

# Innovation and Practice, Teaching and Learning

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**Abstract**—As a key component of the national innovation system, the University Students' Innovation Activities Project has been implemented in many universities since 2007. In the meanwhile, many research groups adopted the method of guidance and draw a lesson from it. Thus, our research group has gained wider experience by guiding 23 projects. This paper presents several successful experiences on guiding the Project and shares with the relative members of research groups to better strengthen the students' quality levels.

**Index Terms**—Innovation activities, practice, teaching, learning, high-tech textile.

## I. INTRODUCTION

The University Students' Innovation Activities Project is an important component of the national innovation system. Since 2007, National/Shanghai University Student's Innovation Activities Project have been carried out in Donghua University. Our research group has completed a total of twenty-three innovation activities in the level of national and Shanghai (Tab. 1). Looking back on those years' guiding experience, we realize that "Innovation and Practice, Teaching and learning" is the greatest harvest and achievement. Thus, we would like to share our experience with you in this paper.

## II. INNOVATION ACTIVITIES ARE IMPORTANT PRACTICE OF LEARNING BASED ON THE PROJECTS

In recent years, we are responsible for the teaching task of high-tech textile direction. We choose the learning style based on projects as our active practice which is proved out to be an effective method to improve students' innovation and comprehensive quality by many universities at home and abroad [1-4]. We also realize that this method should run throughout the whole process of undergraduate study. Therefore, besides the form of class teaching, we take the University Student's Innovation Activities Project as an important way to enhance students' innovation. "University Student's Innovation Activities Project", "innovative ideas and innovative practice", and "inventions around ourselves" are highly promoted and introduced during the freshmen orientation, direction selection and other technology festivals in order to arouse their creative invention and the interests in scientific research, as well as the innovation demands and innovative behavior of each student.

## III. SET-UP OF MULTI-GRADES TEAM IS THE FOUNDATION OF INNOVATION ACTIVITIES

Three to five students come from different grades are encouraged to form a team, because of the time flexibility they have. What's more, the team leader who is also the spirit leader plays an essential role in a team. The one who want to be a team leader should not only have innovative enthusiasm, but also have good communication skills [5]. Usually, team leader is cultivated through the college level innovative programs. Here in the College of Textiles, we pay a lot attention on the consistency of creative training. Students can apply for the Shanghai or National University Student's Innovation Activities Project after six months practice in college level innovative programs.

Instructors are of great importance in respect of theoretical and experimental methods, project research methods and technical tools [6-7]. With their leading and guiding, students accomplish the work of topic chosen, project establishment and organization. Our research group mainly focuses on the teaching and research of biomedical textile materials and technology. Teachers in our group have different research backgrounds: textile engineering, materials engineering, biology and medicine. Two or three teachers work as the direct guidance to give advices and help students to set up research team and subjects. Thus, the students from different grades and teachers with different background will ensure the quality and the level of achievement

## IV. SCIENTIFIC ATMOSPHERE IS THE SOFT POWER OF INNOVATION ACTIVITIES

In order to ensure a successful progress of undergraduate innovation activities, the experimental demonstration center, all kinds of open laboratories and the key laboratory offer the appropriate testing environment and experimental apparatus for those who are involved in the project. However, scientific atmosphere also determines the quality and sustainable development of the innovative projects [8-9]. The weekly held seminar in our research group is completely open to everyone joined innovation projects, who are encouraged to ask questions to get more exchange. PhD or master students in the similar project act as listeners of their primary experimental schedule to fulfill their autonomy, communication and coordination skills. The atmosphere of innovation, unity, harmony, and the accomplishment of overcoming difficulties

greatly increase the confidence and determination of undergraduate students to face up with challenges and problems in innovation activities.

TABLE I. THE LIST OF INNOVATION PROJECTS THAT WE DIRECTED

Rank	Students (team leader)	Innovation Project	Time
Shanghai	Li Zhuo, et al	Design and performance of porous ePTFE vascular grafts	2008-2009
Shanghai	Zhao Ying, et al	Formation, structure and fatigue properties of textile based endovascular artificial blood vessels	2008-2009
Shanghai	Lv Aifeng, et al	Development and research of multi-functional botanical dyeing preparation and ecological wool fabric	2009-2010.4
National	Fu Sha, et al	Development and application of botanical antimicrobial and pigment compound preparations	2010.5-2012.5
National	Yang Jinru, et al	Structure design and mechanical properties of Stent-Graft membrane	2010.5-2012.5
Shanghai	Wang Yinyan, et al	Preparation and anti-coagulation properties study of silk fibroin/PET small diameter vascular grafts	2010.4-2011.5
National	Zhao Cunyi, et al	Textile-based multilayer branch artificial blood vessels with shape memory structures	2010.11-2012.11
Shanghai	Lu Mingkan, et al	Research and development of medical antibacterial braided silk suture	2011.6-2013.6
Shanghai	Song Ge, et al	Preparation and fatigue resistance prediction of Stent-Graft fabric	2011.6-2013.6
Shanghai	Hu Xingyou, et al	Influence of the content and distribution of silk on the performance of silk polyester mixed small-diameter vascular grafts	2011.6-2013.6
National	Xu Weini, et al	Formation and properties study of textile based biodegradable ureteral stent	2012.4-2014.4
National	Jia Hao, et al	Preparation and properties of branched Stent-Graft membranes	2012.4-2014.4
National	Zeng Di, et al	Development and manufacturing of smart hemostatic bandage based on wet shape memory fiber	2012.4-2014.4
National	Du Jia, et al	Design and application of an in vitro device to simulate the twist and blending fatigue performance of SG artificial blood vessels	2012.4-2014.4
Shanghai	Han Weiyi, et al	Design, preparation and properties of imitation down warm fiber assembly	2012.10-2014.10

Shanghai	Xu Rui, et al	Exploration of details of standardized test methods for water permeability of artificial blood vessels	2012.10-2014.10
National	Yu Chenglong, et al	Forming and degradation behavior of gradient degradation ureteral stent	2013.5-2014.5
National	Chen Peifeng, et al	Bifunctional surface modification of PCL tissue engineering scaffold	2013.5-2014.5
National	Fang Yini, et al	Preparation and filtration performance of ePTFE high temperature filtration membrane	2013.5-2014.5
National	Huang Jiantao, et al	Surface functional modification of fibroin fiber artificial blood vessels	2013.10-2015.10
National	Huang Zhaolong, et al	Research on antibacterial modified starch	2013.10-2015.10
National	Wang Yiying, et al	In vitro analysis of porous silk fibroin membrane for artificial skin	2013.10-2015.10
National	Mao Ying, et al	Design of textile enhanced tissue engineering small diameter artificial vascular stent	2013.10-2015.10

#### V. THE PROCESS OF INNOVATION ACTIVITIES SPEAKS LOUDER THAN THE RESULTS

The most important part for undergraduate students is to experience the innovation process. Through the process and details, students can make themselves fully involved in the projects, practice and management [10]. Meanwhile, they gained rich experience and became increasingly mature. Summarization, refining and academic exchanges provide interaction opportunities for both students and teachers. Apart from the exchange in our group meeting, we also encourage students to take part in other forms of academic activities in the level of college, school, and Shanghai, such as domestic and international academic conference, submitting papers and posters.

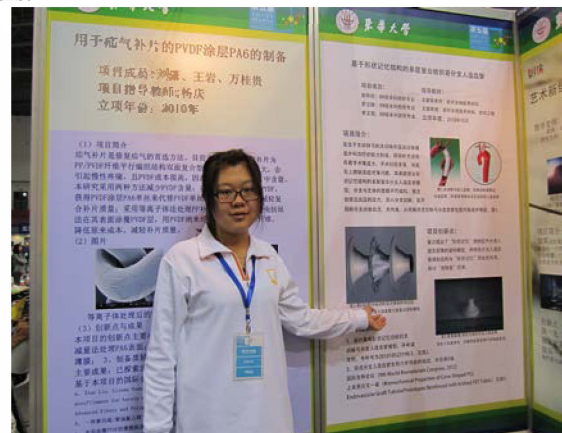


Fig. 1. The student who participated in the 5<sup>th</sup> Annual of National Undergraduate Innovation and Entrepreneurship

The national innovation project “Textile-based multilayer branch artificial blood vessels with shape memory structures” co-guided by professor Wang Lu and Wang Fujun participated in the 5<sup>th</sup> Annual of National Undergraduate Innovation and Entrepreneurship sponsored by the Ministry of Education, Science and Technology (Fig. 1). The achievements of Shanghai innovation project “Research and development of medical antibacterial braided silk suture” completed by Lu Mingkang and other students were published on the 2012 International Forum on Biomedical Textile Materials. Hu Xingyou, team leader of Shanghai innovation project of “Influence of the content and distribution of silk on the performance of silk polyester mixed small-diameter vascular grafts” which won the third prize of the 18<sup>th</sup> Shanghai college students’ inventions “Kechuang Cup” (Fig. 2), got the opportunity to go directly into PhD study after obtaining his bachelor degree. Relevant papers are published on the Journal of Biomaterials Applications January 2013. Jia Hao, another student went immediately into his PhD study, was the team leader of “Preparation and properties of branched Stent-Graft membranes” which attended the 2013 3<sup>rd</sup> Shanghai University Students’ Creative Activities Program exchanges.

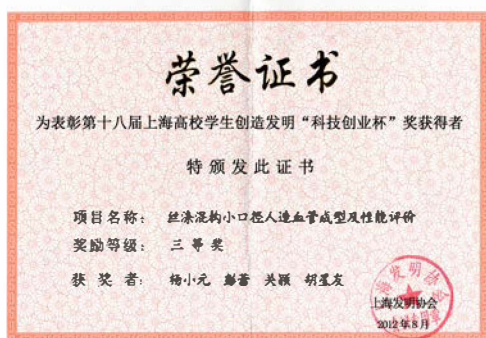


Fig. 2. The certification of the third prize of the 18<sup>th</sup> Shanghai college students’ inventions “Kechuang Cup” won by Hu Xingyou

#### VI. THE EXTENDING AND DEEPENING OF INNOVATION ACTIVITIES NEED TO BE FURTHER EXPLORED

Based on the research practices and initial results, we encourage students to do further exploration in their graduation thesis from which they will get eighteen academic credit. It has been proved that the students who had went through innovative activities do much better in their graduation thesis than those who had not. According to the incomplete statistics, the outstanding dissertation winners have all went through the innovation projects. Based on the Shanghai innovation project “Preparation and fatigue resistance prediction of Stent-Graft fabric”, Song Ge won the outstanding thesis of Donghua University in the year of 2013 with the title of “In vitro simulation of the fatigue properties of Stent-grafts with Zigzag and ring stents” (Fig. 3).



Fig. 3. The outstanding thesis of Donghua University in the year of 2013 won by Song Ge

With the expansion of the influence of college students' innovative activities, more and more sophomore or even freshman began to participate in the research team to carry out some innovation activities. Du Jia and Chen Jiyoung were involved in the college-level innovative project “Research on the *in vitro* fatigue performance of SG” when they were in their first year study. In their second year, they applied for the National University Student’s Innovation Activities Project titled “Design and application of an *in vitro* device to simulate the twist and blending fatigue performance of SG artificial blood vessels”. During the research progress, they also applied a Chinese invention patent “A simulation device and test methods for twisting and bending fatigue test of minimally invasive endovascular stent”, and won the third prize of the 19<sup>th</sup> Shanghai college students’ inventions “Kechuang Cup” (Fig. 4). The paper “Fatigue performance of fabrics of stent-grafts supported with zigzag stents vs ringed stents” and “Stent fabric fatigue of grafts supported by Z-stents vs ringed stents: an *in vitro* buckling test” were published on the Journal of Donghua University and Journal of Biomaterials Applications. Du Jia and Chen Jiyang continue their graduation studies at Donghua University and North Carolina State University in USA respectively. Wish the passion of innovation could help them to achieve greater progress in their graduate studies.

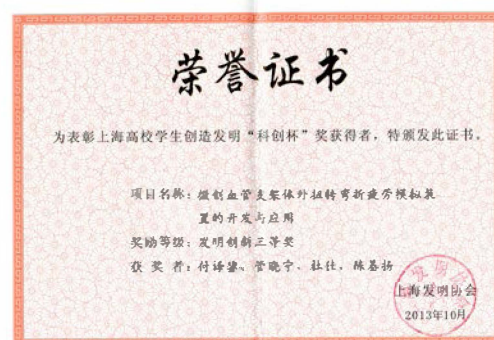


Fig. 4. The certification of the third prize of the 19<sup>th</sup> Shanghai college students’ inventions “Kechuang Cup” won by Da Jia and Chen Jiyang

The practice of innovation activities provides a good foundation for those who choose to continue their studies. Fu

Sha and Ding Yi used to be team members of national innovation project “Development and research of multi-functional botanical dyeing preparation and ecological wool fabric”, and recently they gained their master degree successfully through the thesis “Cationization and dyeing of the fabric” and “Vegetable dyes”. In addition, they started their doctoral studies which are further exploration of the innovation activities they partook during their undergraduate time. All this fully proves that the innovation activities at Donghua University which is of great creativity have a strong impact on students and the research achievements is in a relative high level.

#### VII. INSTRUCTORS BENEFIT FROM INNOVATION ACTIVITIES AS WELL

We deeply realize from the practice that innovation activities have not only arouse students' initiative, enthusiasm and creativity, but also stimulate students' sense of innovation and lead them to think in a more creative way. From innovation activities, students gradually learn the ability of finding, thinking and solving problems. As a result, their innovation and practical capacity has been well exploited [11]. As instructors, we contribute our wisdom and time to inspire students to think independently in scientific guidance methods and to abide the honesty and preciseness of the scientific research. We try to develop their enthusiasm, initiative and creativity, to cultivate their management skills, communication skills, and the spirit of dedication and team cooperation. However, we teachers also benefit a lot from this [12]. The problems we met during this procedure prompt us to go further into our research; it supplies us with a platform for innovative education practices; the innovation achievements enhance the popularity of both the subject and our teaching and research team; a number of outstanding students have been cultured from the innovative activities. As teachers, we are pleased to have all these excellent students!

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