Study on the Application of Interactive Teaching in Organic Chemistry Experiment Course

Xuemei Hu

Lyuliang University, Lvliang, 033000, Shanxi, China

739006731@qq.com

Keywords: Interactive teaching; Organic chemistry experiment course; Theoretical basis; Implementation strategy; Challenge response

Abstract: At present, the limitations of traditional organic chemistry experiment teaching mode are increasingly prominent, so it is of great significance to study the application of interactive teaching in this course. This article focuses on the application of interactive teaching in organic chemistry experiment course. Firstly, this article expounds the basic concepts of interactive teaching and organic chemistry experiment course, and discusses the rationality of its application based on constructivism learning theory and social learning theory. By adopting the strategies of problem-oriented interaction, group cooperative interaction and results display and reflective interaction, interactive teaching is integrated into the stages of experiment preview, operation and summary. These strategies can stimulate students' learning initiative and improve students' participation, but they also face challenges such as time management, unbalanced participation of students, and improvement of teachers' literacy requirements. Through targeted measures, it is expected to optimize the experimental teaching of organic chemistry and provide an effective way to train high-quality chemical professionals.

1. Introduction

With the continuous development of education, the innovation of teaching methods has become the key path to improve teaching quality. As an important part of the chemistry discipline system, the organic chemistry experiment course is of great significance for cultivating students' practical operation skills, innovative thinking and scientific research ability [1]. The traditional teaching mode of organic chemistry experiment course is mostly teacher-centered, and students passively accept knowledge and operation instructions. This model has limitations in stimulating students' initiative and creativity, and it is difficult to meet the needs of the new era for the cultivation of chemical professionals [2].

In this context, interactive teaching has gradually attracted the attention of the education sector because of its characteristics of emphasizing the communication and cooperation between teachers and students [3]. By creating an active teaching atmosphere, interactive teaching promotes students to change from passive learning to active exploration, enhances students' participation in the classroom, and helps to cultivate students' critical thinking, communication skills and teamwork spirit [4].

The application of interactive teaching in organic chemistry experiment course is expected to break the shackles of traditional teaching and inject new vitality into teaching [5]. On the one hand, it can make students understand the experimental principles and master the experimental skills in the interactive process; On the other hand, it can promote the ideological collision between students and stimulate innovative inspiration [6]. Although some educators have tried interactive teaching in different disciplines, the systematic research on the specific field of organic chemistry experiment course is still insufficient. It is of great theoretical and practical value to carry out the application research of interactive teaching in organic chemistry experiment course and explore the interactive teaching strategy suitable for this course, which will improve the quality of organic chemistry experiment teaching and cultivate high-quality chemical professionals. This study aims to fill this

  DOI: 10.25236/icemeet.2025.022

gap and provide useful reference for the reform of organic chemistry experiment teaching.

2. Interactive teaching and organic chemistry experiment course

Interactive teaching is a teaching method with the interaction between teachers and students and students as the core. It encourages students to actively participate in the teaching process through various interactive forms, such as classroom discussion and group cooperation, and promotes the transfer and sublimation of knowledge in interactive communication [7]. Interactive teaching emphasizes students' dominant position and focuses on cultivating students' ability to think and solve problems actively.

The experimental course of organic chemistry focuses on the synthesis, separation and identification of organic compounds. Its teaching goal is not only to make students master experimental operation skills skillfully, but also to cultivate students' rigorous scientific attitude, innovative thinking and the ability to analyze and solve practical problems [8]. Traditional organic chemistry experiment courses are often based on teachers' explanation and demonstration, and students' step-by-step operation. In this mode, students lack opportunities for active thinking and communication, and it is difficult to fully stimulate students' interest and potential in learning.

3. Application of interactive teaching to the theory of organic chemistry experiment course

The application of interactive teaching in organic chemistry experiment course is not without roots, but with solid theoretical support. Constructivist learning theory emphasizes learners' active constructive role. According to this theory, students are not passive recipients of knowledge, but actively build a new knowledge system through interaction with the external environment on the basis of existing knowledge and experience. In the course of organic chemistry experiment, students discuss and analyze the experimental phenomena and principles in the interaction with teachers and classmates, so as to deepen their understanding and mastery of knowledge [9].

Social learning theory points out that individuals learn by observing others' behaviors and their results. In the organic chemistry experiment class, the interaction between students provides opportunities for each other to observe and learn. Students can observe their peers' experimental operation skills and problem-solving ideas, so as to improve their own ability [10]. Teachers' guidance and demonstration also play an important role in setting a correct learning example for students. Figure 1 clearly shows the guiding role of interactive teaching related theories in each teaching link of organic chemistry experiment course:

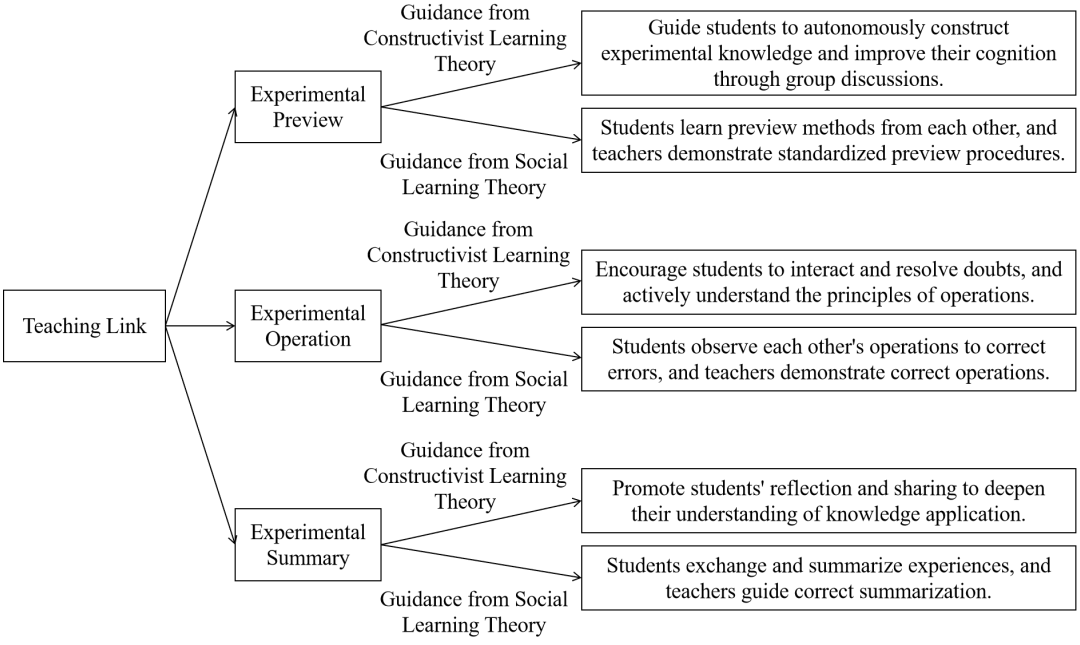

Figure 1 The guidance of interactive teach theory to experimental teaching

4. Implementation strategy of interactive teaching in organic chemistry experiment course

In order to effectively implement interactive teaching in organic chemistry experiment course and improve the teaching effect, it is necessary to formulate a series of practical implementation strategies. These strategies will focus on different stages of teaching, give full play to the advantages of interactive teaching, and stimulate students' learning enthusiasm and initiative.

In the experiment preparation stage, the problem-oriented interactive strategy is a powerful weapon for teachers to stimulate students' learning initiative. Teachers can carefully design a series of enlightening questions according to the experimental content. Taking the experiment preview of "Preparation of Acetanilide" as an example, the teacher put forward "what measures should be taken to improve the yield in the experiment" to urge students to explore the key points of the experiment operation; "What side reactions may occur during the reaction? How to avoid it? " Then guide students to think about the potential problems in the experiment and the countermeasures. With these questions, students independently consult materials, explore answers in the ocean of knowledge, and exercise their information retrieval and independent thinking ability. Then organize a group discussion, students express their opinions, and the sparks of thinking collide with each other, which can not only deepen the understanding of the experiment, but also gain new ideas from their peers. This interactive strategy makes students change from passive preview to active exploration, laying a solid foundation for the smooth development of subsequent experiments. The interactive evaluation of organic chemistry experiment preview is shown in Table 1:

Table 1 Interactive Evaluation Form for Pre-experiment Preparation in Organic Chemistry

Evaluation Item	Evaluation Criteria	Points
Accuracy of Question Answering	Provide accurate, well-reasoned answers to the pre-experiment questions posed by the teacher.	30 points
Richness of Information Consulted	Consult multiple sources and elaborate on experiment-related content from different perspectives.	20 points
Participation in Group Discussion	Actively participate in group discussions, proactively share viewpoints, and attentively listen to others' opinions.	20 points
Completeness of Knowledge Summary	Summarize knowledge such as experimental principles and procedures comprehensively and systematically.	30 points

In the experimental operation stage, the strategy of group cooperation and interaction is actively promoted. Teachers comprehensively consider students' learning ability, personality traits and other factors, carefully divide students into several groups, each group has a reasonable number, so that each student can deeply integrate into it. During the operation, members cooperate closely, observe each other's operation details, remind them in time, and quickly correct the wrong actions. Teachers tour the whole process to guide and encourage groups to speak freely and exchange experiences. Once the common problems are found, all students are organized to discuss them together, and the wisdom is concentrated to overcome the difficulties, so that the experimental classroom is full of vitality and wisdom.

In the conclusion stage after the experiment, the strategy of achievement display and reflective interaction is used. Each group sends representatives to show the experimental results, including experimental data, phenomenon analysis, conclusions and so on. Other groups of students ask questions, evaluate and put forward suggestions for improvement. Teachers guide and comment in the process of student interaction to help students deepen their understanding of the experiment. Taking the experimental summary of "preparation of cyclohexene" as an example, a group showed the result of low experimental yield. Other groups quickly launched an analysis, suggesting possible reasons such as improper temperature control and insufficient purity of raw materials during distillation, which triggered all students to think deeply about the details of the experiment. Teachers timely guide and comment on the performance of each group to help students deepen their understanding of the experiment. Finally, teachers guide students to reflect on the experimental process in an all-round way, sum up experiences and lessons, and let students further improve their experimental operation ability and scientific thinking level in the exchange collision.

5. Potential challenges and countermeasures of interactive teaching in the application of organic chemistry experiment course

Although interactive teaching has obvious advantages in organic chemistry experiment course, it also faces a series of potential challenges in practical application. These challenges need to be solved by effective measures to ensure the teaching effect and quality.

Time management is the primary challenge for interactive teaching. Organic chemistry experiment course is rich in content and complicated in operation steps, but interactive teaching needs to reserve enough time for students to discuss, communicate and display the results [11]. This will easily lead to the difficulty in controlling the teaching progress, and some experimental links cannot be completed as planned. In response to this challenge, teachers need to carefully design the teaching process before class, accurately estimate the time required for each interactive link, and set strict time limits. Teachers should have strong classroom control ability, guide students to return to the theme in time, and ensure the orderly progress of teaching. The challenges and countermeasures of interactive teaching time management of organic chemistry experiment course are shown in Figure 2:

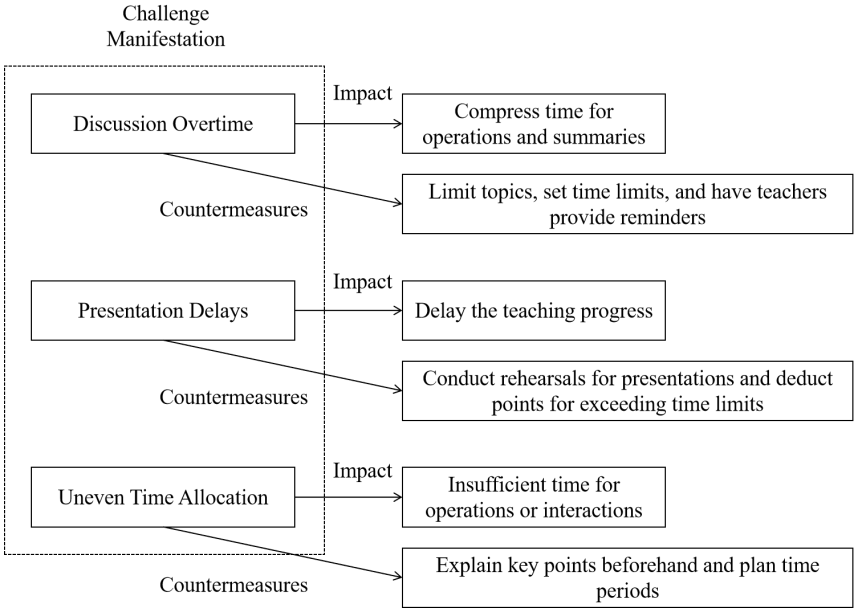

Figure 2 Challenges and countermeasures of interactive teaching time management

Unbalanced student participation is also a common problem. In interactive teaching, some students with cheerful personality and high learning enthusiasm tend to have higher participation, while some students with introverted personality or weak foundation may be in a passive state and have lower participation. In order to solve this problem, teachers should pay attention to observing students' participation, adopt diversified interactive forms and encourage each student to actively participate. In group assignment, teachers should pay attention to the complementarity of students' personality and ability, so that each student has the opportunity to undertake important tasks; For introverted and weak students, teachers should give more attention and encouragement and guide them to express their views.

Interactive teaching puts forward higher requirements for teachers' professional quality and teaching ability. Teachers should not only have solid knowledge of organic chemistry, but also be able to flexibly guide students to interact and answer all kinds of questions raised by students in the discussion process in time. Teachers should constantly improve their professional quality, participate in relevant training and academic exchange activities, accumulate teaching cases, and improve their ability to cope with various teaching situations. In addition, teachers should strengthen the research on interactive teaching methods and constantly optimize teaching strategies, so as to better cope with various challenges in the application of interactive teaching in organic chemistry experiment courses, ensure the smooth development of teaching activities and achieve

teaching objectives.

6. Conclusions

In this article, the application of interactive teaching in organic chemistry experiment course is deeply studied, and the necessity, feasibility and actual situation of its application are analyzed from many aspects. Through the overview of interactive teaching and organic chemistry experiment course, it can be seen that the traditional teaching mode has been difficult to meet the current teaching needs, while interactive teaching has injected new vitality into organic chemistry experiment course with its unique advantages.

Based on constructivist learning theory and social learning theory, the application of interactive teaching in organic chemistry experiment course has a solid theoretical foundation. In the process of implementation, corresponding interaction strategies are adopted in different stages, such as problem-oriented interaction in experimental preview, collaborative interaction in experimental operation and demonstration and reflective interaction in experimental summary. These interactive strategies have effectively stimulated students' learning enthusiasm and initiative, promoted students to change from passively accepting knowledge to actively exploring knowledge, and enhanced students' teamwork, communication and problem-solving skills.

However, interactive teaching has not been smooth sailing in practical application, and it has encountered challenges such as difficult time management, uneven participation of students and the improvement of teachers' professional quality and teaching ability. In view of these challenges, these problems can be alleviated to some extent by carefully designing teaching processes, rationally grouping, paying attention to individual differences and constantly improving teachers' own abilities.

Generally speaking, the application of interactive teaching in organic chemistry experiment course has important value and positive significance. Despite the challenges, as long as scientific and reasonable coping strategies are adopted, we can give full play to its advantages, improve the teaching quality, help cultivate high-quality chemical professionals with innovative thinking and practical ability, and provide a feasible and worth exploring path for the experimental teaching reform of organic chemistry. With the continuous updating of educational ideas and the continuous development of teaching technology, interactive teaching is expected to be more widely and deeply applied and improved in organic chemistry experiment courses.

Acknowledgements

The authors acknowledge the 2023 Shanxi Provincial Education Department Shanxi Province Higher Education Teaching Reform and Innovation Project: Practice Teaching Reform of "Organic Chemistry Experiment" under the Background of Professional Certification(Project Number: J20231334)

References

[1] Zeng Yanfei, Tian Hunan, Guo Qin, et al. Application of the dual-subject interactive teaching model in the organic chemistry course [J]. Technology Wind, 2024(4): 103-105.

[2] Wang Chao. Analysis of the application of interactive teaching model in the organic chemistry course in colleges and universities [J]. New West, 2020, (06): 157-158. DOI: CNKI:SUN: XXBL.0.2020-06-090.

[3] Li Yanli, Yu Lu, Li Meina, et al. Blended teaching practice based on the "interaction-feedback" model: taking undergraduate organic chemistry teaching as an example [J]. Higher Education in Chemical Engineering, 2021, 38(5): 133-137. DOI: 10.3969/j.issn.1000-6168.2021.05.026.

[4] Huang Mianli, Liu Kewei, Zheng Yanyu, et al. Practice of interactive teaching model in the reform of organic chemistry experiment course [J]. Chemical Fiber & Textile Technology, 2024,

53(4): 165-167. DOI: 10.3969/j.issn.1672-500X.2024.04.054.

[5] Zhang Lingling, Yao Shanhuo, Sun Fenfang, et al. Exploration of online-offline blended teaching model in organic chemistry oriented towards improving students' comprehensive quality [J]. Neijiang Science and Technology, 2023, 44(9): 86-87.

[6] Huang Tianzi, Tang Wei, Li Tongxiang. Application of PBL and integrated interactive teaching method in "Organic Chemistry Experiment" teaching [J]. Modern Salt and Chemical Industry, 2021(5): 143-145. DOI: 10.3969/j.issn.1005-880X.2021.05.065.

[7] Li Xiangzi, Chen Jiexia, Feng Zhijun, et al. Exploration and practice of Rain Classroom combined with MOOC teaching method in online experimental teaching of medical organic chemistry [J]. Journal of Wannan Medical College, 2023, 42(1): 84-86. DOI: 10.3969/j.issn. 1002-0217.2023.01.024.

[8] Xu Na, Zhang Qingjing. Research on the online-offline flipped teaching model in organic chemistry course [J]. Chemical Enterprise Management, 2024, (21): 53-56. DOI: 10.19900/j.cnki. ISSN1008-4800.2024.21.015.

[9] Zhang Jianying, Liu Xueli. Research on interactive teaching model of "Organic Chemistry" based on the Learning Platform [J]. Anhui Chemical Industry, 2020, 46(03): 123-124+127. DOI: CNKI:SUN:AHHG.0.2020-03-037.

[10] Xu Xiaona, Hou Dangshe, Li Zhen, et al. Exploration of online-offline blended teaching model in organic chemistry [J]. Chemical Enterprise Management, 2023(13): 42-45.

[11] Huang Chao, Ye Yanqing. Exploration of ideological and political construction in organic chemistry experiment course [J]. Journal of Yunnan Minzu University (Natural Sciences Edition), 2024, 33(4): 539-542.