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Abstract: IT students' clubs play an irreplaceable role in training students' innovation and practical abilities. Through questionnaires and interviews, the paper analyzes students' participation in IT clubs, the training of students' innovation and practical abilities and the problems existing in the organization management of clubs. By referring to the successful experience of Wuhan University of Science and Technology in the practice teaching reform, a "project-driven" system for training practice and innovation abilities, which focused on training students' innovation spirit and practical abilities, was established and achieved remarkable success.

Keywords: IT students' clubs, practice and innovation abilities, training system, project-driven

1. INTRODUCTION

With the rapid development of IT industry, the society is in need of a great number of versatile IT talents with innovation spirit and engineering practical abilities, and raises increasingly high requirements on the knowledge, ability and quality of IT professionals [1-2]. More than 850 colleges and universities nationwide have set up IT related undergraduate majors such as Computer Science and Technology, Information Management and Information System, Software Engineering, Network Engineering and E-Commerce. However, as the teaching in colleges and universities overemphasizes theoretical knowledge and neglects practice teaching, students in these undergraduate programs lack practical abilities and innovation spirit. Therefore it is hard for graduates of IT majors to meet to the job requirements of IT industry [3-5].

Many scholars in colleges and universities have done some researches on this issue. For example, Xu Yunqing *et al*, taking market demands into account, has explored a "plug and play" talent training mode; Zhang Jiexin has proposed an IT talent training mode based on MCLA's "four relationships"[7]; Lin Piyuan *et al* has discussed an IT talent training approach focusing on problem solving ability[8]; Qin Zunyue *et al* has introduced CDIO teaching concept into the teaching of Java language[9]; Fan Rongzhen *et al* has summarized the project teaching method promoted by NanYang Polytechnic and put forward an excellent IT talent training mode based on specific projects[10]. However, these researches seldom systematically analyze from the perspective of students and make an in-depth discussion on club culture, project platform, role definition and abilities training.

IT students' club, as an important practice and innovation platform for training students' innovation ability and enterprising spirit, can effectively train students' scientific research innovation and practical abilities through conducting academic exchanges and organizing competitions and activities. This paper, through conducting questionnaires and interviews in the IT students' clubs in Wuhan University of Science and Technology, has combined the development of IT students' clubs and constructed a system for training the practice and innovation abilities of IT students' clubs based on "project driving", aiming to strengthen the training of college students' practice and innovation abilities and gradually improve their innovation, practice and materialization abilities through project practice.

2. RESEARCHES AND ANALYSES ON IT STUDENTS' CLUBS BASED ON THE PERSPECTIVE

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OF STUDENTS

2.1 Research method and subject

The research combines questionnaires in the form of multiple choice questions and supplementary individual interviews. This paper, taking the construction and development of IT students' clubs in Wuhan University of Science and Technology for example, has investigated IT students' clubs and students and collected the data on students' participation in IT clubs, the training of students' innovation and practical abilities and the problems existing in the construction and management of clubs.

The subjects researched cover the undergraduates and graduate students who were enrolled in 2005-2011 and have joined IT students' clubs, mainly in the majors such as Computer Science and Technology, Information Management and Information System, Software Engineering, Network Engineering and E-Commerce. 300 questionnaires are issued totally, 87.3% (262 pieces) of which are collected. In the questionnaires collected, the proportions of students in these majors are respectively: 19.8% (Computer Science and Technology), 27.5% (Information Management and Information System), 18.3% (Software Engineering), 15.5% (Network Engineering) and 18.9% (E-Commerce). As the subject groups are clearly targeted and the samples, with a large and extensive coverage, are very representative, the research results are considered effective and well-founded.

2.2 Main contents of questionnaires

2.2.1 Students' involvement in IT clubs

In the research regarding "the biggest difference between IT clubs and cognition practice and curriculum design", 39.9% of the students argue that IT clubs have provided them with a platform for hands-on experience where they can participate in the real IT projects of enterprises and public institutions directly under the guidance of teachers, while cognition practice and curriculum design do not; 30.9% of the students believe that through participating in projects of IT clubs, they can convert their abilities into productivity, while through participating in cognition practice and curriculum design, they always doubt the usefulness of their knowledge; and 8.9% of them deem that in the process of actual project development in IT clubs, contracts and other legal documents are present for compliance, while the binding effect in cognition practice and curriculum design is smaller. The data analysis in Figure 1 indicates that most students are more likely to acknowledge the benefits from their involvement in IT clubs, since they think that compared with practice teaching in schools such as cognition practice and curriculum design, participation in projects of IT clubs is more practical.

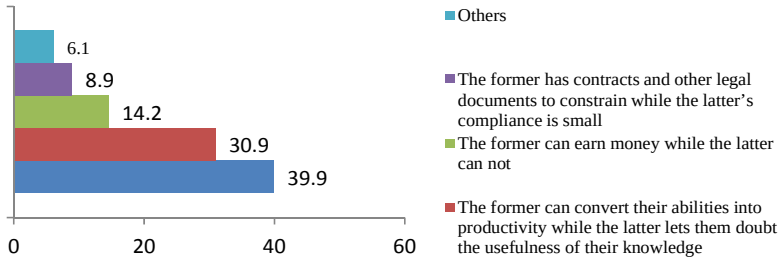

Figure. 1 The differences between IT clubs and cognition practice and curriculum design

The research findings on "the employment advantages of students participating in projects of IT clubs" are shown in Figure 2. 35.4% of the students argue that project development experience is helpful to employment; 27.4% of them believe that it is the influence of group that helps; 25.7% of them deem that through project participation in IT clubs, they can find out their strengths and weaknesses and better capitalize on their abilities; and the remaining 11.5% think that the channel of employment established through projects is of great help for job hunting.

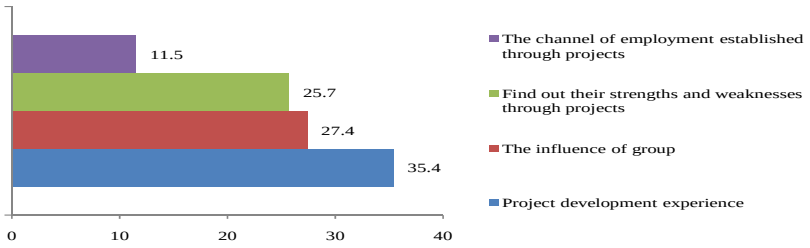

Figure. 2 The employment advantages of project participation in IT clubs

2.2.2 The training of innovation and practical abilities

The research findings on "students' innovation abilities trained through participating in projects of IT clubs" are shown in Figure 3. 39.2% of the students argue that they have developed a strong innovation ability of "problem awareness"; 31.1% of them believe that their curiosity and thirst for knowledge have been developed through projects; 22.4% of them deem that they have gained a valuable quality of pursuing innovation through taking part in projects of IT clubs; and the remaining 7.3% think that they have developed a spirit of adventure which may bring a great driving force to their life.

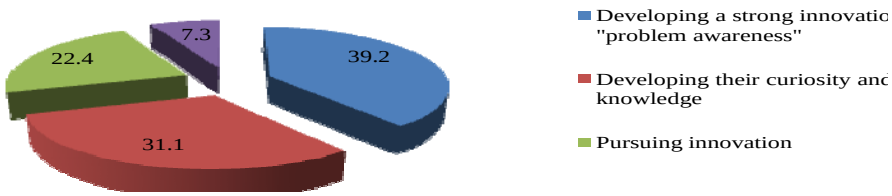

Figure. 3 Students' innovation abilities trained in IT clubs

The research results on "students' practical abilities improved by IT projects" are shown in Figure 4. 38.1% of the students argue that their abilities to find new problems, put forward new ideas or methods and solve new problems have been improved; 27.4% of them believe that through implementing the whole project, they can view the project as a whole and possess abilities to master the overall situation and analyze problems systematically and integrally; 20.3% of them deem that their practical abilities in study, communication and project teamwork have been improved; and the remaining 14.2% think that they can apply the learnt theories in practice well.

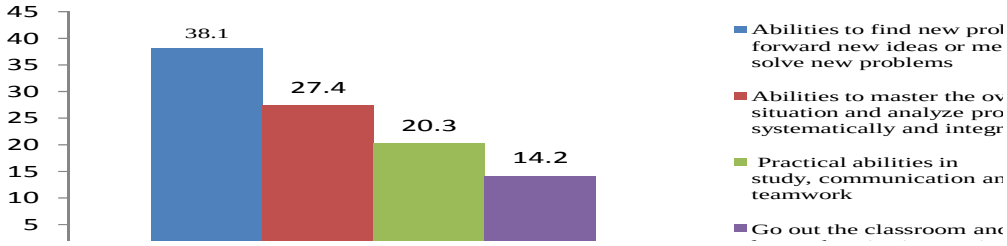

Figure. 4 Students' practical abilities improved by the projects of IT clubs

In the research regarding "the most important factor influencing the schedule of IT projects", 31.8% of the students argue that it is the communication with Party A (project implementation organizations such as enterprises, public institutions and schools), since in the earlier investigation stage of a project or throughout the process of project implementation, the communication regarding project details is of vital importance, and the probability of project success will be reduced in the case of poor communication; 30.9% of them believe that the initial overall architecture may be changed greatly as customer adds new demands in the future; 23.9% of them deem that it is the solving of a technical problem; and the remaining 13.4% think that as the demands of Party A are often modified or even changed greatly and repeatedly, the schedule of project will slow down, and the

cooperation may even be terminated halfway.

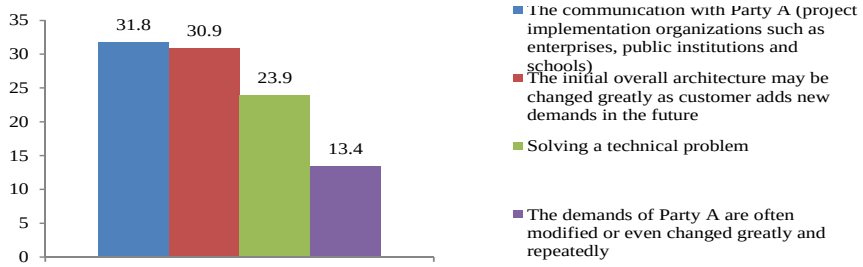

Figure. 5 Factors influencing the projects of IT clubs

In the research regarding "the important traits of IT students for undertaking a project", 41.7% of the students argue that it is the sense of ownership (being highly responsible for the project); 38.9% of them believe that it is the flexible communication ability; and the remaining 7.9% think that it is the ability to empathize with customers, since the team members of a project should give consideration to both parties to succeed in the project.

2.2.3 Team building of IT clubs

In the research regarding "the method of selecting talents for IT clubs", 34.2% of the students argue that clubs can recruit relevant talents through competitions such as program design competition and website design competition; 32.3% of them believe that senior members can look for talented persons through carrying out academic exchanges with junior students; 21.2% of them deem that the advisers of the clubs and relevant teachers can observe students' occupational skills through their class performances and average grades to determine whether these students have some potentials to develop; and the remaining 12.3% of them think that teachers can put forward enterprise demands, and interested students can recommend themselves.

3. DATA ANALYSIS

An evaluation matrix is built based on questionnaire survey data so as to analyze the influence of project-driven IT clubs on students' innovation and practical abilities. The external factor evaluation matrix and internal factor evaluation matrix are used as research tools. The analysis method of evaluation matrix is used to assign the two factors with weights ranging from 0.0 (unimportant) to 1.0 (very important). Weight indicates the relative importance of the factor in improving the innovation and practical abilities of IT club members, and the total weights of all factors should be 1. Points ranging from 1 to 4 ("1" stands for poor, "2" stands for fair, "3" stands for good, and "4" stands for excellent) are given according to the actual ability improvement of students in IT clubs against project implementation. The points are given based on the project-driven importance in training students' innovation and practical abilities. The weight of each factor is multiplied by its score to gain the weighted score of each factor, and the weighted scores of all factors are added together to obtain the total weighted score of the innovation and practical abilities of IT club members. The total weighted score ranges from 1.0 to 4.0 with an average of 2.5. The total weighted score higher than 2.5 indicates that the IT club can effectively improve practical abilities through project.

The weighted score of each factor is calculated according to the project-drivenness, weight of each factor and score concluded. The sum of the weighted scores of all factors is the total weighted score. A project driving evaluation matrix of IT clubs is obtained based on the above values and calculations (see Table 1).

Table.1 Project-drivenness evaluation matrix of IT clubs

Project-drivenness	Weight	Score	Weighted Score
Convert the theoretical knowledge from textbooks into productive forces	0.14	3	0.42
Find out their own strengths and weaknesses through projects	0.08	2	0.16
Practical abilities	0.16	3	0.48
Possess curiosity and thirst for knowledge	0.12	2	0.24
Gain a strong problem awareness	0.10	3	0.30
Pursue innovation	0.10	3	0.30
Find out new problems, put forward new ideas	0.08	3	0.24
Develop projects with the language learnt	0.06	2	0.12
The sense of ownership (being highly responsible for project)	0.06	2	0.12
Flexible communication ability	0.08	2	0.16
Total	1.00		2.54

The total weighted score gained in the project- drivenness evaluation matrix of IT clubs is 2.54 which is slightly higher than the average of 2.5. As the weights and scores are gained subjectively, the total weighted score of project-drivenness evaluation can be deemed to be higher than the average score, which indicates that the IT clubs in colleges and universities can improve students' innovation and practical abilities well through project. In developing members of clubs in future, the advisors of clubs in colleges and universities should focus on three aspects: flexible and effective management system, innovation and application of knowledge, and the healthy development of students' character. They should truly focus on students, guide students to exploit their potential through project gradually and strengthen their innovation and practical abilities [11-13].

4. THE SYSTEM FOR TRAINING THE PRACTICAL AND INNOVATION ABILITIES OF PROJECT-DRIVEN IT STUDENTS' CLUBS

Wuhan University of Science and Technology always insists on educational innovation, strengthens quality-oriented education, pays equal attention to knowledge and action and lays emphasis on personality development. Its IT clubs, under the guidance of advisors, visit factories for practice, invite experts and scholars to hold high-level lectures, go deep into the society for data collection, participate in high-level scientific research projects and take part in all kinds of discipline competitions at different academic levels. They have constructed a system for training the practical and innovation abilities of "project-driven" IT students' clubs based on "project driving" (as shown in Figure 6), formed the culture of IT clubs with the characteristics of the university and achieved remarkable success.

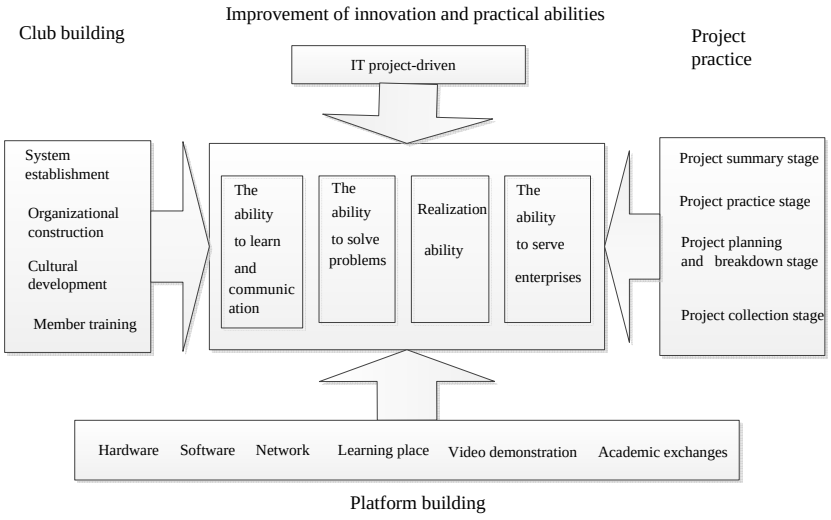

Figure.6 The system for training the practice and innovation abilities of project-driven IT students' clubs

4.1 Platform building

The building of IT clubs platform should be supported by hardware and software. Colleges and universities should provide corresponding learning places and link the clubs with the outside world through network, and the club members should frequently study and discuss, have video demonstrations and academic exchanges. Schools can provide a platform to students and enable the students of various majors who are good at communication, comprehend management, master technologies and possess innovation ability to communicate and study together under the organization of schools, and thus build teams and better capitalize on their innovation and entrepreneurial abilities[14].

For example, hardware equipment such as server, PC, projector and experiment table and software facilities such as LAN, system development software, installation tools and test tools are used by clubs in developing a reservation platform system for mechanical experiments. In the process of developing this system, the IT club members also have unscheduled academic exchanges which enable then to learn skills and strengths from each other and solve the problems encountered when implementing projects. After the completion of projects, video tutorials are attached so as to demonstrate the achievements to other members.

4.2 Project driving

The most effective method to tackle the traditional problem in training IT talents is to involve students in the practices of IT project development. Through project-driven training, the practice and innovation abilities of the IT club members can be improved effectively. As the clubs undertake projects from the outside and advisors cooperate with the personnel from enterprises, governmental agencies and units on projects, students can experience the real projects of enterprises.

When participating in the specific projects of enterprises, students can constantly strengthen their abilities to learn and solve problems, form a systematic view and examine problems from an overall perspective. When developing projects, they firstly design a theoretical model independently, and transform theories into methods and into the practice, then improve their own innovation and practical abilities and finally possess the ability to serve enterprises. Driven by project, students in clubs not only possess professional competence, certain abilities to organize and coordinate and dedication spirit, but also take delight in participating in competitions and serving. The technical ability of project development and improvement of innovation ability have long-term and comprehensive requirements on students' training. Trainings and projects can bring results only when they are organized and implemented by responsible management teams effectively and persistently. Currently, the IT projects can start from the following aspects:

4.2.1 IT project construction

Through developing small and medium-sized information system projects such as enterprise ERP system, security monitoring system and the educational administration system in schools, students who are IT club members can integrate into the informationization of enterprises and public institutions well and experience the progress brought by informationization to the society personally.

4.2.2 Website development project

Students can develop government web portals, campus news websites as well as the websites of IT clubs, enterprises and public institutions, which are within their power. On one hand, their innovation and practical abilities are improved through website development; and on the other hand, they can understand the effect of websites on enterprise promotion and advertising.

4.2.3 Decision support system project

IT clubs can develop online book recommendation system, logistics site selection system for express and logistics companies, decision support system for process optimization, etc.

4.3 Club building

The team building of IT clubs is of vital importance. Excellent teams can inspire members and enable them to possess team spirit and make best use of their potentials and talents. Each member should bear a sense of responsibility and a sense of ownership, so as to achieve team cooperation, mutual assistance, win-win situation and better team building. The organizational structure of club building is shown as Figure 7.

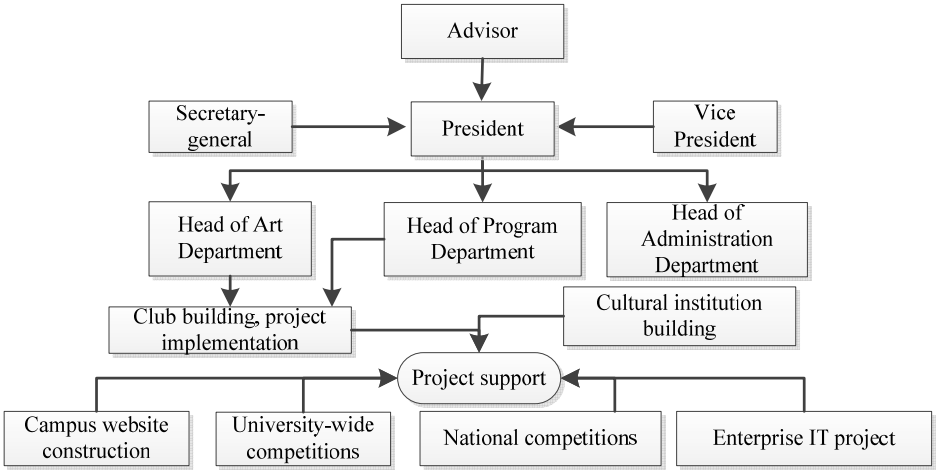

Figure.7 Organization chart of IT clubs

4.4 Project practice

Practice module plays an important part in ability training and improvement. Students can truly apply what they have learnt through practice and take the test in practice. In this cyclic process, their abilities will be strengthened and improved circuitously and gradually. The project-driven training module of practical abilities realizes a minor cycle of four increasing steps and a major spiral cycle within the module, fosters students' innovation ability and achieves the interaction between universities and enterprises [15].

4.4.1 Project collection stage

As students discuss with clients and undertake projects alone or under the guidance of advisors, they can understand clients' overall requirements on projects and working process and construct suitable project frameworks.

4.4.2 Project planning and breakdown stage

Experienced club members are organized to plan and break down the projects undertaken. Tasks are assigned according to different skills of members so that they have jobs to exercise their skills.

4.4.3 Project practice stage

Through constructing a project implementation system of "platform + module", each part of project is integrated into innovation practice in the practice module in four steps, namely, foundation, integration, application and innovative practice.

4.4.4 Project summary stage

The implementation process and results of projects are summarized. The contents summarized are not only returned to the project collection stage to form the major spiral cycle in the ability training module, but also integrated into enterprises to achieve the interaction between universities and enterprises.

5. THE EFFECTS OF TRAINING

In training IT talents through project, real project development improves students' practical abilities in practice. A system for training the practical and innovation abilities of "project-driven" IT students' clubs is put

forward on this basis. It breaks up the knowledge and key techniques in real IT projects into parts, runs through the whole process of training the engineering ability of IT talents through providing the real settings of IT projects and trains students' abilities to "work" and "accomplish work". The effects of training are mainly reflected in the following aspects:

5.1 Improvement on students' engineering practical abilities

For example, a team which is composed of a dozen of students from Information Management major and E-Commerce major has successively and remarkably completed large-scale information system projects entrusted by the Ministry of Water Resources such as "Embankment Information Service System of Yangtze River" and won the "Best Design Award" of software works of the Ministry of Water Resources.

5.2 Fostering students' innovation ability

For example, in the project of "Unattended Garbage Dump Measuring System of the Urban Management Bureau of Wuhan City", the project team members, after thoroughly studying RFID technology and the principles of weighing instrument, have put forward a data acquisition algorithm based on time slot and circular queue and mastered the essential technology of the project which is a leading technology in China in the field of unattended measurement. Relevant reports have been made by Hubei TV Economic Channel and other media.

5.3 Promoting the booming of students' clubs

For example, Adou Studio (the Party Committee Publicity Department of Wuhan University of Science and Technology) organized and established by students spontaneously has gathered talents from many majors such as Machinery, Computer, Information Management, Automatic Control and Art Design and splendidly completed the IT projects entrusted by enterprises in website design, information system development, aided intelligent decision making, industrial automatic control and other fields.

5.4 Students win awards in competitions

Students of IT related majors have won many awards in international and national technological innovation and skill competitions successively, such as the First Prize of Contemporary Undergraduate Mathematical Contest in Modeling, the Special Award of National Undergraduate Students Intelligent Car Competition, the First Prize of National Undergraduate Embedded System Design Contest, the Gold Award of "Challenge Cup" Business Plan Competition for Chinese College Students and the Championship of International Steelmaking Challenge Match; and the "Climber" Robot-soccer Team has won 10 world championships and 13 national championships successively.

6. CONCLUSIONS

Driven by projects and with IT students' clubs as a carrier, this practice fully capitalizes on interdisciplinary advantages, transforms professional knowledge into productivity directly and changes students' learning approach from "passive reception" into "active exploration", effectively solving the problem of excessive virtualization in the current practice teaching system, significantly inspiring students' innovation ability and learning passion and greatly cultivating their hands-on practical ability, communication ability, project management experience and innovation ability.

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