

Teaching Innovation of Hydrogen Energy Technology and Application Course

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Abstract: *The course of Hydrogen Energy Technology and Application is a newly opened course aimed at the introduction of hydrogen energy knowledge. This course has the characteristics of strong academic frontiers in knowledge points, difficulty in forming systematic knowledge points, and lack of mature textbooks. This study lists the problems existing in current course teaching, describes the main content of teaching reform, and elaborates on the significance of teaching reform.*

Keywords: Hydrogen energy technology and applications, Teaching Innovation.

1. Current Situation

Hydrogen energy is regarded as an important component of the future national energy system, with clean and low-carbon characteristics, which can help promote the green and low-carbon transformation of energy consuming terminals such as transportation and industry, as well as high energy consuming and high emission industries. Therefore, it is imperative to carry out hydrogen energy teaching in higher education. However, due to the fact that hydrogen energy technology and its applications belong to an immature frontier technology field, relevant textbooks are still blank, which has led to some problems in the teaching of hydrogen energy technology and its applications courses.

1.1 Inappropriateness of Textbook Content

Hydrogen energy technology and its applications are cutting-edge scientific technologies, unlike traditional classic course teaching, which does not have mature textbooks and courseware. Only relevant academic monographs can be used as textbooks, but monographs often focus on in-depth research in a certain field, and the content may be too specialized and complex, not suitable for beginners or students with non-professional backgrounds. Monographs are usually complete books that lack interactive and participatory design, which is not conducive to stimulating students' interest and initiative in learning. The structure and content of monographs are relatively fixed, making it difficult to adjust and customize them according to teaching needs, and their ability to adapt to different teaching contexts is poor. Monographs usually only contain textual content and lack supporting multimedia teaching resources such as videos, animations, simulation software, etc., which affects teaching effectiveness. Monographs may focus on theoretical exposition, lacking specific experimental guidance and practical operation steps, which is not conducive to cultivating students' practical abilities.

1.2 Difficulty of Creating Teaching Courseware

Hydrogen energy technology and application course is a newly established teaching course, therefore, there is no corresponding professional course courseware, and it needs to be re-created. Producing high-quality courseware requires a

lot of time and work, which can take up teachers' preparation and research time. Creating courseware requires certain computer operation skills and design abilities, which not all teachers possess.

1.3 Difficulty for Teachers to Learn Cutting-edge Knowledge

With the rapid development of technology, new knowledge, techniques, and theories continue to emerge, and teachers need to constantly learn and update their knowledge base. Although there are abundant online resources, teachers may lack the time and ability to access and screen high-quality resources. In addition to teaching tasks, teachers also need to handle administrative work, student counseling, etc., which makes it difficult for them to allocate enough time for self-improvement [1].

1.4 High Pressure for Students to Learn Expertise

New terms and technologies have emerged in the course of hydrogen energy technology and applications, requiring students to conduct in-depth and detailed self-study outside of class. Students need to complete multiple tasks such as course learning, exams, and paper writing within a limited time, and the time for literature review is often squeezed. The quality of academic literature varies greatly, and students need to spend a lot of time discerning the reliability and relevance of the literature. For non-native academic literature, language barriers are also an issue that cannot be ignored, increasing the difficulty of reading and understanding.

2. Teaching Reform Content

2.1 Sorting Out Key Knowledge Via Multi Textbook System

By reading the table of contents, introductions, and conclusions of multiple textbooks, one can understand their structure and main content, thereby gaining insight into the emphasis of different textbooks. Teachers can compare the differences in content, perspectives, and methods among different textbooks to identify common knowledge points and unique perspectives. Teachers can thoroughly read the relevant chapters of each textbook, focusing on the common

knowledge points across multiple textbooks. Teachers can build a knowledge framework based on learning objectives and textbook content, and integrate knowledge points from different textbooks into this framework. Teachers can compare and analyze the explanations and viewpoints of different textbooks on the same knowledge point, understand their similarities and differences, and the theoretical basis behind them. Teachers can consult with experts to obtain their opinions and suggestions on different textbooks and knowledge points. Based on the integrated knowledge points, teachers can organize the key knowledge suitable for teaching hydrogen energy technology and application courses.

2.2 Collaborative Production of Courseware by Teaching and Research Groups

Collaborative courseware production by teaching and research groups is a process of teamwork that requires clear division of labor, effective communication, and coordinated actions. Firstly, it is necessary to determine the theme and teaching objectives of the courseware, ensuring that all members have a clear understanding of the purpose and content of the courseware. Different tasks are divided based on the expertise and interests of the members of the teaching and research group. It can include content writing, design and production, technical implementation, etc. Teachers can collect relevant teaching materials, pictures, videos, and other resources to ensure that the courseware content is rich and accurate. Teachers can write the text content of the courseware, paying attention to concise and clear language, and clear logic. Teachers can design the visual effects of courseware, including layout, color, font, etc. Teachers can use professional design software such as PowerPoint, Keynote, or professional courseware production tools. Teachers can utilize multimedia elements such as video, audio, and animation to enrich the content of the courseware and increase its visual and auditory appeal. Introducing knowledge points through storytelling makes abstract concepts easier to understand and remember. Gamification elements such as point systems and role-playing can be used to stimulate students' interest and motivation in learning. Charts, images, and diagrams can be used to explain complex concepts and make the content more intuitive and understandable [2].

2.3 Multi Channel Tracking of Academic Frontiers

There are many ways to track academic frontiers, and different tracking methods have different characteristics. Teachers can make full use of literature search tools such as CNKI, Wanfang Database, Google Scholar, Web of Science, etc. to explore the latest research frontiers. By searching keywords, authors, institutions, topics, etc., they can quickly find the latest frontiers in their relevant fields, thereby improving reading efficiency. Teachers can make full use of academic social platforms such as ResearchGate and Academia.edu to follow peer researchers and timely obtain the latest research results published by peers. Teachers can also subscribe to academic information by following the academic WeChat official account, and know the latest academic frontiers through the official account, so as to improve the tracking efficiency [3].

2.4 Sharing Learning Paths and Methods

The course on hydrogen energy technology and its applications is a relatively trivial subject. Therefore, teachers should encourage students to actively speak up in class, share their learning methods and experiences, and communicate with teachers and classmates. Teachers can encourage students to form or join study groups, regularly discuss learning content, and share their own learning methods and skills. Teachers can encourage students to participate in or organize academic presentations to share their research findings and learning experiences. Teachers can encourage students to recommend and share their own learning tools and applications, such as note taking software, time management tools, etc. Teachers can encourage students to participate in or organize online seminars to discuss learning issues and share experiences with other students and experts. Teachers can encourage students to utilize the resources of the library, such as academic databases, e-books, etc., to share their learning resources and methods. Teachers can encourage students to participate in academic activities organized by the school, such as academic competitions, lectures, etc., and share their learning experiences. Teachers can encourage students to organize their study notes into documents and share them with classmates via email or online documents. By sharing learning approaches and methods, knowledge sharing is promoted, learning efficiency is improved, students' interest in learning is stimulated, team spirit is cultivated, self-confidence is enhanced, critical thinking is promoted, communication skills are improved, and personal growth is promoted [4].

3. Significance of Teaching Reform

3.1 Conducive to the Formation of Systematic Key Knowledge

The course of hydrogen energy technology and application belongs to the forefront of knowledge. By sorting and organizing different teaching materials, a set of key knowledge system can be formed around the teaching core of this major. Textbooks can help students better understand the internal connections and logical structures of subject knowledge by forming teaching priorities, thereby promoting systematic learning of knowledge. Different teaching focuses can attract students with different interests and stimulate their enthusiasm for learning. For example, some textbooks may focus more on practical operations, while others may focus more on theoretical analysis. Through different teaching focuses, students can understand and analyze problems from different perspectives, which helps cultivate their critical thinking and independent thinking abilities. With the continuous updating of educational concepts and methods, textbooks also need to constantly adjust their teaching focus to meet the new requirements of educational reform. Different teaching priorities require teachers to possess corresponding knowledge and skills, which can promote continuous learning and improvement, thereby enhancing the quality of teaching.

3.2 Conducive to Creating High-quality Courses

Through the collaborative efforts of the hydrogen energy technology and application course teaching and research

group, we can create high-quality courses with a more complete knowledge system. Teachers can share teaching resources, such as textbooks, courseware, cases, exercises, etc., to enrich teaching content and improve teaching effectiveness. The teaching styles and methods of different teachers can inspire each other and promote innovation in teaching methods and curriculum design. Through collaboration, teachers can learn from each other, draw on each other's strengths, and jointly improve the quality of teaching. Collaboration among teachers can cultivate team spirit and cooperation awareness, which is very important for educational work. Different teachers can design more targeted teaching plans based on the learning needs and backgrounds of different students, in order to better meet their diverse needs. Teachers can learn from each other and enhance their professional competence and teaching skills during the collaborative process. Teachers' collaboration can design more interesting and challenging course content and activities, increase the attractiveness of the course, and stimulate students' interest in learning. Teachers from different disciplines can collaborate to design interdisciplinary course content, promote interdisciplinary and fusion, and cultivate students' interdisciplinary thinking. Teachers' collaboration can more flexibly adjust course content and teaching methods to adapt to changes in educational reform and student needs. Teachers can conduct more effective course evaluation and feedback, adjust teaching strategies in a timely manner, and improve teaching effectiveness. Teachers' collaboration can continuously update and improve course content, ensuring the continuous development and adaptability of the curriculum. Through these advantages, teachers' collaboration in creating high-quality courses can not only improve teaching quality, but also promote the professional development of teachers and the comprehensive development of students.

3.3 Beneficial for Teachers to Learn Cutting-edge Knowledge

By learning cutting-edge knowledge, teachers can update their teaching content in a timely manner, making it more relevant to the latest academic research and practical applications, thereby improving the quality of teaching. Understanding cutting-edge knowledge can help teachers innovate in teaching methods and curriculum design, adopt more advanced teaching methods and concepts, and improve teaching effectiveness. Learning cutting-edge knowledge can guide students to think and explore new problems, cultivate their innovative thinking and problem-solving abilities. By learning cutting-edge knowledge, teachers can participate in academic discussions and exchanges, enhance their academic influence and professional status. The content and methods of education need to constantly adapt to the development of society and technology, and teachers' mastery of cutting-edge knowledge helps to timely update and adjust educational content. By tracking cutting-edge knowledge through multiple channels, teachers can promote cross disciplinary integration and design more diverse curriculum content. Teachers who learn cutting-edge knowledge can provide students with the latest academic and practical information, helping them to have stronger competitiveness in employment and further education.

3.4 Beneficial for Students to Learn Professional Field

Knowledge

Sharing learning paths and methods among students is indeed a very effective way to help them better grasp knowledge in their professional fields. By sharing different learning resources and methods, students can learn from each other, broaden their knowledge horizons, and obtain more learning materials and information. Sharing learning experiences can stimulate other students' interest in learning, especially when they discover that others have made significant progress through a certain method. Sharing learning paths and methods can promote cooperation among students, cultivate team spirit and collaboration ability, which is very important for future learning and work. Students can learn from others' effective learning methods, improve their own learning efficiency, and avoid taking detours. Seeing others achieve success through certain methods can motivate other students to try these methods as well and enhance their learning motivation. In the process of sharing and discussing learning approaches and methods, students can learn to think from different perspectives, cultivate critical thinking and independent thinking abilities. Through sharing and discussion, students can learn and master more learning strategies and skills, and improve their ability to choose and apply learning strategies. Sharing one's own learning methods and successful experiences can enhance students' confidence and make them more willing to try new methods and challenges in their studies.

4. Conclusion

The course of hydrogen energy technology and application is an important foundational course for new energy majors. Identifying a series of problems in the current course and addressing them one by one is a key issue in the teaching reform of hydrogen energy technology and application courses. This study provides a detailed description of the problems existing in the course, the main reform content, and the significance of teaching reform, which has reference value for improving the teaching quality of courses such as hydrogen energy technology and application.

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