Education Reform and Development, 2025, Volume 7, Issue 2
https://ojs.bbwpublisher.com/index.php/ERD
Online ISSN: 2652-5372
Print ISSN: 2652-5364

Analysis of Teaching Reform Strategy of Remote Sensing Principle and Application Course under the Background of Engineering Education Certification

Xiang Li*

College of Geography and Remote Sensing Sciences, Xinjiang University, Urumqi 830017, Xinjiang, China

***Corresponding author:** Xiang Li, xiangli@xju.edu.cn

Abstract: "Remote Sensing Principle and Application" is an important content of remote sensing science and technology major in college courses. In the context of engineering education certification, this paper explores the teaching reform of the Remote Sensing Principle and Application course to meet the educational demands of the new era and enhance the quality of engineering education. It also examines the existing challenges in the teaching of this course. This paper specifically analyzes the teaching concept, content, methods, and evaluation mechanisms, proposing corresponding reform measures to continuously improve the teaching model of the remote sensing principle and application course. The aim is to provide reform support for the training of well-rounded remote sensing professionals and to meet the course teaching requirements set by engineering education standards.

Keywords: Engineering education; Remote sensing principle and application course; Teaching reform

Online publication: March 7, 2025

1. Introduction

Engineering education is an important content of the development of higher education in our country [1]. Engineering education certification is a specialized certification implemented by China Engineering Education Professional Certification Association and Higher education Teaching Evaluation Center of Ministry of Education on the basis of engineering majors set up in universities. Since June 2016, when China officially joined the "Washington Agreement", the country has sought to align with the global development of engineering education and advance its own engineering education standards. Many Chinese colleges and universities have seized this opportunity to actively pursue engineering education accreditation, aiming to foster the growth of engineering education in China. This marks a significant step in transitioning from being a large nation in engineering education to becoming a powerful one [2].

2. Overview of the background of remote sensing principle and application course teaching

In the context of education in the new era, engineering education certification is based on three core principles. First, it emphasizes a "student-centered" approach. This means that in the teaching process of professional education, the status of students as the central focus of learning should be respected. It encourages students' active participation, fosters their initiative, and guides them toward independent and proactive learning. The second is "results-oriented", that is, students are required to obtain learning results in professional education through curriculum learning, and enrich their theoretical knowledge and practical literacy. Moreover, "continuous improvement" is required, which requires teachers to reform and improve educational concepts and teaching content with the times in the process of education and teaching.

Remote sensing principle and application is a basic course on the principles of remote sensing science and technology. It mainly involves physical geography mapping, earth exploration, resources and environment, etc. Remote sensing technology is used to help students observe nature from different angles, understand the earth, and acquire physical geography knowledge [3]. However, due to the constraints of traditional teaching concepts, the form and content of the course are often simplistic and theoretical. The professional theory is disconnected from real-world engineering practice, which fails to meet the core concept requirements of engineering education certification. Therefore, as a crucial component of remote sensing education and a key training path for engineering application talents, the teaching of remote sensing principles and applications must align with the standards of engineering education certification. This requires updating teaching concepts, adjusting course content, optimizing teaching methods, improving evaluation mechanisms, and advancing the engineering development of remote sensing principle and application course teaching.

3. The existing problems in the teaching of remote sensing principles and application courses

3.1. Solidification of teaching concept

At this stage, despite the advancement of engineering education certification, teachers' teaching concepts have not been effectively transformed. Many still adhere to traditional ideas such as "teachers teach, students listen" and "theoretical knowledge as the main focus, with practical education as a supplement". These outdated concepts influence practice, leading to teaching methods that remain simplistic and overly theoretical [4].As a result, students are unable to achieve a balanced understanding of both theoretical knowledge and practical skills. This leads to difficulties when faced with engineering practice, as they struggle to apply theoretical knowledge to real-world problems. Consequently, teaching efficiency is low, and the overall teaching effectiveness is limited.

3.2. The teaching content emphasizes theory and ignores practice.

On one hand, most of the current teaching content is based on theoretical knowledge, combined with concrete case analysis, to facilitate students understanding of the relevant theoretical system of remote sensing principles. However, due to the lack of engineering experiment teaching, the course content design of remote sensing principle and application can only help students to carry out basic practical operations. It cannot effectively guide students to combine theoretical knowledge with real life and it is difficult to transform it into students' internal cognitive framework when facing complex engineering problems [5]. On the other hand, with

the rapid development of remote sensing technology and the continuous innovation of research results, the teaching content is one-sided and lags. Students are unable to grasp the latest scientific research technologies and their underlying principles. Additionally, the content of teaching materials is disconnected from actual engineering practice, which hinders students' ability to apply what they have learned in real-world scenarios. This gap in knowledge and practical application negatively impacts their future employability and career readiness [6].

3.3. Unitary teaching method

With the continuous development of information technology, education in the new era has put forward more teaching requirements for the teaching of remote sensing principles and applications [7]. The content of remote sensing courses is vast and complex, often covering interdisciplinary theoretical concepts. Due to this, teachers tend to rely on the traditional "teacher-centered" approach, where teachers speak and students passively listen. This method fails to provide a comprehensive and engaging educational experience. The single teaching approach and rigid education model lead to a decline in students' enthusiasm for learning and a lack of initiative in their studies. On the other hand, teachers' lack of focus on integrating information technology into teaching leads to a flat, disorganized teaching approach. As a result, students are unable to systematically grasp the curriculum framework, which hinders their ability to clearly understand the course content. This lack of structure negatively impacts the development of students' theoretical knowledge and undermines the quality of their education [8].

3.4. The assessment system has not yet been perfected

At present, the assessment method of remote sensing principle and application still follows the traditional assessment mechanism, and the assessment of students' learning ability is often based on the usual scores and the final scores, lacking in-depth understanding of students' learning situation [9].On the other hand, teachers' lack of focus on integrating information technology into teaching leads to a flat, disorganized teaching approach. As a result, students are unable to systematically grasp the curriculum framework, which hinders their ability to clearly understand the course content. This lack of structure negatively impacts the development of students' theoretical knowledge and undermines the quality of their education [10].

4. The reform measure of remote sensing principle and application course teaching

4.1. Updating the teaching idea

Under the background of engineering education certification, teachers need to keep up with the pace of education development in the new era, abandon the traditional educational concept of "theoretical learning", conform to the core concept of engineering education, change from "teacher-centered" to "student-centered", from "theory-led" to "results-oriented" development, from "abiding by the old rules" to "continuous improvement" adjustment [11].

This necessitates that teachers encourage students to actively engage in the classroom during the remote sensing principle and application course, allowing them to fully utilize their subjective initiative. Teachers should focus on developing students' abilities for independent observation, learning, and critical thinking. Additionally, attention must be given to enhancing students' practical skills [12].Optimizing the teaching model and addressing the relationship between professional theoretical knowledge and engineering practice

are crucial for fostering a more effective learning environment. So that the students can use the theoretical knowledge to apply to the specific case practice. For example, to help students master the analysis methods of remote sensing information, teachers can have students design relevant engineering projects. This could involve collecting real-spectrum data from the ground through field experiments, evaluating the quality of remote sensing products in specific regions, and analyzing and processing the experimental results. Such hands-on activities would allow students to apply theoretical knowledge in real-world situations, bridging the gap between theory and practice, and ultimately enhancing both the teaching quality and the students' overall abilities [13].

4.2. Optimize the teaching content

In response to the core concept of "continuous improvement" of the Engineering Education certification, teachers need to optimize the content of the teaching process with the times. After reviewing the course content on remote sensing principles and applications, the teacher integrates the material by dividing the course into distinct knowledge units: the concept theory of remote sensing, the imaging principles of remote sensing images, the basics of remote sensing image processing, image interpretation and production, and remote sensing applications. The teacher then breaks down the course focus into detailed, manageable sections and incorporates it into a blended teaching model that combines both online and offline learning. This approach allows for a more structured and interactive learning experience, catering to different learning styles and enhancing the overall effectiveness of the course. The teaching content of remote sensing principle and application course was scientifically and reasonably optimized and adjusted, so that the teaching content was clearly layered and the context was clear.

4.2.1. Choose the structure of teaching content and achieve systematic unity and emphasis

With the continuous development of quality-oriented education in the new era, the arrangement of class hours in curriculum teaching can gradually fail to meet students' expansion and digestion of theoretical knowledge. In this situation, teachers must carefully plan the overall curriculum focus and make thoughtful decisions regarding the content of each textbook chapter. For the theoretical chapters, students can be arranged to preview before class and master the theoretical structure of the system in advance by consulting materials and watching videos. For professional theories with strong practicality, teachers can focus on explaining them and analyzing them with specific cases. On the other hand, remote sensing courses involve many disciplines, and different arrangements should be made for the course contents of different majors. For example, the curriculum for surveying and mapping majors should emphasize the engineering aspects of remote sensing surveying and mapping. It should integrate textbook content with practical activities, such as field surveying and mapping lectures, and organize timely special sessions. This approach will help strengthen students' understanding of the material and enable them to apply the knowledge effectively in real-world situations.

4.2.2. Update the teaching content in real time to keep up with the pace of educational development in the new era

In the era of rapid progress in science and technology, remote sensing technology is also constantly innovated and upgraded with the development of science and technology, resulting in an endless stream of scientific research results and academic theories. In this context, teachers should stay up-to-date with the rapid advancements in remote sensing technology. They need to actively track the latest developments in

remote sensing principles and applications through information platforms such as online resources, research broadcasts, educational policies, and industry requirements. By incorporating this up-to-date information, teachers can update their course content, ensuring that the teaching of remote sensing principles and applications remains relevant and timely [10]. For example, in the development process of the aerospace field, through the transmission of the latest news about the launch and sampling return of "Chang 'e-6", to explain to students the remote sensing principles involved in the Mid-Autumn moon exploration project and carry out specific analysis, which is helpful to stimulate students' learning interest and improve the teaching effect of remote sensing courses.

4.2.3. Attach importance to engineering practice teaching, combine scientific research results to enrich teaching cases

When optimizing the course content of remote sensing principle and application, teachers should combine the core concept under the background of engineering certification, pay attention to the education of students' professional theoretical knowledge, but also pay attention to the cultivation of students' practical skills and logical thinking ability, which requires teachers to adjust the allocation of theoretical and practical courses and increase the course content of practical teaching. For example, in the course of teaching "remote sensing image processing", combined with the latest scientific research results and concrete case analysis, students are guided to carry out teaching experiments such as image preprocessing, polynomial geometric correction, DEM differential correction, etc [11]. Through the specific experimental activities, students can understand the storage mode of multi-band data and the basic information of image file storage, master the practical skills of image file data reading in ASCII format, and improve students' practical ability and thinking logic ability.

4.3. Enrich the teaching method

The traditional classroom teaching is mainly based on the teaching mode of "teacher teaching and student learning". The knowledge output of teachers in classroom teaching is one-way and solidified, and they blindly "cram" knowledge into students, resulting in a boring classroom atmosphere and students' lack of initiative, and can not be efficiently integrated into classroom teaching. To solve this problem, teachers need to innovate teaching methods. For the important and typical professional theories of remote sensing principles, teachers will mainly teach in class, and help students understand the basic theoretical knowledge through detailed explanation, laying a solid foundation for the application of remote sensing technology. As for some flexible theoretical and practical knowledge, teachers can use information technology to assist the teaching mode, guide students to actively explore and bravely create through intuitive and concrete display, and stimulate students' interest in learning.

4.3.1. Use information technology for teaching

Principles and application of remote sensing is a theoretical course with remote sensing images as the main information carrier. According to the traditional "blackboard teaching" mode, due to its high generalization of content and fast teaching rhythm, it is difficult for teachers to complete the deconstruction and analysis of knowledge through verbal descriptions of some obscure teaching modules in the principles of remote sensing. To solve this problem, teachers need to combine multimedia teaching with blackboard teaching. For remote sensing video processing, visual interpretation of remote sensing images, and detection and calculation of remote sensing images in the course, teachers can use computers to collect and sort out video materials related

to remote sensing principles and conduct case analysis in combination with specific principles in classroom teaching [13]. For example, in the teaching of "satellite" related courses, teachers can share with students the relevant video and frequency data of meteorological satellites, land resources satellites, ocean satellites, and military reconnaissance satellites. When introducing the characteristics and uses of various satellites, teachers can also simulate the motion trajectory of satellites through Flash animation technology and explain them in combination with the teaching content. With the support of intuitive information technology, students can clearly understand the composition, classification, use of satellites, and deepen students' cognition of theoretical knowledge.

4.3.2. Increase interactive teaching in the classroom

To meet the core concept of "student-oriented and results-oriented" in engineering education, teachers can adopt project-driven education method, actively organize classroom interaction in combination with teaching content, and guide students to actively participate in classroom teaching. First, teachers should clearly define the teaching tasks and course objectives based on the curriculum content. They should design preview assignments in a scientific and reasonable manner, allowing students to familiarize themselves with the course material ahead of time. Students can explore the remote sensing principles they are interested in through resources like Baidu search and reading materials, encouraging exploration and critical thinking. Secondly, teachers actively organize group discussions in class, encourage students to raise their own questions and carry out group discussions in the form of project cases, to improve students' logical thinking ability and teamwork consciousness.

In addition, teachers also need to arrange practical activities according to the curriculum requirements [14]. For example, in the teaching of "Digital Image Processing of Remote Sensing", teachers first ask students to conceive the digital experiment of remote sensing application and guide them to complete the experimental activities related to digital image processing, so that students can combine theoretical knowledge with practical application. Finally, let students sort out and summarize an experiment report, including the experiment purpose, experiment content, experiment process, problems, and solutions, etc., to help students sort out the theoretical and experimental knowledge system, effectively implement the core concept of engineering education, and promote the all-round development of students.

4.4. Improve the assessment mechanism

Teaching assessment is an important link in course teaching. A scientific and reasonable assessment method is conducive to clarifying students' learning situation and helping students find their shortcomings and problems in course learning. Most of the traditional assessment methods are based on the final examination results and regular results. Teachers check the degree of students' mastery of professional theoretical knowledge through the feedback of test papers and regular course performance, which often ignores the cultivation of students' practical ability. Therefore, teachers are required to follow the core concept of engineering education, combine the teaching content of remote sensing principle and application, and build a diversified course assessment system based on regular scores, final scores, course reports, and practical scores.

Under the background of engineering education certification, teachers should reasonably design assessment standards. In the new assessment system, the usual score accounts for 20%, the final score accounts for 30%, the course report accounts for 20%, and the practice score accounts for 30%. By adjusting the proportion of different assessment standards, the emphasis of teaching objectives is clearly defined, that is,

the investigation of students' theoretical knowledge and practical ability is emphasized. First of all, the usual scores include course attendance, course participation, course tests, etc. Teachers check students' attendance through APP check-in and teacher roll call, and actively organize group discussion activities and in-class tests in course teaching to create an active teaching atmosphere and let students actively participate in class learning. Secondly, teachers need to optimize the content of the final exam, reduce the choice of theory and fill in the blank, and add comprehensive analysis questions about practical engineering design, to test students' practical ability [15]. Moreover, the homework report is mainly divided into two parts: homework and class report. Homework is an important means to test students' learning results. Teachers need to guide students to pay attention to homework after class. Finally, practice results, as a relatively high assessment content, are incorporated into the inspection mechanism, mainly through the assignment of relevant practical activities, so that students can improve their autonomy and practical literacy in the practice assessment. It can be seen that a scientific and reasonable assessment mechanism based on the core concept of engineering education and the overall teaching objective not only examines the students' professional theoretical knowledge quality, but also cultivates their independent learning ability and practical ability, and promotes the comprehensive development of students.

5. Conclusion

Strengthening the engineering education certification is of great significance for the professional disciplines in the field of engineering technology in China to improve their education level and adapt to the international environment. Under this background, the course teaching of remote sensing principles and applications should keep up with the pace of the times, update the educational concept, optimize the educational model, adjust the teaching content, respect the principal position of students, and pay attention to the balanced teaching of theory and practice. Through the continuous exploration and research of education and teaching in the new era, the principle and application of remote sensing are further improved. The teaching system actively promotes the steady development of engineering teaching level in our country.

Disclosure statement

The author declares no conflict of interest

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