

Research on the Reform Strategy of Inorganic Chemistry Experimental Teaching Based on Digital Reforms

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Nowadays, in the era of rapid digitalization development, digital education presents significant opportunities and challenges in universities. The confluence of contemporary science and technology, the evolving landscape of higher education, and the new era of education and teaching necessitate the adoption of digital education in universities. This transition also calls for the transformation of inorganic chemistry laboratory experiments from traditional operations to digitalization, a shift that can greatly enhance the interaction between teachers and students. In light of these opportunities, we propose implementing teaching reform strategies, such as continuous updating and maintenance of digital teaching resources, digitization of student assessments, and interdisciplinary cooperation and resource sharing, to adapt to teaching inorganic chemistry experiments. In our future work, we are committed to exploring new technologies and methods in this field to further elevate the quality and effectiveness of education.

Keywords: digital reforms, teaching strategy, inorganic chemistry, experimental teaching

Introduction

Today, in a rapidly developing digital era, the field of education is undergoing a profound transformation. Inorganic chemistry, as a basic and important subject area, is also facing a transition from traditional to modernized laboratory teaching (Rodríguez & Vicente, 2002). This transition is facilitated by digital innovation, which provides new perspectives and methods for this transformation. The innovation is both about the innovation of teaching content and methods and involves changes in the way of interaction with students and adjustments in assessment mechanisms. Effective digital reform strategies can help students better understand

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complex chemistry concepts and laboratory skills, while also providing teachers with diverse teaching tools. Therefore, the exploration of teaching strategies of inorganic chemistry experiments based on digital reform to improve teaching quality and students' learning outcomes is not just a theoretical exercise but has significant practical implications for the improvement of inorganic chemistry education.

Advantages of Digital Teaching and Learning

Digital teaching has become an important means for universities to improve the quality of teaching and services (Xiang, Mao, & Xiao, 2023). In order to further promote the digital development of colleges and universities, we must achieve high-quality educational development from a variety of perspectives, such as the improvement of digital information technology and facilities and the management of digital teaching resources. The teaching practice of digital development of higher education not only improves the quality of education but also plays a pivotal role in promoting educational equity and optimizing the allocation of educational resources. At present, the digitalization process has been vigorously promoted, and various online office, teaching and management tools have emerged. With the development and popularization of information technology, digital tools have become an indispensable part of higher education and have a wide range of application prospects, inspiring a new era of educational empowerment.

The Necessity for Digital Teaching and Learning in Universities

Requirements for Scientific and Technological Development

With the continuous development of science and technology, big data technology, 5G, and other new technologies have gradually come into people's lives, bringing radical changes to people's lives. The development of new technologies also implies new opportunities and challenges, and the teaching work of universities is also affected by them, and most universities have actively constructed "smart campuses" and "famous teachers and classes on the cloud", and have made certain achievements. The main reason for universities to build digital teaching is to adapt to the national education development strategy, such as the first attempt to apply the rain classroom, nail, wisdom tree, and another digital teaching platform. However, due to technical or financial constraints, the application of digital teaching in most colleges and universities only stays on the surface. From the viewpoint of the new direction of the development of higher education teaching and the external environment, in-depth promotion of digital reform has become a necessary way for higher education to adapt to the development of science and technology (Cho, 2023).

Trends in University Education

In the era of extensive use of a large number, the traditional teaching mode gradually lost its main position and new teaching methods and others were gradually accepted by students. High-quality digital teaching will surely be the focus of future teaching and learning practices. In addition, the organization of universities is in the form of continuous innovation and has withstood the test of practice. For example, Google's technical director Ray Kurzweil founded the Singularity University; Soochow University and Huawei Technologies Co., Ltd. jointly constructed the "cloud in the Soochow University" and so on. These new forms of higher education organization for the development of teaching and learning in higher education have pointed out the direction. Therefore, the implementation of digital teaching is a trend for the future development of higher education.

The Inevitable Requirements of Education and Teaching

At present, most of the students in universities were born after 2000. Those students growing up in the information age and like to pursue freedom, individuality and are able to accept new things quickly. At the same time, the coverage of intelligent equipment in the student population is large, which makes it convenient for students to obtain more knowledge and information independently. In this regard, teaching in colleges and universities is faced with many new challenges, and it is difficult to reap the ideal teaching effect with a single and formalized teaching mode. How to carry out teaching activities on the premise of respecting students' individuality and differentiation, how to promote students' initiative to carry out learning activities, how to make use of students' fragmented time, and how to make effective use of students' intelligent devices in learning, etc. make it urgent for colleges and universities to promote digital teaching in depth.

Challenges of Inorganic Chemistry Laboratory Teaching in the Context of Digital Reforms

In the context of digital transformation, teaching inorganic chemistry labs faces a number of challenges and most notably higher demands on teachers. While some teachers already have the basic skills to use these tools, many other teachers need time and training to familiarize this new technology. At the same time, maintaining the authenticity and practicability of laboratory operations is another challenge. While digital tools offer a lot of security and convenience, they may not be able to fully replicate the hands-on experience and intuition found in a laboratory setting. Finally, student engagement and motivation may also be compromised. In particular, this has the potential to reduce students' direct contact and interaction with laboratory materials when digital teaching methods are not properly applied, thus affecting learning outcomes. Therefore, these challenges need to be carefully considered when implementing digital individual reforms and appropriate measures need to be taken to overcome the above difficulties.

Keys to Digital Reform of Inorganic Chemistry Laboratory Teaching

Digital Transformation of Laboratory Operations

Virtual and remote laboratories are now changing the traditional approach to laboratory instruction (Potkonjak, Gardner, Callaghan, Mattila, Guetl, Petrovic, & Jovanovic, 2016). Virtual laboratories allow students to conduct experimental operations in a simulated environment on a computer, in which students can accurately simulate real experimental conditions and processes, yet without the need to actually use chemicals or laboratory equipment. This new paradigm reduces the consumption of actual chemical resources and potential experimental risks and makes laboratory instruction less limited by geographic location and physical space. Students can practice and explore laboratory operations at any time and place, greatly enhancing the flexibility and diversity of learning. Meanwhile, remote labs will provide a different kind of digital lab experience. Students can remotely manipulate real laboratory equipment and perform experimental operations through an internet connection. This approach combines the realism of actual operation with the convenience of digital technology. Students can get real experience in operating the experimental equipment and learn the complex process through the remote lab.

Digitization of Student Interaction and Assessment

The digitalization of student interaction and assessment is done through an online interactive platform and digital assessment, which effectively enhances the interactivity of teaching and the accuracy of assessment. Online interactive platforms can provide a virtual space that enables students and teachers to communicate effectively without time and location constraints. At the same time, these platforms support real-time discussions,

file sharing, and collaborative learning, greatly facilitating interactions between students and teachers. Students can participate in online discussions, submit assignments, and even collaborate in groups on these platforms. These activities increase students' engagement and enhance their teamwork and communication skills. Moreover, digital assessment methods provide more diversified and flexible means to assess students' learning effectiveness. Compared with traditional paper-and-pencil exams, digital assessments can include online tests, interactive assignments, and even project-based assessments. These assessment methods can more comprehensively evaluate students' knowledge mastery and skill application ability.

Reform Strategies for Inorganic Chemistry Laboratory Teaching Based on Digital Reforms

Continued Updating and Maintenance of Digital Teaching and Learning Resources

Continuous updating and maintenance of digital teaching resources is a crucial part of the reform of inorganic chemistry laboratory teaching (Korshunov & Knyazeva, 2020). In the modern education system, the role of digital teaching resources is becoming more and more important, especially in enhancing learning efficiency and teaching quality, which plays an indispensable role. With the continuous progress of science and technology and the changing needs of teaching, teaching resources need to be updated regularly to ensure the relevance and advancement of the content. Updating teaching resources covers the latest scientific discoveries and experimental techniques and improvements in teaching methods and tools. For example, introducing more interactive simulation software allows students to explore complex chemical reactions in a safe environment, improving their experimental skills and stimulating their interest in science. In addition, the maintenance of teaching resources is equally important to ensure that digital teaching resources can run stably and efficiently. Maintenance work includes regular inspections, fixing technical faults, updating software to prevent security vulnerabilities, analyzing user feedback and teaching effectiveness to make timely adjustments to the teaching content. This dynamic maintenance mechanism ensures that the teaching resources are always in the best condition, which helps to improve the quality of the teaching and learning experience (Abdalla, 2020). In addition, teachers play a crucial role in the updating and maintenance process. Teachers are not only knowledge disseminators, but also integrators and optimizers of resources. Through teachers' professional perspectives and practical experience, they can more accurately identify which resources need to be updated or adjusted and how to make the teaching content more vivid, practical, and attractive. Therefore, strengthening teachers' initiative and creativity in updating and maintaining digital teaching resources has an important impact on maximizing the use of teaching resources and continuously improving teaching effectiveness.

Enhancing Teachers' Digital Teaching Skills

Teacher training and professional development are central to enhancing teachers' digital teaching skills (Lin, Yang, Jiang, & Li, 2023). With the rapid development of educational technology, traditional teaching models are undergoing a digital transformation, which requires teachers to master basic teaching skills and be proficient in using various digital tools and platforms. Effective teacher training programs should include an introduction to the latest teaching technologies, such as interactive whiteboards, online collaboration tools, and virtual labs and how to integrate these essential technologies into daily teaching. In addition, training should cover the use of digital media, including video production, online course design, and even the use of social media in teaching. These skills will both enhance teachers' teaching efficiency and improve students' learning experience.

Professional development for teachers is equally important. It is not just about improving teaching skills but also a process of continuous learning and self-improvement. Professional development programs should encourage teachers to explore new teaching concepts and methods and stimulate their innovative spirit. For example, by attending workshops, seminars, or online courses, teachers can learn about the latest educational theories and practices, which can help them to better adapt to the trend of digital teaching and inspire their passion for education. In addition, encouraging knowledge and experience sharing among teachers is also an important aspect of professional development. Through the establishment of a teacher community, teachers can learn from each other and share successful teaching strategies and experiences so as to improve the quality of teaching together. Currently, the ultimate goal of teacher training and professional development is to create an active, learner-centered teaching and learning environment. Teachers are able to support student learning and promote holistic student development more effectively when they are equipped with the necessary digital pedagogical skills and keep these skills modern and relevant through continuous professional development.

Interdisciplinary Cooperation and Resource-Sharing

Interdisciplinary cooperation and resource sharing occupy an important position in digital teaching reform, especially in promoting the effective use of educational resources, optimal resource integration, and knowledge dissemination. In the contemporary educational environment of multidisciplinary intersection, cooperation among different disciplines can enrich the teaching content and improve teaching efficiency. Sharing digital resources, such as common online platforms, course content, and teaching tools, can reduce duplication of efforts and promote optimal resource integration. For example, chemistry and physics disciplines can share simulation experiment software, while history and literature can share digital archives. Such resource sharing not only saves costs but also increases the diversity and interactivity of teaching resources. Through interdisciplinary collaboration, teachers can gain new teaching inspiration and methods from other disciplines, which is conducive to stimulating innovative teaching strategies. For example, math teachers may learn from music teachers how to use digital tools to create more interactive classroom activities. In addition, students can learn specialized knowledge from interdisciplinary teaching and learning environments, and also develop integrative thinking and creative skills. Interdisciplinary programs and activities, such as joint research projects or thematic seminars, can enhance students' interest in learning and promote the integration of their knowledge and skills in different fields. Of course, in order to realize effective interdisciplinary cooperation and resource sharing, corresponding strategies and mechanisms need to be developed. This includes establishing a framework for cooperation, specifying rules and standards for resource sharing, and establishing channels for communication and coordination. Educational institutions should provide the necessary support and incentives, such as providing technical support, setting up funds for collaborative projects, and recognizing the results of interdisciplinary projects, so as to create a richer and more diversified learning environment for students and provide teachers with a broader vision of teaching and resources.

Conclusion

The reform of inorganic chemistry laboratory teaching based on digital reform is a multifaceted and multilevel process. This process requires innovative teaching content and methods, active participation, and professional development of teachers. It is also crucial to ensure effective sharing of resources and interdisciplinary cooperation. Although this reform process faces many challenges, such as insufficient resources

and technology adaptability issues. However, reasonable strategies and sustained efforts can effectively overcome these obstacles. In conclusion, digital reforms have brought new possibilities for inorganic chemistry laboratory teaching and are expected to play a significant role in improving teaching efficiency, enhancing student engagement, and promoting innovative thinking. Future work should continue to explore new technologies and methods in this field to continuously improve the quality and effectiveness of education.

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