International Journal of Advanced Education and Research
www.multidisciplinaryjournals.net
ISSN: 2455-5746
Received: 10-02-2024, Accepted: 04-03-2024, Published: 27-03-2024
Volume 9, Issue 1, 2024, Page No. 63-70

Applying constructivist and learning-centered principles to design classroom teaching model

Yu Lasheng
Department of Computer Science and Technology, School of Computer Science and Engineering, Central South University, China

Abstract
At present, China's teacher-centered teaching mode undergraduate education is constantly questioned, and is facing a "learning-centered" teaching reform, which is not only the reform of teaching mode, but also the teaching paradigm reform involving the entire university system. This paper applies constructivist theory to summarize the connotation and characteristics of learning-centered classroom teaching, construct a learning-centered classroom teaching model and related core issues of classroom teaching, and aim to promote the practice of learning-centered classroom teaching in colleges and universities. Finally, taking the data structure course as an example, the implementation path of the "learning-centered" teaching paradigm is proposed.

Keywords: Constructivism, learning centered, teaching model, classroom teaching

Introduction

In the current undergraduate education, the traditional "teaching-centered" teaching model is constantly being questioned, and the "learning-centered" teaching paradigm reform is sweeping in. The Ministry of Education clearly requires the implementation of "learning-centered, teaching-led" classroom teaching to be examined in this undergraduate education teaching audit and evaluation index system, and the new engineering construction also sets the educational goal to not only cultivate students' ability to solve professional problems, but also cultivate innovative ways of thinking (He Kekang, 1997) [2]. It is necessary to fully embody the concept of "student-oriented". How to adapt to this change and reform the undergraduate classroom teaching paradigm is a major issue that needs to be studied and solved urgently in China's higher education management. As a bilateral activity that unifies the contradiction between "learning" and "teaching", "teaching" should serve "learning", that is, classroom teaching should be "learning as the center". Adhere to learning-centered, not only pay attention to "teaching well", but also pay attention to "learning well", stimulate students' interest and potential in learning, and enhance students' sense of social responsibility, innovative spirit and practical ability.

The connotation and characteristics of the "learning-centered" teaching model

Since the 90s of the 20th century, constructivist learning theory has become prevalent, and the core content of constructivism is: knowledge is not imparted by teachers, but in a certain social context, with the help of others, using necessary learning materials, through the way of meaning construction, here The construction of meaning places special emphasis on students' agency, and the teaching form is more inclined to independent exploration, mutual cooperation and conversation-based cooperative learning (Lulu Guo, 2020) [8]. Constructivist theory believes that learning is the process of learners actively constructing their own knowledge and experience, which emphasizes student-centeredness, taking students as cognitive subjects and constructors of knowledge meaning, and teachers mainly play a guiding and helping role. In this context, the "learning-centered" teaching model has attracted attention, which is a further evolution of the "student-centered" teaching model (Li Yiping, 2021) [7]. The "learning" in "learning-centered" contains two aspects: learning and students, which is richer in connotation, emphasizing both the centrality of students and the centrality of learning. The concept of "learning-centered" education was originally proposed by educators John Dewey and Jean Piaget, among others Advocate that students are the main body of the classroom, teachers are the main guides of the classroom, knowledge is not only obtained through teachers, but also learners in a certain context, that is, cultural background, with the help of teachers and learning partners, etc., using necessary learning materials, through the way of meaning construction. Therefore, the "student-centered" teaching model requires that the main task of teachers is not to "teach", but to "promote" learners to self-realize their learning potential through learning-centered teaching activities Encourage students to participate in all aspects of teaching activities, guide students to fully mobilize students' enthusiasm for learning through active independent exploration, group collaboration, etc., establish the connection between old knowledge and new knowledge, and apply new knowledge to solve problems and achieve innovation It changes the traditional teaching mode of cramming teaching and passive acceptance, and truly gives full play to the initiative of learners in learning.

Learning-centered teaching principles

The concept of "learning-centered" covers four aspects: student development, student learning, student participation, and learning effectiveness. The concept of "learning-centered" fully embodies people-oriented, lays a theoretical foundation and points out the direction for further promotion of curriculum teaching. To this end, the teaching of undergraduate courses in colleges and universities should adhere to "student development as the center", "student

learning as the center", "to Student engagement is the basic principle of "learning outcomes centered".

1. Adhere to the principle of centering on student development

Focusing on student development refers to the main purpose of promoting student development as the judgment standard for achieving talent training goals and teaching quality evaluation, transforming traditional knowledge telling into cultivating students who can learn, think, analyze and solve problems, and be innovative Awareness and innovation, and the ability to learn for life. The traditional classroom pays more attention to the teaching of professional knowledge, so that the high-level goals such as value shaping and ability training in the "trinity" of value shaping, ability training and knowledge transfer in colleges and universities are almost formal. Adhere to the center of student development, aiming to promote the all-round development of people and achieve personalized training. Therefore, curriculum teaching must adhere to student development as the center, promote the "trinity" of value shaping, ability cultivation and knowledge transfer college talent training goals are implemented in the curriculum, teaching materials, and classroom terminals, so as to realize the return of education and teaching.

2. Adhere to the principle of centering on student learning

Constructivism believes that learning is the active meaning-building process of learners, and the key to the occurrence and quality of learning lies in whether students learn rather than whether teachers teach. Taking student learning as the center is to take learning as the core goal of the teaching supply system, making it clear that teaching is the means, learning is the goal, and in the "learning-centered" classroom, "students are the main body of learning, teachers are the designers of learning activities, the creators of learning environments, and the tutors of learning processes" Teachers are no longer just lecturers of knowledge, but need to play more critical roles, including guides, facilitators, organizers and managers of learning. Students' learning construction activities rely on setting up a good learning environment for students, teaching and practical activities adopted by teachers in the classroom, and students' active learning, thinking and practice. Therefore, adhering to student learning as the center is to build a professional experiential learning scenario based on the teaching content of professional courses, with instructors as the lead, students as the main body, and learning as the center, so that students can conduct deep learning through experience, exploration, thinking, practice, discussion and other diversified ways. For example, students are required to relate and analyze what they are learning with real-life things, and students are encouraged to propose new literature reading, projects or course activities. Show the class their designs, proposals, or creations, and encourage students to challenge the teacher's ideas with respect Come up with your own ideas from other students' ideas or related literature, set up problem-solving activities in small groups, and involve each group in discussing their solutions with the class, etc.

3. Adhere to the principle of student participation

Focusing on student participation refers to ensuring students' right to know, participate and choose, and ensuring students' active participation and effective participation in the process of teaching quality management and evaluation (HU Yin, 2012) [4]. In the Learning-Centered Classroom, the “Learning-centered" classroom engages students in a variety of learning activities through the use of diverse teaching strategies, including student teamwork, teacher-student interaction, and student-student interaction It is the main form of learning. The "learning-centered" classroom encourages students to participate in reflection, collaboration, inquiry and innovative learning activities, and allows students to learn to discover, research and solve problems, consciously cultivate and develop students' problem-solving, collaboration, innovation and other abilities, learn to cooperate with others, learn to help and seek help and resources, and become practitioners with critical spirit and innovative spirit; Encourage students to work as a team to get more learning experience, so as to continuously mobilize students' interest and motivation in learning, and adapt to the differences in students' learning preferences, initial abilities, etc., learn more knowledge, and obtain more specific learning experience and sense of achievement and satisfaction.

4. Adhere to the principle of focusing on learning outcomes

Focusing on students' learning effectiveness refers to paying attention to learning effects, and there are three meanings: (1) guided by teaching objectives, which are embodied in every link of teaching design to ensure the effective achievement of teaching goals; (2) Pay attention to the learning effect, provide timely feedback for the implementation of teaching, and ensure the effectiveness of teaching and learning. Focusing on learning effectiveness is also the main basis for judging teaching quality. (3) Learning effectiveness evaluation aims to promote and improve learning, and encourages students to participate in evaluation. Therefore, learning evaluation should pay more attention to the learning process and multi-subject evaluation methods, discover problems in students' learning in a timely manner through various formative assessments, and give effective feedback and guidance. As for the evaluation standards corresponding to the learning objectives, students should also be involved in the formulation of evaluation standards, so as to motivate students to be more responsible for their own learning behavior.

It is important to note that "learning-centered" teaching does not unconditionally meet student needs. When combining the characteristics and needs of students, we must not forget that the goal of teaching is to promote students' learning and development, not to teach students what they want to learn. It should also be emphasized that "learning-centered" classrooms are still classrooms conducted under a specific teaching plan, and need to take on specific teaching tasks to help students achieve specific learning goals within a certain number of lessons.

"Learning-centered" undergraduate teaching practice paradigm

The ideal state of learning that constructivism believes should have these characteristics: learning should be active, constructive, and cumulative, and learning should be goal-oriented, diagnostic and reflective at the same time. Teaching is an activity that contains two levels of teaching and learning, teachers are the main body of teaching and students are the main body of learning, the two restrict each

other in the same activity, each has independent activity space, which can be called an ideal teaching state. However, in the past view of teaching practice, there was a general antagonism between subject and object. Extreme behaviorism emphasizes the initiative of the teacher, while radical constructivism emphasizes that everything should be based on the subjectivity of the student, ignoring the effective guidance of the teacher. In the process of practicing teaching theory, students' subjectivity should be highlighted, but at the same time, the leading role of teachers should not be ignored (ZHAO & LIU, 2021) [14]. In March 2019, General Secretary Xi Jinping pointed out that "we must adhere to the unity of indoctrination and inspiration, pay attention to enlightening education, and guide students to discover problems, analyze problems, and think about problems." Constantly inspiring students to come to conclusions" also points the way for classroom teaching.

Under the background of constructivism and learning-centered teaching principles, the design of teaching mode is manifested in teaching reform, from "emphasizing teaching method" to "paying equal attention to teaching law and learning method". In terms of teaching subjects, from "teachers" to "students"; In terms of teaching methods, from "teaching" to "guidance"; In terms of teaching content, it has shifted from "basic textbooks" to "ability training"; In terms of teaching methods, from "traditional teaching" to "information teaching"; In terms of teaching assessment, it has shifted from "single examination" to "comprehensive evaluation" (ZHANG Kuiming, 2017) [13]. Therefore, the establishment of a "learning-centered" teaching model is recommended to be carried out around the model of "one goal, two combinations, four reconstructions, and four autonomy". In this teaching mode, we should pay attention to the teacher-led and student-oriented teaching mode and process, so that students have more independent learning opportunities, can actively participate in curriculum learning and various practical activities, cultivate students' learning initiative, enable them to actively construct knowledge structures, and then cultivate students' innovation ability and effectively improve learning effects (Chen Zheng, 2022) [1].

1. A purpose

Under the central principle of constructivist theory and learning, the teacher is no longer the giver of knowledge and the manager of power, but a guide, facilitator, negotiator, cooperative inquiry and motivator. The student is no longer a passive recipient of knowledge, an unconditional submissive, but an active constructor, inquirer, negotiator, and interlocutor of learning. The goals of classroom teaching under constructivist theory can be summarized into three aspects: (1) promote students' deep knowledge of knowledge Understand. Starting from the goal of cultivating innovative talents, constructivists emphasize that "constructive learning and teaching aim to enable learners to form a deep understanding of knowledge". Learning for the sake of understanding and teaching for the sake of understanding have become important goals and behavioral principles of constructivist learning and teaching. (2) Promote the development of students' innovative ability. Constructivist teaching is committed to cultivating students' ability to innovate, cooperative learning, lifelong learning, knowledge transfer, practical problem solving and critical thinking. These capabilities are the basic requirements for the quality of talents in the economic and social development of the times, and are also consistent with the prediction of the demand for talent quality in the future society. (3) To cultivate students' good qualities as future social citizens. It is an important mission of modern education to promote students' understanding of social relations centered on core social values such as democracy and equality, as well as the formation of attitudes and behavior habits, so as to promote the continuous progress of social civilization.

2. Two combinations

The two combinations refer to the combination of in-class and extra-curricular courses and the combination of online and offline courses. The combination of in-class and extracurricular means that students concentrate on learning the knowledge in the classroom, actively participate in extracurricular learning activities, and organically combine in-class learning with extracurricular learning to develop hobbies and increase their intelligence. Extracurricular learning is the continuation and development of in-class learning, including all learning activities outside the curriculum, such as visits, social surveys, subject activities, knowledge competitions, extracurricular reading and inquiry, etc., extracurricular construction provides a variety of choices outside the curriculum to meet the diverse and individual needs of students. Establish and implement the course teaching link of "pre-class preparation, in-class cooperation, on-the-spot compliance, and after-class inquiry and reinforcement" (Yang, Yuan & Zhang, 2021) [11], grasp the main line of ability cultivation, and refine the teaching mission of teaching and educating people and ability training. In a combination of online and offline courses, online courses focus on fostering student connectivity. Online courses through rich digital teaching resources and online discussions, online tests, online experiments, and online Digital teaching methods such as activities help students complete the learning of course content and knowledge expansion. Offline courses focus on cultivating students' in-depth construction ability, guiding students to build a complete personal knowledge system, and can also promote the growth of learners through innovation, test students' learning results through sharing reports, discussions, competitions, experiments, etc., and promote the in-depth construction of knowledge.

3. Four refactoring

Constructivism emphasizes both the external connectivity of learning and the internal construction of knowledge. Therefore, in classroom teaching, the teaching content, teaching methods, teaching process and teaching evaluation should be reconstructed.

1. Reconstruct teaching content centered on students' needs

The reconstruction of teaching content should pay attention to novelty, stimulate students' interest in learning, try to use new activities and learning methods, and provide an interesting learning environment, which can not only stimulate students' enthusiasm for learning, effectively improve learning effects, but also stimulate students' creative thinking. Timely adjust the teaching content for students, organically fragment the professional knowledge of the system, pay attention to students' subjective participation in the classroom, and use teaching resources such as micro-content, micro-knowledge, and micro-video,

as well as corresponding teaching activities such as tests and discussions that meet the characteristics of students' attention (HOU, LIU & TAN etc, 2022) [3]. The classroom teaching plan should fully consider the learning level of students, select appropriate teaching content, highlight key points, and perfect structure, which can stimulate students' enthusiasm and enable students to return to the main body and participate in classroom teaching. The reconstruction of teaching content involves sorting, decomposition, classification, processing, integration and reflection of the knowledge architecture of the course.

2. Reconstruct the teaching process centered on student development

The evaluation of the effectiveness of classroom teaching mainly focuses on whether problems are actively identified and explored in activities, whether information is actively collected and organized literature and data to solve problems, and fully attention is paid to the ideas and methods adopted by students in the process of problem solving. Obviously, "teaching" and "learning" in the classroom is the process of students' perception, feeling and perception. This process belongs to the student as well as to the teacher. In this process, students should be in the position of the subject, but this subject status is not given by the teacher, but should be respected, and should be manifested as students first, that is, let students see first, think first, say first, ask first, practice first, and give students the freedom of thought, emotion, and creation. On the basis of completing the overall design of the course and the construction of the online course, according to the order of teaching, a complete teaching process can be divided into six teaching links: pre-class teaching preparation, online teaching, in-class classroom teaching, after-class practice and thinking development, post-class assessment and evaluation, evaluation and improvement.

3. Reconstruct teaching methods with the goal of attracting students' sense of participation

Learning-centered teaching puts students at the center of the learning process, it is aware of students and their needs, and designs the teaching process and selects teaching content according to students' needs. Teachers need to break the original teaching methods and carry out learning methods that integrate theory and practice and combine knowledge and action, such as adopting cooperative inquiry teaching, that is, "HIBL" (Hands-on Inquiry Based Learning), internationally collectively known as "inquiry-based science education" or "Research learning" truly hands over the classroom to students. Inquiry is both the purpose and the way of science learning. The teaching strategies offered by Mia MacMeekin include case studies, situational teaching based on scene reproduction, role-playing, and inquiry-based learning based on problem discussion Interactive teaching, collaborative learning, work presentation, brainstorming, discussion, group learning, project-based learning, problem-based learning, discovery learning, games and competitions, etc. on the premise of equal interaction can help you create a learning environment. Helpful or familiar teaching strategies.

4. Reconstruction of teaching evaluation with highlighting students' abilities as the core

The core of constructivism is to allow students to establish their own knowledge system in the teaching process, so the curriculum teaching evaluation system should focus on student activities in the construction process, and analyze the achievement of learning goals such as students' knowledge, abilities, values and emotional factors. In the teaching process, it emphasizes the achievement of learning goals, the selection of learning content and learning methods, the experience process of knowledge, the experience of students' emotions, the mastery of methods, the advancement of thinking, the development of literacy and the common growth of teachers and students (Jing, Ma & Zhang, 2021) [5]. The "learning-centered" classroom teaching evaluation index system takes learning objectives as the core, and evaluates from the situation of the learning objectives themselves, the implementation of learning objectives (learning process), and the achievement of learning objectives (learning effects), and the definition includes (classroom) teaching quality, learning environment, and learning effectiveness The basic dimension, in which the learning effectiveness dimension evaluates students' learning process, learning ability and overall learning situation, including not only the mastery of knowledge, but also the comprehension of subject ideas, the improvement of learning interest, the advancement of thinking, the improvement of learning ability and the formation of correct values in the process of learning knowledge Through evaluation, students are urged to explore individual-appropriate learning methods to improve their learning outcomes. In addition to teachers, the main body of teaching evaluation can also include individual students and learning partners.

4. Four Autonomy

Under the background of constructivism and learning-centered teaching principles, by reconstructing teaching content and teaching process, it can help students achieve the goals of independent learning, independent construction, independent innovation and independent development.

1. Self-directed learning

Self-directed learning refers to students' ability to learn independently and actively. It breaks the traditional passive learning state, so that students consciously and actively recognize the importance of learning in the learning process and take the initiative to complete learning tasks. Independent learning focuses on the transfer of learning responsibilities, from the original teacher responsibility to the current student responsibility, including learning plans, learning content and methods are no longer unilaterally formulated and decided by teachers, but by students themselves. At the same time, they should monitor and evaluate their own learning process. In the constructivist teaching method, which emphasizes cooperative learning, in the learning-centered classroom, teacher-student cooperation is to reduce the communication mode of teacher irrigation and student listening, and the teacher is no longer the sole organizer of teaching activities, but becomes a teaching community with students. In this collaborative learning, teachers are organizers, leaders, and members of the group, discussing with students, exchanging personal opinions, and making concluding remarks. Through the two-way interaction in the learning process, learners' initiative

and consciousness of learning are enhanced, which stimulates their interest in learning, obtains good teaching effects, and enhances students' ability to learn independently.

2. Self-construction

Self-construction is the core mechanism of individual learning knowledge, which is such an activity process: driven by the internal needs and strong desires of self-realization and self-development, individuals consciously and actively make themselves in an unbalanced cognitive state and gradually reach a relatively balanced state through interaction with the surrounding environment. Learning-centered classroom teaching is based on knowledge learning as the carrier and main line, under the guidance of value guidance, goal control and task-driven, and in the process of problem solving, with "group interaction and independent construction" as the basic way, cultivate and develop a society in which students' self-learning ability is the main body, innovation ability as the core, and moral ability as the soul Viability. Through online self-directed learning, offline collaborative learning, and inquiry-based learning, students gain in the course Knowledge needs to be processed and integrated according to individual needs, actively constructing personal knowledge systems, and testing, applying, correcting and improving the construction results.

3. Independent innovation

Constructivism believes that learning is not only the understanding of knowledge, but also the analysis, testing and criticism of knowledge, and learning and innovation are synchronized. Therefore, constructivist learning theory emphasizes that the process of realizing learning goals is the process of active construction of knowledge, which can better reflect the subjective status of learners, and can give full play to learners' learning initiative and realize independent innovation. Independent innovation means that students do not stick to books, do not believe in authority, do not follow conventions, but based on existing knowledge, combined with the current reality, discover connections, and constantly integrate, analyze and think, bold exploration, actively put forward their own new ideas, new views, new ideas, new designs, new solutions, new methods, etc., personal knowledge system is constantly impacted, reconstructed and improved. This makes it possible for students to create and generate new content on their own.

4. Independent development

The so-called independent development refers to the active development of students on the basis of self-education, which plays a foundational role in students' lifelong development. Building a vibrant "learning-centered" classroom is an effective strategy to promote students' all-round development and independent development. "Student-centered, life-centered, education is life", the cultivation of students' independent ability is the key to students' independent development, promote the development of students' independent ability, enable them to independently adapt to social life in the future, and become innovative and future-oriented talents who can adapt to the needs of lifelong development and social development. Taking classroom teaching as an example, the classroom should be full of vitality and passion, and the participation of teachers alone is not enough, but also need to mobilize students' enthusiasm, carefully design situational teaching, and complement the strategies of multiple teaching modes such as inquiry-based teaching and cooperative teaching Guide and motivate students to establish a learning attitude of "wanting to learn", "knowing how to learn" and "persistently learning". This self-development includes three processes: self-monitoring, self-direction and self-reinforcement. In such a process, cultivating students' awareness, methods, habits and abilities of independent learning is an objective need to achieve students' independent development, and it is also an important way for schools to achieve self-development goals.

"Learning-centered" undergraduate teaching model facilities: taking data structure courses as an example

Data Structure is a theoretical and practical course, the theoretical part involves 10 submodules of introduction, linear tables, stacks and queues, strings, multidimensional arrays and generalized tables, trees and binary trees, graphs, lookups, and internal sorting; Experimental teaching is divided into three levels: verification, design and synthesis, which helps students understand the theoretical part and improves students' ability to analyze and solve problems.

1. Complete the reconstruction of teaching content through course research and demonstration

Data structure course teaching continues to innovate the teaching mode, adopting the teaching mode of "student-oriented, teacher-guided", "case-oriented as the core" and "task-driven as the main line"; Adopt the form of context-setting, student-participation, and interactive teaching to provide conditions for students' independent learning and build a mechanism and atmosphere that encourages students' independent learning (LI i, XIE & YANG etc, 2020) [6]. The course group organized front-line teachers with rich teaching to conduct serious research and full discussion, re-examine and evaluate the original course syllabus, teaching materials, teaching mode, and teaching evaluation, and combine constructivist ideas on the basis of extensive solicitation of relevant enterprise experts (Oliver McGarr, 2023) [9]. The development needs of society and the students' own conditions should adjust, update and improve the content of curriculum teaching, reduce complexity and simplify, keep pace with the times, and transform and update. In the classroom teaching and practical teaching links are considered flexible content system, in the course teaching content setting, mainly adopt the "basic module" + "extended module" system, of which the "basic module" includes algorithm measurement basics, linear structure, string and pattern matching, tree, graph, sorting, retrieval and other 7 modules, the requirements must be fully explained; "Extension modules" include generalized tables, AVL trees, and cutting-edge applications such as XML DOM trees, OWL classification trees, DHT, and compression algorithms Encryption and decryption algorithms, etc., are flexibly mastered and implemented by teachers according to students' learning conditions.

The course is done by assigning an appropriate amount of after-class exercises (including in-class homework, extracurricular thinking extension homework, extracurricular online practical homework, and team work)., so that students can further consolidate and improve their comprehension and application ability of what they have learned in class. When choosing exercises, on the one hand,

we pay attention to the mastery of the knowledge of the three fundamentals (basic theory, basic method, basic skills), and on the other hand, we also fully consider the flexible application of knowledge, so that students can solve problems from multiple angles and methods, which not only exercises their systematic thinking, but also improves their ability to analyze and solve problems.

2. Reconstruction of learning-centered teaching process

In the teaching process, combined with the characteristics of "data structure" course content, the relevant methods aimed at improving students' interest in learning are studied from the aspects of course introduction, course development and classroom atmosphere creation. In the course introduction stage, the "data structure" is combined with the problems in the professional field studied by the students, so that students can realize the practical significance of learning the "data structure" course and arouse students' interest in learning. In the course development stage, various methods such as "step-by-step teaching", "task-driven teaching", "case teaching", and "flipped classroom" are used to enhance students' interest in learning. In terms of classroom atmosphere creation, students can learn happily through a variety of methods such as seminars, student sharing or keynote speakers, group competitions, and pairing and mutual assistance.

3. Update the teaching concept and reconstruct the teaching method

The "Data Structure" course group has determined the teaching concept of "teacher-led, student-oriented", that is, "classroom teaching and discussion as the guide, independent learning and practice as the improvement", adopting the "guided, interactive and seminar" teaching mode, and establishing a "key core technology research as the guide". Integrate cutting-edge scientific and technological achievements, build a database of typical cases, and run through case practice, innovative practice, and competition practice", allowing students to immerse themselves in the teaching links of discovery, exploration and problem solving, forming interactive teaching and improving the overall teaching level.

The curriculum adopts teacher-led students' independent exploratory learning collaboration Learning, Research learning, innovative teaching methods, teaching is task-driven, highlighting problem solving, paying equal attention to teaching and practice, using flexible and diverse teaching methods, Q&A, discussion, classroom demonstration, computer practice, problem-solving report meeting, participating in various related competitions and undergraduate scientific research, special reports, cutting-edge lectures, bilingual teaching and other ways imparting knowledge in a scientific, vivid and flexible way of teaching, Cultivate students' ability of abstract thinking and creative thinking, logical reasoning, algorithm design, and the ability to flexibly use data structures and algorithms to solve problems. While carefully organizing classroom lectures and paying attention to the normal operation of each link, teachers also adopt different methods to explain different teaching content, so that the course content is not only clear and simple, but also focused and distinctive, the teaching content is flexible, including mandatory content and content selected for different professional needs and characteristics.

4. Reconstruction of experimental practice teaching oriented to ability improvement

Experimental practice teaching is an important part of curriculum teaching. In order to help students understand and master the curriculum knowledge and apply the knowledge to practical problems, practical teaching is designed to validate, design and synthesize the application Three levels of innovation. Among them, the most basic verification experiment refers to the specific realization of course knowledge points, focusing on deepening students' understanding of basic data structures and cultivating basic programming ability; Design experiments start from practical problem solving, integrating the application of 2 to 3 data structures or algorithms for related data structures Extensions, such as the bank's multi-window queuing service, multi-fork intersection vehicle scheduling and other issues, need to abstract the real world into a data model and apply the knowledge of relevant data structures to solve them, which has certain modeling and implementation difficulties; The top level of the experimental content system is a comprehensive experiment, aiming at solving practical problems on a certain scale, driven by specific tasks, covering a variety of models of data structures, and exercising students' ability of abstract modeling and problem solving. The requirements for designing experiments and comprehensive experiments are composed of several parts, such as problem description, basic requirements, test data, experimental tips, thinking questions, etc., of which the problem description is to establish the background environment of the problem for the reader and indicate "what is the problem"; The basic requirement is to standardize the implementation of the problem, ensure the predetermined training intention, so that certain difficulties and points will not be bypassed, and it is also convenient for teaching inspection; The test data gives the basic test cases in the experiment; The experimental prompt gives the main idea of designing data structures and algorithms (students can break through the prompts); The thinking questions guide readers to summarize and expand students' experiments after the experiment, so that they can maximize their imagination and creativity to cultivate students' innovative awareness and innovation ability.

5. Reconstruction of **data structure curriculum evaluation method centered on student learning effectiveness**

The reconstruction of data structure course teaching evaluation adopts a combination of process and final evaluation to construct a multi-dimensional teaching evaluation mechanism (Xu Lifang, 2022) [10], and the evaluation adopts the three-party diversified evaluation of teachers, students and learning partners, to make the evaluation more scientific, objective, fair and comprehensive. The purpose of students' self-evaluation and evaluation of classmates is not to evaluate itself, but to learn in evaluation, learn in mutual affirmation, mutual correction and supplementation, see the strengths of others, their own shortcomings, and improve themselves. Strengthen the daily assessment, including online video learning, preview tests, unit tests, attendance and classroom performance, completion of homework inside and outside the classroom, experiments inside and outside the classroom, and team work etc. The design of the evaluation link and evaluation content is shown in Table 1.

Table 1: "Student-centered" multi-dimensional perspective personalized course evaluation

Course sessions	Evaluate the content	Evaluation subject
Learn before class	Preview completion in videos or other ways Completion and accuracy of pre-class exercises Seriousness of preparation	Himself + teacher Himself + teacher Himself + classmates
Classroom performance	Completion and accuracy of in-class exercises Group tasks Participation in classroom activities In-class experiments	Himself + teacher Self + classmates + teachers Self + classmates + teachers Himself + teacher
Learning after class	Individual assignment/test question completion and accuracy Review thinking and inquiry questions outside of class Extracurricular OJ Team assignments/course research	Self + classmates + teachers Self + classmates + teachers Himself + teacher Self + classmates + teachers

6. Data structure teaching effect

From the perspective of teaching in the past two years, the classroom teaching atmosphere is active, students actively participate in the classroom, the class head-up rate is close to 100%, and more and more students participate in various programming competitions, and their grades are getting better and better. Figure 1 and Figure 2 are the analysis of the final exam results of the "Data Structure" course in the past two years. From the perspective of the achievement of index points, the completion of the four index points is very good, and the annual improvement is higher than that of previous years, indicating that the students have a good grasp of knowledge, and can use the knowledge learned to analyze and solve problems strongly, and the comprehensive ability is relatively good, in the course objective 4, the effect is still the best, indicating that students have a significant improvement in practical programming skills. From the perspective of performance distribution, the distribution of medium and high-end grades has also increased year by year. Through the final grades, it can be found that the situation that students usually have high grades but low final grades has now been basically curbed.

Fig 1: Comparison of Course achievement in the past two years

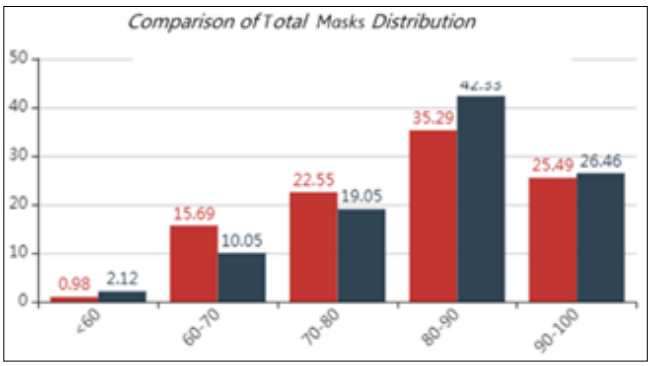

Fig 2: Sample analysis of total Masks

Conclusion

The focus of education in the 21st century has shifted from the acquisition of knowledge to the development of innovation, adaptability and cooperation. The goal of undergraduate teaching has also shifted from the original teaching of knowledge instillation and interpretation to cultivating students' comprehensive application ability, including innovation ability. The curriculum teaching mode under the guidance of constructivist theory pays attention to the practice of curriculum learning and student autonomy, and highlights the main position of students in the learning process. Therefore, in this teaching mode, students are no longer passive knowledge recipients, but independent learners, active constructors and practical users of knowledge. This paper applies constructivist theory to summarize the connotation and characteristics of learning-centered classroom teaching, construct a learning-centered classroom teaching model and related core issues of classroom teaching, and aim to promote the practice of learning-centered classroom teaching in colleges and universities. The teaching mode design based on constructivist theory proposed in this paper has achieved good results in the teaching of data structure courses in our school, and also provides a reference and model for the teaching of related courses in engineering.

Disclosure statement

There are no relevant financial or non-financial competing interests to report.

Funding

This work was partly supported by the Central South University Educational Reform Projects Granted in 2022.

Notes on contributor

Lasheng Yu is a assistant professor at the School of Computer Science and Engineering at the Central South University in China. His research and teaching interests are in the area of smart education and Strucutre and Algorthm.

ORCID

Lasheng Yu http://orcid.org/ 0000-0001-7078-9068

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