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Research and Practice on "Triple-driven" Based Software Development Practical Teaching System

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Abstract

According to the situation that the IT students can not meet the software industry demand for qualified personnel, a "triple-driven" three-dimensional software development practical teaching system was proposed, aiming to improve the software development capabilities and innovation sense of students. This system can effectively improve students the interest of software development and the practical skills and sense of innovation, laying a solid foundation for student after graduation to rapidly integrate into the software development process, meeting the needs of software industry.

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1. Introduction

Currently, employment of college graduates has become a prominent social issue in China. In particular, the employment situation of the IT professionals, computer professional as the representative, is even more severe. Meanwhile, the software industry demand for talent also faces considerable difficulties. A dilemma of "difficult for graduates finding a job and difficult for software companies recruiting staff" appeared in the software industry. This dilemma was in association with the curriculum system, more importantly was due to

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the professional practical teaching system and the management mechanism[1-2]. Fundamentally speaking, the background of higher education in china is still a replication mode to reflect the large-scale industrial production, which emphasizes the standardization and specification.

According to the status of china's IT education and training, a series of studies were carried out in this paper to improve the software design practical ability and innovation sense of students. A fine guidance of incentives was built and a three-dimensional practical teaching platform for software development skills training was created, which stimulated the driving force behind the study for professional knowledge and software design, improving the students' enthusiasm of innovation, training excellent software development talents.

2. Basic system of “triple-driven” software development

On the basis of studying in-depth the connotation of the software development capabilities of the computer major students, taking software development capability training as the goal, a "triple-driven" multi-level progressive software development practical teaching system was built. The so-called "triple-driven" refers to three “driven” as following. Firstly, in the first year of students studying programming, "Interest-driven" practical method was used. Writing simple games was taken as the main practical direction to arouse students' programming initiative and lay a solid foundation for further studying[3-4]. Secondly, at the basic course study stage in the second and third year of students, "competition-driven" practices were applied to encourage students to participate in the ACM programming contest and the ministry of software talents programming contest games. These competitions only involve knowledge of programming and algorithms designing, without needing very extensive expertise. These competitions have the characteristics of low threshold but great depth, which are very suitable for students to improve programming proficiency and master the skills of algorithm analysis and designing. These competitions can train the internal strength of student to engage in software development in the future. Thirdly, in the third and fourth year of professional courses study stage, the students are exposed to a wide range of expertise. “Project-driven” practice method was adopted to allow students to participate in the development of practical research projects. Opportunities were provided to students to be close to the actual practices, which played an important role for students to firmly grasp the professional knowledge and enter the software development work of IT field.

"Triple-driven" practical teaching system was designed according to the specific characteristics and problems encountered by IT major students during the different stage of learning in the school, which matches with the curriculum and students' level of knowledge, is compatible with students' psychological process of change. The "triple-driven” practical system not only presents a step relationship, but also can be intensified independently. The specific research topics include the establishment and implementation of the following three platforms.

2.1. Basic training platform of “interest driven”

The learning objectives, methods, and the wishes of the freshmen newly enrolled in are blurred. If not promptly and effectively guided, irreparable damage would be brought to their future studying. So, the key task of this stage is to create interest in learning. Interest in learning refers a positive understanding of tendency and emotional state of a person in learning. From the point of view of educational psychology, the interest is a psychological characteristics of a person tending to recognize and study for obtaining some knowledge, is an inner strength that can push people to seek knowledge, is a motivation to learn, is the most active and realistic psychological component in the enthusiasm for study[5]. If interested in a subject, students could continue to concentrate on studying it and improve learning outcomes. So, it is important to stimulate

interest in learning through some simple and interesting examples. Therefore, at the beginning of the programming teaching, the previous theoretical boring classroom model was abandoned. Instead, some interesting examples were introduced into the teaching, such as backgammon, Othello. The effective introduction of these instances can allow students to understand the practicality of the program, training their learning enthusiasm. With a certain programming foundation, the students were guided to design their own simple games, to train the basic programming skills of the students. In the second and third year, students were encouraged to go further in writing games by competition, a network platform was provided to students for competing in game writing. Practical experience showed that this way can greatly stimulate students' interest in programming, even can change students indulging in playing games into indulging in compiling games. In the third and fourth grade, the students have learned sufficient knowledge. They can begin to try a larger, more standardized game design. Now, the students were encouraged to form a group, to use spare time and even graduation design period to do development work, or to carry out works of game design and game testing, which are all very good professional practices. In short, instead of letting the students playing games from freshman to senior, it is better to let them compiling game from freshman to senior.

2.2. "Contest driven" ability cultivation platform

Currently in many universities, there all exists in the fundamental teaching stage of computer science major the following problems: unreasonable allocation of hours between theoretical and practical teaching; too stereotyped experiments in class, which have difficulty in cultivating students' innovation thinking; lack of cooperative learning ability and teamwork spirit, low learning efficiency. What's more, it has also been found that, on the one hand, fundamental teaching is far from practical application——the fundamental teaching subjects such as math, etc. are far from the practical application of computer major, and it is difficult for students to understand[6-7]. On the other hand, students are eager to learn the latest computer techniques and skills, while they dislike or even reject relatively boring fundamental subjects esp. mathematical courses. In this way, although students can learn some computer application and development technologies quite well in the early stage, they show ability deficiency in later further development, and lack knowledge support of fundamental subjects.

The professional contest, such as ACM International Collegiate Programming Contest and MIIT Software Talent Programming Contest, etc. plays a positive role in promoting the professional study of students, and helps a lot with solving the above problems which exist in the professional teaching, specifically manifested in:

- Cultivate students' self-learning ability and make up for the deficiency of talent cultivation mode

In the development of talent cultivation project, it's quite difficult to reasonably allocate theoretical and experiment hours. In order to solve this problem, extracurricular self-experiment is the only way. In the preparation of contest, students can choose what to learn and how to learn by themselves, according to the various types of problems met in the process. To achieve a good result in the contest, they will make full use of their spare time and do a lot of exercises during the contest. Though the learning of some knowledge may be boring, they often enjoy it and will try to make everything clear because this will help with solving the problems and is also a kind of putting what learned into practical application. This virtually makes up for the deficiency in our teaching process, and plays a good role in promoting the teaching.

- Cultivate students' teamwork spirit and improve cooperative learning ability

Cooperative learning is a way to learn in the form of teamwork, and team members' cooperative work is necessary to achieve the learning objectives. ACM Contest requires three persons to share one computer, and to work out the maximum problems with great difficulty within limited time. How to give full play to three persons' effort, allocate time reasonably and cooperate in the contest is the key to success. The knowledge

content covered in the contest is very extensive. Team member often study in cooperation with a due division of labor according to each one's advantages and gather to discuss or do exercises at regular intervals, so that they can speed up learning and understanding. Through training before contest and cooperation during contest, students' thinking ability is inspired, communication ability and accommodation ability are cultivated and a solid foundation for students' further job is laid.

- Make fundamental subjects work well in programming and help students in strengthening learning and understanding.

The contest question requires multi knowledge of related subjects, and students are able to acquire much more knowledge of fundamental subjects and improve their thinking ability by training and learning. Only using the basic knowledge about algorithm and data structure learned in university courses is far from enough to improve programming level. Only through exploring and gaining an insight into the knowledge of related subjects such as discrete math, graph theory, probability theory, computation geometry, etc. using various types of contest questions, and fully developing a kind of programming and algorithm thinking, can contestants achieve a good result and have much more strong ability to work in the scientific research domain in the future.

By applying contest platform reasonably, our professional teaching can be more scientific and normalized, our students' horizons can be broadened, the cultivation of innovative talents can be boosted, and students' employment competence can be improved.

2.3. "Project driven" actual development platform

In the present university educational reform, improving students' innovative ability is strongly advocated, and attracting students to take part in the scientific research project is an effective method. Scientific research activities not only help students in expending their scope of knowledge and building a reasonable knowledge structure, but also can satisfy their high level psychological requirements and increase their confidence of daring to overcome difficulties and risking making breakthroughs. Therefore, scientific research is the only road to cultivate students' modern way of thinking. In this process, teachers come up to students, and develop a harmonious relationship with them. Their instruction is full of original research inspiration and achievement and gives students gradual and imperceptible cultivation and enlightenment; at the same time, students gain the chance to be in intimate contact with teachers, which will further inspire their enthusiasm and desire of exploration and will be very helpful in cultivating students' innovative ability[8-10]. To achieve this objective, making students recognize the enjoyment and value of scientific innovation is the key, and on this basis, students are guided to develop their own innovative ability.

Scientific research activities focus on fostering students' self-learning ability and independent operation skills; this arouses students' appetite for knowledge, their comprehensive thinking quality and ability to utilize knowledge comprehensively to solve actual problems, at the same time cultivates students' serious attitude, strict requirement and rigorous style toward scientific knowledge, and really improves manipulating ability and phenomenon observation ability[11-12]. Scientific research activities add the part for students' manipulating, increase the interest in learning, enhance the understanding between each other, and cultivate students' cooperative spirit, theoretical thinking and innovation ability; they are good for cultivating students' comprehensive ability such as scientific research ability, thinking ability, self-learning ability, manipulating ability, expressing ability and cooperation ability, etc., and they will lay a solid foundation for their future work and further study.

3. "Triple-driven" implementation

In the recent years, according to students' psychological diversity of different period as well as disparate characteristics of teaching content, the following teaching practices are carried out.

3.1. Freshmen

In the early stage of program learning, programming some easy games is the main practice direction; this is done for the purpose of attracting students' initiative programming and this will lay a solid foundation for further systematic learning. Teaching cases of seven simple games, namely Gobang, Reversi, Meichess and Snake Munch, have been finished.

3.2. Sophomores and juniors

Encourage students to take part in all kinds of programming contests, in order that students can increase their proficiency of programming, and acquire the skills of algorithm analysis and design. At the present stage, over 20 programming groups have been set up in our university; in 2010, our university was awarded 27 provincial prizes and 6 national prizes; in 2011, awarded 45 provincial prizes and 8 national prizes; students' unprecedented enthusiasm of taking part in the contest soars, so it is suitable for striking while the iron is hot and pressing on with propelling the work of this sort.

3.3. Juniors and seniors

After upperclassmen have acquired extensive professional knowledge, they are allowed to take part in the development of actual scientific research project, and this is to provide them with very precious practice opportunities which are close to reality. In our university, upper classmen entering the scientific research office has already existed and is becoming more and more popular in recent years. The ratio of undergraduates who combined their graduation projects with actual projects in 2011 was up to 68.3 percent, and 21.4 percent of these graduation projects were directly used in the actual projects. Each research office under the faculty of computer science is working in support of the corresponding undergraduate interest group of scientific research. In our practice, sufficient postgraduate resources of research office directing the undergraduate interest group of scientific research to do some appropriate research work are another form and a powerful supplement of "undergraduate tutorial system" and is also a good way to cultivate postgraduates.

4. Conclusions

The "triple driven" practical teaching system for skills of software development is put forward in this paper for the first time. Beginning with "interest driven", gradually promote students' learner autonomy; increase students' "internal strength" through "contest driven"; enhance employment competitive power via "project driven"; this three-dimensional grading stereoscopic practical teaching system of software development is a set of effective methods for cultivating students' software development ability. Through using the "triple driven" practical teaching system to students of each grade in computer science major and related majors, the goal of letting aimless students generate the motivation to learn and letting aspirant students acquire opportunities to exert their potential to a larger degree has been realized and professional teaching administrative personnel have also been provided with new ideas of practice teaching.

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