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Exploration and Practice of Blending Learning Mode of Physical Chemistry under the OBE Concept

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Abstract: This study starts with the core and main course"Physical Chemistry"for chemistry majors,organically combining the outcome based education(OBE)with the blending learning mode,and transforming the"teacher based"model to the"student independent learning based"model.The research results show that the online and offline blending learning of Physical Chemistry under the OBE mode breaks the limitations of traditional classrooms,enhances students'autonomous learning ability and comprehensive ability,and improves the quality of curriculum teaching and talent cultivation.

Keywords: OBE Concept;Blending Learning Mode;Physical Chemistry

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"Physical Chemistry"is an important professional basic course for chemistry majors and applied chemistry majors.Due to the need for a solid foundation in mathematics and a large amount of physical knowledge during the learning process of"Physical Chemistry",it has become one of the most difficult courses in chemistry related courses.Guided by the trend of higher education teaching reform,to better promote professional construction and improve the quality of talent cultivation,it is necessary to introduce high-quality,up-to-date and suitable MOOC(massive open online courses)teaching resources in the construction of the teaching system of Physical Chemistry,reasonably integrate teaching materials and MOOC teaching resources in the teaching process,connect physical and online classes,and explore online and offline blending learning based on MOOC[1].

1. Current Teaching Situation of Physical Chemistry and Necessity of Developing Blending Learning

In the teaching of Physical Chemistry,there are many mathematical formulas that need to be used,as well as many abstract deductions.A large amount of physical knowledge is also required as a foundation for teaching.On the one hand,students have difficulty learning,and on the other hand,with the continuous reform of higher education,the class hours of many specialized basic courses,including Physical Chemistry,have been gradually compressed.This leads to the inevitable contradiction between teaching and learning during the implementation of teaching plans.In the teaching process,if teachers still use traditional teaching concepts and models,it is difficult to stimulate students'enthusiasm and initiative in learning,which is not conducive to cultivating students'ability to use the knowledge they have learned to solve practical problems.

2. Construction of Blending Learning Mode for Physical Chemistry

2.1 Blending learning design strategy for physical chemistry under OBE teaching concept

According to the characteristics of chemistry majors and based on the OBE teaching concept,a blending learning mode framework for Physical Chemistry is designed,and the teaching content of the course is further adjusted.

In terms of the overall positioning of the course,the training objectives of the Physical Chemistry course are repositioned

according to the reverse design idea of"job requirements-vocational abilities-learning tasks-learning projects-knowledge points"in the OBE concept[2].The course focuses on cultivating students'ability to apply the principles they have learned to reveal the mechanisms in chemical reaction processes,and combines specific teaching objectives with modular teaching content.

In terms of course content design,it is necessary to analyze the course content,then match each knowledge point to specific competency goals,and assign weights based on their importance.For each knowledge point,the initial ability level before learning,the required ability level after learning,and the expected learning effect should be designed.Through these steps,a table of expected learning outcomes for the entire course is designed.Only in this way can teachers have a clear understanding of the ability objectives and weight of knowledge points that need to be developed when imparting knowledge points,have a quantitative understanding of the level of ability,and have a reasonable expectation of learning outcomes.

In terms of course evaluation standards and methods,including attendance,online learning by MOOC,pre class preparation,classroom participation,homework assignments,midterm exams,stage tests,and final exams,specific evaluation contents,standards,and methods should be formulated to achieve strong assessment,wide coverage,and the evaluation weight of each part should be consistent with the teaching content and class hour allocation ratio.

In terms of the arrangement and implementation of teaching activities,the OBE model emphasizes the main role of students in the learning process.During the teaching practice process,courses should combine the characteristics of the course,flexibly use multiple teaching methods and means,and change the single whole-process instillation method[3],allowing students to actively participate in teaching activities to achieve purposeful and targeted learning.

2.2 Construction of online and offline blending learning mode for physical chemistry

With the development and application of mobile internet technology,learners can learn independently and lifelong through mobile learning platforms anytime,anywhere.In this era,various teaching platforms have emerged as the times require,and a large number of high-quality MOOC resources have rapidly emerged.Teachers and students can share high-quality teaching resources,and students can use various spare time to learn anytime and anywhere,greatly improving their enthusiasm for learning. Therefore,creating a blending"golden course"of Physical Chemistry that meets the high-level,innovative,challenging requirements is a requirement of the progress of the times and the development of education[4].During the teaching reform process of Physical Chemistry,the following points should be achieved:①introducing high-quality online MOOC teaching resources:In the existing teaching practice process,the introduction of the"Physical Chemistry"MOOC resources in the national high-quality course online learning platform of China University MOOC and the online high-quality course learning platform of the school has been well received by students.This online and offline blending teaching mode not only facilitates students'preview,but also helps students improve their project learning efficiency and reduce the pressure of attending classes through preview in advance.It can also provide students with the opportunity to repeatedly watch things that they do not understand in offline courses until they understand and master them;②actively building its own curriculum resources and question bank to improve students'learning effectiveness:Pre class preview materials should be prepared to test the effectiveness of students'autonomous learning of MOOC classes.In-class exercises should be developed to enhance teacher-student interaction and improve classroom teaching efficiency.After-school test questions should be prepared to keep track of students'learning on knowledge points at any time,so as to facilitate timely adjustment of teaching arrangements based on specific learning situations.The entire learning process of students needs to be tracked and monitored through the"pre class","in class",and"after class"three-stage teaching monitoring system;③making full use of the existing classroom intelligent teaching platform of the school to collect relevant data in the teaching process,improving the assessment and evaluation methods,providing comprehensive and full cycle teaching data analysis for subsequent teaching reforms and facilitating evaluation and reflection on the effectiveness of teaching reforms so as to comprehensively optimize teachers'teaching efficiency and students'learning effects.

2.3 Implementing formative assessment and improving assessment and evaluation methods

The student's total evaluation score for each semester is 100 points,which is obtained by combining the formative evaluation score and the summative evaluation score,each accounting for 50%.Formative evaluation mainly includes two parts,curriculum learning evaluation and ability quality evaluation.Course learning evaluation includes online learning evaluation(20%)and offline learning evaluation(20%).Online learning evaluation mainly refers to the performance of online MOOC learning,including watching MOOC videos,completing MOOC exercises,and posting discussions.The evaluation of offline learning mainly includes offline pre class preparation,in class testing,and after class assignments.The ability and quality evaluation section(10%)encourages students to

organize,internalize,and think deeply about their knowledge by drawing a mind map after completing their studies.The final evaluation score(50%)is the final exam score,which aims to test the students'final mastery of the knowledge of the course.This assessment and evaluation method implements the formative evaluation of students by tracking the entire learning process of students,thereby achieving an organic combination of formative evaluation and summative evaluation,and improving the assessment and evaluation method.

2.4 Reform Effect of Blending Learning Mode of Physical Chemistry

The online and offline blending learning practice of Physical Chemistry led by the OBE teaching concept has greatly enhanced the autonomy and participation of learning.Students can adjust their learning progress in a timely manner according to their learning rhythm,fully reflect and explore the knowledge they have learned,summarize the key points and difficulties of knowledge,and cultivate their exploratory,learning,and innovative abilities,thereby better improving learning efficiency and quality.By comparing the scores of students in the two academic years(2021-2022)after the implementation of online and offline blending learning with those in the two academic years(2019-2020)without blending learning,it is found that the comprehensive scores of students after the implementation of blending learning generally improved.This fully demonstrates that through personalized learning methods,students can learn,understand,and master knowledge in a more systematic and comprehensive manner during the blending learning process,laying a solid foundation for future employment or further education.

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