Research on Teaching Method of Data Structure Algorithm Course

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Abstract. China has taken the lead in educational reform and development by constructing an international higher education system. To evaluate the internationalization of elite colleges, one must take into consideration the quality of education offered to foreign students. The curriculum is the most significant educational resource for overseas students, and how well it is evaluated has a direct impact on their overall experience. Analyzing the characteristics of data structure teaching earnestly, the actual situation of students learning, and the integrated case application and problems of teaching design, an algorithm to the core of the computer categories of professional basic course "data structure" serves as an example, demonstrating the process of implementing a task-driven teaching mode. By utilizing a task-focused and problem-oriented approach, foreign students can be taught by their teachers as a passive infusion to foster active learning, thus enhancing student engagement, curriculum, and education quality, as well as student satisfaction with the educational experience.

Keywords: International students; Data structure algorithm; Course teaching; Task-driven; Problem oriented.

1. Introduction

Computer science and engineering necessitate a fundamental course in algorithms for data structures. They are not only the building blocks of programming and software development, but also key to solving complex problems and optimizing system performance. Organizing and storing data in a data structure allows for efficient access and modification. The algorithm, a process of data processing and operation to achieve desired results, is comprised of the stages and techniques employed to resolve the issue.

The internationalization of China's higher education has been hastened by the country's comprehensive and economic strength, and the number of students studying in China has grown annually. Education is the cornerstone of a nation's prosperity, national prosperity, and people's joy. [1] However, the foundation of these students is generally low, the understanding ability is weak, the enthusiasm for learning is not high, coupled with language communication barriers, which brings great challenges to the teaching work. Data structure algorithms are essential to many contemporary computer applications, including social networks, search engines, e-commerce platforms, and large-scale artificial intelligence and data analysis. Therefore, master data structure algorithm for computer professional students, is an essential skill [2], but for the teacher to students in teaching data structure algorithm could face some unique challenges, such as language barriers, cultural differences and different learning habits. Providing a valuable chance to acquire knowledge and develop, these difficulties are nevertheless present. By overcoming these difficulties, teaching teachers are not only able to acquire professional knowledge, but also develop excellent problem solving skills and cross-cultural communication skills. For international students, the course is both a challenge and an opportunity.

As a result, it is worthwhile to research ways to raise the standard of instruction for overseas students taking data structure courses. The curriculum content, teaching strategies and tactics, teaching case analysis, and the author's summary of the course learning experience in the data structure and algorithm analysis will all present obstacles for this essay.

2. Overview of the Course Content

Courses on data structure algorithms encompass a broad range of topics, including theoretical analysis and real-world applications, as well as fundamental and sophisticated data structures. The course's primary content is listed below. The following are the main contents of the course, as shown in Figure 1.

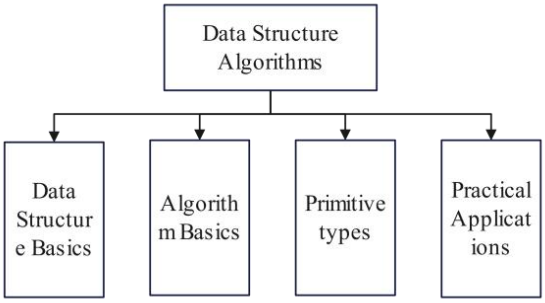

Figure 1. Main contents of the data structure algorithm

Firstly, there is Data Structure Fundamentals, which will introduce the basic concepts and types of data structures, including arrays, chained lists, stacks, queues, trees, graphs and so on. Students will learn how to select and use appropriate data structures in different scenarios to improve the efficiency of data storage and access. This section will cover the fundamental ideas of algorithms and their design methods, such as recursive, partition, greedy, dynamic programming, etc., after going over the algorithm foundation. Students will be instructed in how to devise and utilize efficient algorithms in order to confront a broad array of difficult matters. Next comes the algorithm analysis section, which will explain how to assess the algorithm's performance and include the technique for calculating the algorithm's time and space complexity. Students will learn how to through the algorithm analysis, selection of an optimal algorithm to solve specific problems. Following this, an introduction to Advanced Data Structures and Algorithms will be presented, featuring hash tables, heaps, red-black trees, graph algorithms, and more. Students will be taught how to employ these sophisticated data structures and algorithms to tackle more intricate issues. At long last, the application issue is presented; this section will demonstrate through a series of examples and projects how the data structure and algorithm can be utilized to tackle real-world predicaments. Students will have the opportunity to put their theoretical knowledge into practice, enhancing their programming and problem solving aptitude.

3. The challenge

International students differ greatly from Chinese students in personality, living and studying habits and communication styles, which are caused by the unique cultural background and language environment of different countries. The main problem is shown in Figure 2. Formulating teaching plans and designing activities to suit each student's aptitude and characteristics is essential for a successful teaching of international students, so as to invigorate their enthusiasm [3].

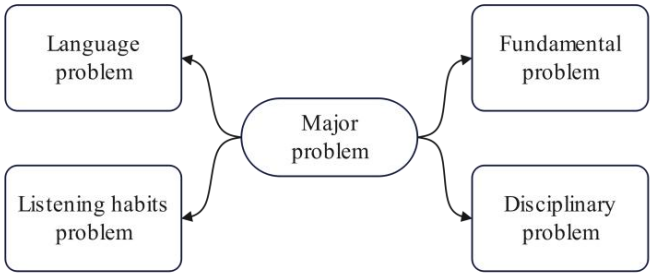

Figure 2. Main problems of international students

3.1 Language Problem. International students due to national differences, daily communication in different countries also have different language, speak English as a spoken language, such as Tanzania is given priority to with Russian in Russia, so students must have differences in spoken English. But in general, English is commonly employed as the official language or second language in these nations, and the English atmosphere is more desirable than that of one's homeland. However, in line with internationalization, the classroom teaching of data structure algorithm and analysis for international students is mainly in English, which requires high English level of teachers. In comparison to Chinese students, the majority of international students possess a considerable command of English listening and speaking, thus making instruction in English more beneficial for their comprehension and approval. But students English accent, often with local characteristics of their countries, so even if some students English is fluent, their pronunciation and standard British accent or American accent is not the same. Furthermore, Foreign students, disregarding grammar when using English and the lack of accuracy in its grammar, can often be a major impediment to communication between teachers and students in China. This can lead to students not comprehending the teacher's teaching of knowledge, thus hindering the successful teaching process [4].

3.2 Basic Problem. In our country, there is currently no standardized test for foreign students wishing to study in China. As a result, we are unable to effectively evaluate the learning and language abilities of these students, leading to disparities in their academic preparedness. In addition to facing challenges stemming from weak foundational knowledge, it has been observed that many foreign students exhibit poor study habits. Evident in their absence of preparation and review beyond the classroom, as well as their failure to finish tasks promptly, communication with these pupils, both within and outside the classroom, has exposed these issues.

As an important professional basic course, the curriculum of data structure learning requires students to advance in the C language program design basis and basic computer, and have certain mathematical foundation such as linear algebra and higher mathematics. However, these courses are usually opened in the first year of enrollment. The speed of visas from different nations, combined with the difficulty of adapting to life and study habits, can lead to international students missing the start of the course, making it hard to keep up with the learning progress and losing interest in it. This can lead to foreign students' reading comprehension, design and writing skills being insufficient, thus increasing the complexity of the teaching.

3.3 Problems of Listening Habits. Compared with Chinese students, international students are more active in thinking and active in performance. When they encounter something they don't understand, they will ask questions to their teachers and seek answers. On the one hand. Questions posed by students can be indicative of their comprehension of the current teaching material, which can foster the teaching process; teachers can modify the teaching material and techniques as time progresses. On the other hand, some students with poor foundation do not understand and repeatedly ask questions about small problems, which will affect the promotion of the whole teaching process. At the same time, Teachers must possess the ability to comprehend the queries posed by pupils and provide accurate responses proficiently in English simultaneously.

3.4 Questions of Discipline. Most international students do not have a strong sense of time, and few students can attend the classroom on time. It is also common that they do not come to class because of their own reasons (e.g., oversleeping, visa, physical examination, etc.), not to mention the independent completion of homework on time. This kind of light and lazy time consciousness largely comes from their living environment and religious belief since childhood, which is deeply rooted and difficult to change through external forces. In addition, overseas students are rich in extracurricular activities, not strong willingness to independent learning and other reasons also lead to most of them free and loose, poor organizational discipline, which directly affects the effect of learning. The secret to helping instructors educate their pupils to solve issues is to actively investigate ways to increase their students' learning initiative and excitement and to help them learn

consciously.

4.Teaching Methods and Strategies

The traditional teaching style of the classroom, with its emphasis on imparting knowledge and teacher-centered approach, results in students passively embracing their teachers' indoctrination. The lack of success in this method in fostering students' autonomy, independent thought, and problem-solving aptitudes is evident. This issue is particularly challenging for foreign students, as language communication may not be smooth enough to effectively engage them in classroom activities [5].

Given the comments from international students on their course experience and the limitations of traditional classroom instruction, we employ a task-driven teaching approach. A teaching style that is task-driven is a type of "task as the main line, teacher as the main figure, students as the main body" approach, mainly seen in the teaching process [6]. The content is carefully tailored to a particular task, allowing the student to have a genuine purpose to learn, with the learning initiative in their own hands, and they are in a heuristic teaching mode, allowing them to think independently, analyze and solve practical problems. At the same time, teachers are constantly guiding and motivating students to help them complete the teaching content. Task driving mode can arouse the enthusiasm of students take the initiative to explore learning, students' participation of ascension as a direct result of teaching quality improvement.

Divided into three stages, the teaching model, as Figure 3 illustrates, consists of task setting, implementation, and evaluation. The "task setting stage" is made up of two components: "task analysis" and "task design"[7]. This teaching method was employed to teach the data structure algorithms. Firstly, it analyzes the course structure and teaching syllabus, lists the teaching themes of each chapter, puts forward the teaching plan in line with the whole course knowledge system according to the teaching theme, and designs the task-driven plan. The following factors need our particular attention when teaching: first, the task design's difficulty should be moderate, neither too easy in order to avoid the loss of students challenging and the power, also cannot too difficult to prevent to produce frustration, fall by the wayside. Second, design the task step by step, after the first difficult, it is better for inner link, and the difficulty is progressive transformation of the relationship, this can let students learn more step by step, to grasp the difficulty strong knowledge. Finally, the design of the task should have certain flaws, yet experience has demonstrated that this task can heighten the students' enthusiasm for learning, and a feeling of accomplishment will be more powerful after rectifying bugs. Moreover, defect design can nurture the students' aptitude to discover and resolve issues, thus attaining an effective teaching effect.

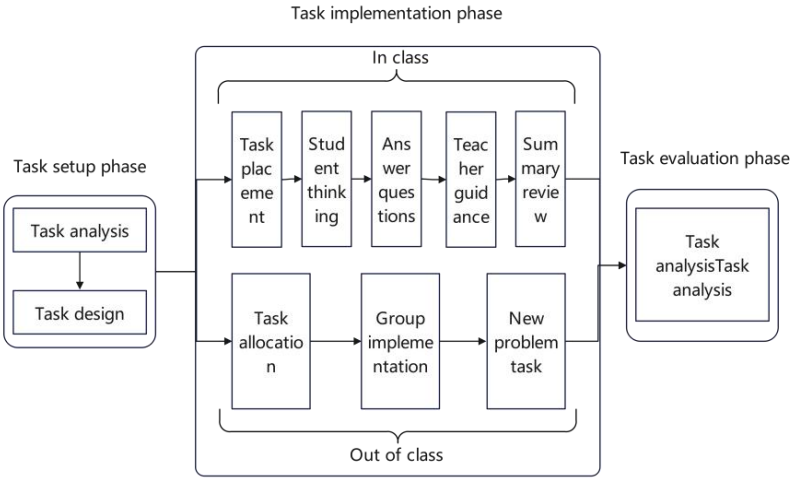

Figure 3. Task-driven teaching method

At the implementation stage, activities such as those carried out in class and outside task force were included. In the classroom, teachers implemented the task-driven system established in the

task setting stage for instruction. This phase is given priority to with the operation of the students, the teacher must leave students plenty of operation time and space, let them in practice experience, feeling, digesting and absorbing the knowledge. In the process of completing the task, because the students have enough time to think, to explore, so will emerge a new problem, put forward the new task, by this time the teacher wants to try to intellectualize students, at the appropriate time in the right range, and reviewed the summary at the end. Outside the classroom, the teacher assigned task, students take the way of grouping. Between students in the process of mutual communication and learning, is likely to produce new hard problem, feedback to the teacher, under the guidance of teachers, generate new task, continue to discuss the team's members to complete the task. Therefore, tasks outside the classroom implementation process are a cycle feedback process. Instructors should urge pupils to look into pertinent materials and converse with other learners, and motivate those with outstanding grades and the capacity to assist others in advancing together. By cultivating collaboration, getting along with people, and providing helpful quality, this method can not only enhance students' capacity to solve practical problems and creativity, but also improve them.

At the "Task Assessment Stage," the teacher assigns a theoretical score to each student based on their performance in the classroom, activities outside of the classroom, and the collective contribution of all group members. This is done through the common assessment and evaluation of both learning and teaching. Teachers according to the teaching effect and student's feedback, reflect on their teaching methods and improving.

The "task-based" teaching model embodies the teaching process of "task as the main line, teacher as the protagonist and students as the main body"[8]. The interaction between tasks, teachers and students reflects the basic characteristics of the "task-based" teaching model. When using the "task-based" teaching method, the teacher's subject position and the student's subject position complement each other and are inseparable. The task was proposed by teachers, who established a sensible framework for the task within the interlinked teaching process, thus preventing students from taking the lead until the task was finished. The students, with their ample thought and free time, can join forces, pioneering ideas, and propose novel issues connected to the task, inspiring teachers to take the lead [9]. Therefore, it appears reasonable for them to finish the assignment. Under the joint promotion of students and teachers, the task itself may have a deeper expansion, there may also be some unpredictable changes, and even produce new tasks, so as to promote students to master knowledge in depth and comprehensively.

5. Teaching Case Analysis

A detailed explanation of each of the three logical structures—linear, tree, and graph—in relation to various storage structures is provided throughout the data structure course. Explaining the task-driven technique, a binary tree's linked storage structure can be employed to teach structure in the tree structure.

The teacher commenced by elucidating the essential structure and characteristics of a binary tree-linked storage system in depth, then demonstrated the binary linked list structure diagram, noting the data and pointer fields of each node. Instructing the students to contemplate the correlation between the pointer field part of the prior node and the subsequent node, and jotting down the pointer field part of the node's value. To validate the theoretical knowledge acquired in class during the experimental stage, students must draw a binary tree independently, distinguishing between the left and right children of each node, and the root from the leaf node. Subsequently, the fundamental operation of binary tree chain storage structure is elucidated. Take traversal operation as an example, the teacher first draws a binary tree, and stipulates the use of pre-order traversal and post-order traversal, students try to write down the traversal order, and draw the corresponding clue binary tree, and then guide students to write down the key statement of the operation. The teacher, providing guidance and guidance in due course, concluded the process by providing a summary and emphasizing the error-prone areas and knowledge points that were hard for students to comprehend.

After the explanation of the binary tree chain structure, some extracurricular comprehensive problems were assigned to students. These questions require students to use binary tree chaining structures to perform operations such as determining whether a binary tree is a complete binary tree or whether it is a symmetric binary tree. In the parallel process of autonomous learning and communication learning, students 'interest in learning was significantly enhanced, and they were active in thinking and exploring solutions to problems. Through the hands-on experience and independent learning of students, a deeper comprehension of the text is attained, significantly enhancing the instructional effect. Finally, the students' satisfaction was investigated from four aspects: the improvement of comprehensive ability and quality, the course assessment method, the course activity design method, and the overall situation of the course. The results are shown in Figure 4.

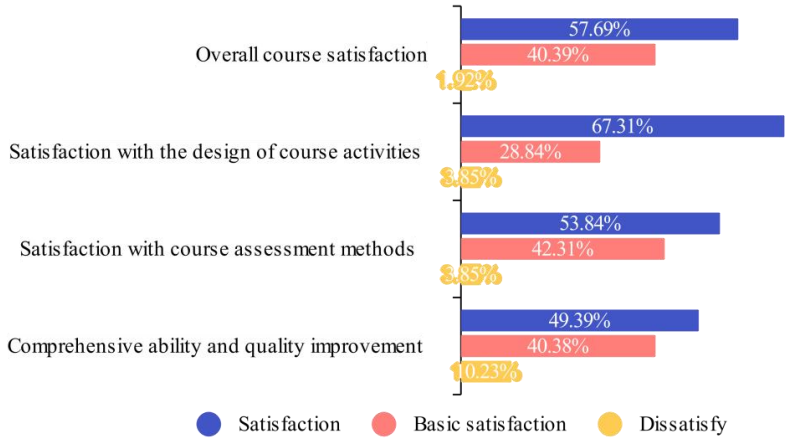

Figure 4. Student satisfaction survey results

6. Final Remarks

In order to foster the internationalization of Chinese higher education, bolster global influence and cultivate international talents who are familiar with China and its allies, it is an unavoidable necessity that student training be of a high caliber [10]. Data structure courses are of great significance in computer education. This course, a compulsory core for computer majors, is of great importance in the education of international students, as it provides a theoretical and practical foundation for future courses and work, while also enhancing students' computational thinking capabilities.

Students from other nations receive instruction on "Data structure and algorithm" using the task-driven teaching approach. Students' initiative along with educational initiative are activated by putting looking forward the task and problem-solving mindset. In order to attain the benefits of teaching and learning, "teaching" and "learning" have been merged, and teachers are encouraged to continuously enhance their techniques and lesson plans via the use of student feedback. effectively raise the standard of instruction for foreign students.

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