while neglecting the cultivation of practical application skills, resulting in a disconnection between what students learn and on-the-job practice, and students cannot convert theoretical knowledge into practical operational capabilities.

2.2. Weak practical teaching

Practical teaching is a central link of the "Remote Sensing Principles and Applications" course and an important part of improving students' practical ability and innovative awareness. However, at present, the practical teaching link of the surveying and mapping major in most universities still has many deficiencies and cannot meet the needs of talent training. Practical teaching resources are scarce: some universities lack professional remote sensing laboratories, and there is a shortage of remote sensing image processing software and remote sensing data resources, making it impossible for students to conduct systematic practical operation training; although some universities are equipped with relevant software, the software versions are relatively outdated, which are quite different from the latest versions actually used in the industry, making it difficult for students to quickly adapt to job requirements after graduation. The content of practical teaching is single, mostly verification experiments, such as basic operations like geometric correction, radiometric correction, and image enhancement of remote sensing images. There is a lack of comprehensive, design-oriented, and innovative experiments, which cannot cultivate students' ability to analyze and solve problems [3].

2.3. Single teaching model

At present, the "Remote Sensing Principles and Applications" course in the surveying and mapping major still mainly adopts the traditional "lecture-based" teaching method, which is relatively single and lacks innovation.

In classroom teaching, teachers mainly impart theoretical knowledge, and students passively accept knowledge without the opportunity to think and explore, which cannot stimulate students' learning interest and initiative. At the same time, the course teaching lacks interactivity, with little communication and interaction between teachers and students, and between students and students, making it impossible to create a good teaching atmosphere[4].

3. Important value of teaching reform of "Remote Sensing Principles and Applications" in the surveying and mapping major

3.1. Adapting to the high-quality development of the surveying and mapping industry

At present, China's surveying, mapping, and geographic information industry is in an important stage of transformation and upgrading. As one of the core technologies, remote sensing technology has an increasingly wide range of applications and is continuously improving its technical levels. The demand for surveying and mapping professionals has also shifted from the original "traditional operational type" to the "innovative application type". Carrying out the teaching reform of "Remote Sensing Principles and Applications", improving teaching content, integrating cutting-edge industrial technologies and practical application cases, and strengthening practical teaching can cultivate talents who master the latest remote sensing technologies and application methods, enhance students' practical ability and innovative awareness, enable students to quickly adapt to industry job requirements, and provide talent support for the high-quality development of the surveying, mapping, and geographic information industry. At the same time, teaching reform can promote the connection between the curriculum system and industry standards, realize the synchronization of education and teaching with industrial development, and help China's surveying, mapping, and geographic information industry occupy a leading position in the world [5]. Carrying out the teaching reform and innovation of remote sensing principles based on the engineering education certification standards plays an important role in improving teaching quality and cultivating innovative application-oriented talents.

3.2. Implementing the talent training goals of the surveying and mapping major

The talent training goal of the surveying and mapping major is to cultivate high-quality engineering and technical talents with solid surveying and mapping theoretical foundations, strong practical abilities, and innovative awareness, who can engage in work such as surveying and mapping engineering, geographic information engineering, and remote sensing applications. "Remote Sensing Principles and Applications" is a backbone course of the surveying and mapping major, and the quality of teaching directly affects whether the talent training goal can be achieved. Carrying out teaching reform can improve the curriculum teaching system, solve the existing problems in current teaching, make course teaching more in line with the talent training goal, and attach importance to the cultivation of students' comprehensive quality. After the reform, students have a better understanding and mastery of remote sensing principles and applications, enhance their professional quality and employability, and lay a solid foundation for their future career development [6].

3.3. Promoting the optimization of the curriculum system of the surveying and mapping major

"Remote Sensing Principles and Applications" is a key part of the curriculum system of the surveying and mapping major. Promoting its teaching reform will promote the improvement and perfection of the entire curriculum system of the surveying and mapping major. Through teaching reform, the connection between this

course and other related courses can be clarified. Then, the problem of overlapping curriculum content can be solved, and a more scientific and reasonable curriculum structure can be formed. At the same time, teaching reform can promote innovation in teaching methods, teaching means, assessment methods, etc., provide references for the teaching reform of other courses, and thus improve the overall teaching quality of surveying and mapping professional education [7]. In addition, teaching reform can promote universities to cooperate with industry enterprises, absorb industry resources into education, improve the distribution of teaching resources, form a situation of "integration of production and education" and "school-enterprise joint talent training", and promote the curriculum system of the surveying and mapping major to adapt to the development trend of the industry. The school-running quality and competitiveness of the surveying and mapping major are significantly enhanced.

4. Implementation strategies for the teaching reform of "Remote Sensing Principles and Applications" in the surveying and mapping major

4.1. Improve curriculum content and adjust knowledge units

According to the development trend of the surveying and mapping industry and the requirements of engineering education certification, improve and optimize the curriculum content, adjust the knowledge units of the course, and make the curriculum content more advanced, practical, and systematic.

Firstly, update the textbook content in a timely manner. Add explanations of the latest technologies, such as high-resolution remote sensing, UAV remote sensing, hyperspectral remote sensing, SAR remote sensing, and remote sensing big data processing to the content, delete parts that have been introduced in other courses, and highlight the key, difficult knowledge and practical skills of the course. At the same time, according to the actual application environment of the surveying and mapping industry, add some practical cases, such as remote sensing applications in territorial surveying and mapping, ecological environment monitoring, urban planning, etc., so that students can better grasp the practical application value of remote sensing technology and improve their application ability [8].

Secondly, adjust the curriculum knowledge units, establish a three-level knowledge structure of theoretical foundation, practical application, and innovative improvement, and divide the course content into four knowledge units: basic remote sensing principles, remote sensing image processing, remote sensing interpretation and application, and cutting-edge technology expansion. Each knowledge unit has specific teaching goals and key points to ensure the systematic logic of the teaching content.

Thirdly, integrate curriculum ideological and political elements into the teaching process, such as family and country feelings, the spirit of scientists, and industry responsibility. Use cases such as the development achievements of China's remote sensing technology and the dedication of surveying and mapping workers to guide students to establish correct employment views and values, and cultivate students' sense of social responsibility and mission [9].

4.2. Build an online teaching platform and promote online-offline integration

Innovate the teaching model, build an online teaching platform, promote online-offline integrated teaching, break the time and space constraints of traditional teaching, and improve teaching effects. Firstly, establish an online teaching platform. Use online teaching platforms such as Chaoxing Xuexitong and Rain Classroom to release teaching resources such as course teaching videos, courseware, exercises, cases, and reference

materials, allowing students to learn independently at any time. At the same time, set up online discussion areas and Q&A areas for students to ask questions and communicate freely, and solve difficulties with the help of teachers, so as to mobilize students' learning enthusiasm[10]. Secondly, promote online-offline integrated teaching, adopt the teaching form of "online preview + offline teaching + online review". Guide students to preview theoretical knowledge and watch teaching videos online; explain key and difficult points, carry out interactive communication and practical operation training offline; help students review and consolidate, complete homework and tests online, to achieve the organic combination of online and offline teaching. Thirdly, use modern teaching methods. Adopt virtual simulation technology to create a remote sensing virtual simulation laboratory, simulate processes such as remote sensing imaging, image processing, and interpretation applications, conduct practical operation training in a virtual environment, improve the shortage of physical laboratory resources, and enhance students' practical operation ability. At the same time, use multimedia technology to vividly display abstract remote sensing principles and complex image processing processes, enabling students to understand and master knowledge [11].

4.3. Strengthen practical training and exercise comprehensive practical ability

Strengthen the practical teaching link, improve the content of practical teaching, improve practical teaching resources, and enhance students' comprehensive practical ability and innovative thinking level.

Firstly, optimize the content of practical teaching, reduce verification experiments, increase comprehensive, design-oriented, and innovative experiments. Set up practical projects, such as comprehensive training of remote sensing data processing, design of remote sensing interpretation and application, and UAV remote sensing surveying and mapping practice, so that students can comprehensively apply the learned knowledge to solve practical problems. According to the actual needs of the industry, take actual enterprise projects as cases for students' practice, and let students participate in the whole process, to improve their ability to solve problems [12].

Secondly, improve practical teaching resources, increase financial support for remote sensing laboratories, add the latest remote sensing image processing software, UAV equipment, etc., to ensure that students can carry out systematic practical operation training. Strengthen cooperation with industry enterprises, establish off-campus practical teaching bases, allow students to go to enterprises, participate in actual projects, understand the needs of industry positions, and improve their practical ability [13].

Thirdly, strengthen the construction of the practical teaching faculty. Encourage teachers to practice in enterprises to improve their industrial practical ability and professional skills. Invite some industry experts to serve as part-time teachers to guide the practical teaching link and provide professional practical help to students. Reasonably increase the proportion of practical teaching hours to ensure the development of practical teaching and improve the quality of practical teaching. Some universities have strengthened practical teaching, which has greatly improved students' professional self-confidence and learning enthusiasm, and the achievement of teaching goals has been improved.

4.4. Conduct diversified teaching assessment and realize dynamic teaching updates

Change the traditional assessment method, establish a diversified and process-oriented teaching assessment system, break the system of evaluating only through examinations, and make a comprehensive evaluation of students' teaching effects and comprehensive quality. Firstly, establish an assessment model combining process assessment and final assessment, with process assessment accounting for 60% and final assessment

accounting for 40%. Process assessment includes classroom performance, online learning situation, homework completion, practical operation results, project design achievements, etc., to comprehensively examine students' entire learning process and practical ability[14]; the final assessment adopts a combination of closed-book and open-book examinations, mainly examining students' mastery of theoretical knowledge and comprehensive application ability. Enrich the content and form of assessment. In addition to traditional written examinations and practical operation assessments, add assessment methods such as case analysis, project reports, and group discussions to comprehensively examine students' ability to analyze and solve problems as well as their innovative ability. Thirdly, establish a teaching feedback system, regularly collect feedback from students and teachers on teaching conditions, to timely adjust teaching content, teaching methods, and examination forms, and promote dynamic teaching innovation. Take industry standards as assessment content to ensure that the assessment is consistent with industry positions and improve students' employability. Through diversified teaching evaluation, students' learning initiative and enthusiasm can be fully mobilized, which is conducive to the improvement of students' comprehensive quality and achieves the teaching goal of "promoting learning and teaching through assessment" [15].

5. Conclusion

In summary, as a core course of the surveying and mapping major, the teaching reform of "Remote Sensing Principles and Applications" is an important measure to adapt to the high-quality development of the surveying and mapping industry, implement talent training goals, and promote the optimization of the curriculum system. In the teaching reform, teachers should improve the curriculum content, build an online teaching platform, strengthen practical training, and conduct diversified teaching assessment, to improve teaching quality and cultivate high-quality surveying and mapping professionals with solid theoretical foundations, strong practical abilities, and innovative awareness. Teaching reform is a long-term and continuous process. Teachers should continuously pay attention to the development trends of remote sensing technology, constantly optimize teaching content and teaching models, promote the continuous improvement of the teaching quality of the "Remote Sensing Principles and Applications" course, and provide strong talent support for the high-quality development of the surveying, mapping, and geographic information industry.

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References

[1] Fang G, 2020, Implementing the Integration of Science and Education to Improve Classroom Teaching Quality—Taking the Course "Remote Sensing Principles and Applications" as an Example. Journal of Heihe University,

11(10): 80–83.

[2] Zhu H, Meng J, Liu X, et al., 2024, Teaching Practice and Reform of the Course “Remote Sensing Principles and Applications” Under the Demand for Disaster Prevention and Mitigation Professionals. Technology Wind, (01): 93–95.

[3] Dong F, Liu Z, Xie F, 2023, Research on the Mixed Teaching Needs and Modes of the Course “Remote Sensing Principles and Applications”. China Modern Educational Equipment, (19): 68–70 + 74.

[4] Deng Y, 2023, Experimental Teaching Design of the Course “Remote Sensing Principles and Applications” Based on the Integration of Professional Education and Innovation Education. Research and Practice on Innovation and Entrepreneurship, 6(15): 32–34.

[5] Cui L, Xian W, Liu J, 2023, Discussion on the Experimental Teaching Reform of “Remote Sensing Principles and Applications” for the Major of Remote Sensing Science and Technology Under the Background of Industry-University-Research Integration. Computer and Information Technology, 31(01): 92–95.

[6] Han Y, Wang S, He Q, 2022, Teaching Reform of the Course “Remote Sensing Principles and Applications” Under the Background of Engineering Education Certification. China Metallurgical Education, (06): 30–32.

[7] Wang J, Cui Y, Ni J, et al., 2022, Discussion on the Ideological and Political Teaching Reform of the Course “Remote Sensing Principles and Applications”. Journal of Higher Education, 8(35): 140–143.

[8] Zhang Y, 2022, Innovative Teaching Reform Design of the Course “Remote Sensing Principles and Applications”. Geomatics & Spatial Information Technology, 45(11): 5–8.

[9] Li Y, Ma Q, Liang L, et al., 2021, Ideological and Political Case Teaching of the Course “Remote Sensing Principles and Applications”. Journal of Jiangsu Normal University (Natural Science Edition), 39(04): 68–70.

[10] Zhuang Q, 2021, Practice of Heuristic Case Teaching Method in “Remote Sensing Principles and Applications”. Technology Wind, (28): 91–93.

[11] Guo H, Wu Y, 2021, Discussion on Visual Teaching Methods for the Course “Satellite Remote Sensing Principles and Applications”. Academy, 14(23): 20–22.

[12] Wang D, Wang Y, 2021, Exploration and Practice of Research-Oriented Teaching Mode in the “Remote Sensing Principles and Applications Internship”. The Guide of Science & Education, (20): 135–137.

[13] Kong C, Dong Y, Xu K, et al., 2021, Discussion on the Curriculum Construction Plan of “Remote Sensing Principles and Applications” Under the Background of Emerging Engineering Education. Science and Technology Innovation Herald, 18(18): 170–174.

[14] Yang Q, Chen D, Zheng J, et al., 2021, Implementation and Exploration of Curriculum Ideology and Politics in Teaching—Taking “Remote Sensing Principles and Applications” as an Example. Education and Teaching Forum, (06): 77–80.

[15] Yang K, Wang M, Xu Z, 2021, Discussion on the Curriculum Teaching Method of Carrying Out “Curriculum Ideology and Politics” in a Drip Irrigation Style—Taking the Course “Remote Sensing Principles and Applications” as an Example. Education and Teaching Forum, (02): 129–132.