Higher Education Studies; Vol. 10, No. 1; 2020
ISSN 1925-4741 E-ISSN 1925-475X
Published by Canadian Center of Science and Education

Exploration and Practice of International Collaborative Teaching Mode for Innovation Talents

Tianhong Pan[1], Yi Zhu[2] & Shan Chen[3]

[1]School of Electrical Engineering and Automation, Anhui University, Hefei, Anhui 230601, China

[2]School of Computer Science and Communication Engineering, Jiangsu University, Zhenjiang, Jiangsu 212013, China

[3]School of Electrical Information & Engineering, Jiangsu University, Zhenjiang, Jiangsu 212013, China

Correspondence: Tianhong Pan, Anhui University, #111 Jiulong Road, Hefei, Anhui 230601, China. Tel: 86-551-6386-1905. E-mail: thpan@ahu.edu.cn

Received: December 23, 2019 Accepted: January 12, 2020 Online Published: January 21, 2020

doi:10.5539/hes.v10n1p115 URL: https://doi.org/10.5539/hes.v10n1p115

Abstract

In order to enrich the training modes for internationalized and innovative talents, universities from China, Japan and Korea have cooperated each other since 2012, and established a consortium named Innovative Research & Education of Asia (IRE). The consortium proposed the "student-centered, innovation-oriented and multiple cooperation" teaching concept. To achieve the objective of innovation talent education, an international interdisciplinary teaching team has been formed and three international innovation engineering education projects have been created. Furthermore, an international collaborative training system for innovation talents has been designed. Up to now, more than 20 colleges and universities joins the IRE consortium and 2000 Asian students participated in the training system. The successful cases demonstrate that the proposed teaching system is effective and has become a famous example of interdisciplinary engineering innovation education for talents.

Keywords: international cooperation teaching, innovation talent, innovation engineering education, Makers, interdisciplinary

1. Introduction

The traditional training system in the high education of China is mature for engineers' education. However, it is insufficient for the international innovation talents education when a new round of scientific & technological revolution and industrial revolution has emerged which caused by the cross-integration of information technology, biotechnology, new energy technology and new materials technology etc. (Yao et al., 2019; Hu et al., 2018). Furthermore, talents with "integration ability, global vision, innovation ability and practical ability" are critically shortage (Nie, 2019). To solve the above mentioned problems, a notice about the development of new engineering research and practice has been issued by the Ministry of Education of China in 2017 (Ministry of Education, 2017).

In response to the challenge of talent demand in the new era, universities from China, Japan and Korea have cooperated each other since 2012, and established a consortium named Innovative Research & Education of Asia (IRE) (Chen et al., 2018). The consortium proposed the "student-centered, innovation-oriented and multiple cooperation" teaching concept, and created an international collaborative training system for innovation talents. Furthermore, the consortium has established an international platform for students' exchanges, organized an international interdisciplinary teaching team consisting of nearly 100 teachers from three countries, and founded three international innovation engineering education projects, i.e. Summer Program for Innovative Engineering Design (SPIED), Creative Engineering Design Competition (CEDC), and International Conference on Innovative Application Research Education (ICIARE). More than 2000 Asian students participated in the proposed training system and most of them have achieved many awards in a variety of subject competitions. The successful cases demonstrate the effectiveness of the presented teaching system.

2. Construction of a Multinational and Multidisciplinary Collaboration Innovative System

As shown in Figure 1, the international collaborative carrier for innovation talent training is created by universities from China, Japan, and Korea. The universities alliance has built an international Maker space,

developed an online international teaching platform and multiple online courses, and established a consortium of Innovation Research and Education of Asian (IRE). Furthermore, an international teaching team has also been formed.

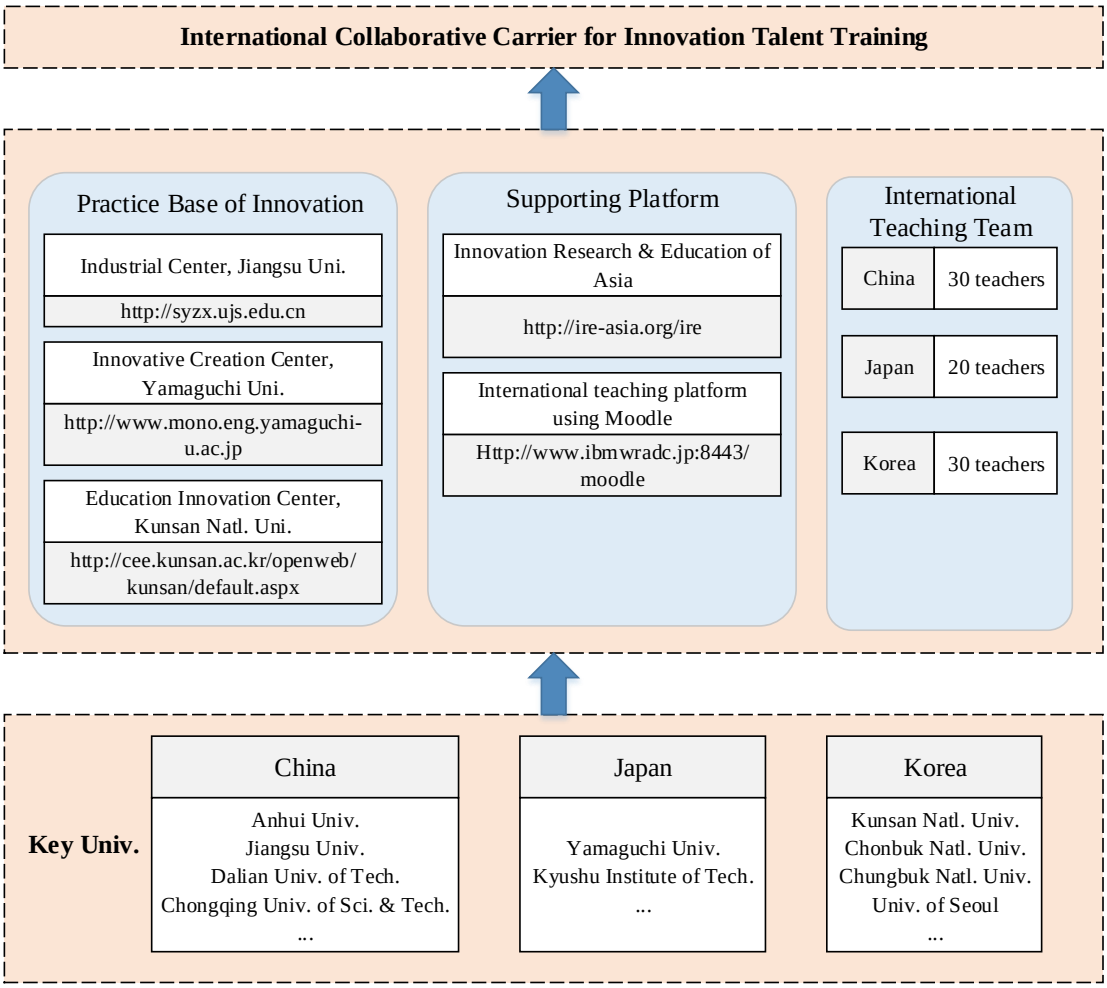

Figure 1. The international collaborative carrier for innovation training system

2.1 International Interdisciplinary Teaching and Practice Platform

In order to provide a strong guarantee for the implementation of international innovation education, the team has established the international interdisciplinary teaching and practice platform. The platform is composed of industrial center of Jiangsu University (China), innovative creation center of Yamaguchi University (Japan) and Education Innovation center of Kunsan University (Korea). Students from three country take the advantage of sources presented by the platform. They work together and learn each other, design independently, and make by themselves, and so on. On the one hand, an experiential environment has been constituted through those activities. On the other hand, an innovation atmosphere has been formed promotionally.

At the same time, more than 20 Asian universities participate in the platform and a consortium named Innovation Research and Education of Asia has been built (http://ire-asia.org/ire). Furthermore, an international teaching team has been formed in which teachers have different technical backgrounds, such as mechanical discipline, electrical and electronic discipline and information science discipline, etc. Teachers in this team have being worked together and built an online teaching platform based on Moodle (https://www.ibmwradc.jp:8443/moodle/). More than 20 online courses, such as “Android Programming”, “Lego Mindstorms Control”, and “3D Printing Design” have been created which present abundant teaching sources for students’ education.

2.2 International Interdisciplinary Teaching Team

Up to now, nearly 80 teachers from China, Japan and Korea work together and form an international

interdisciplinary teaching team. Through the stable exchange and visiting mechanism, teachers cooperate each other and explore many kinds of innovative projects which benefit for cultivation of students' innovative thinking and ability. Furthermore, the interactive mechanism promotes to form the correlation between the students' ability training and the teachers' research works.

3. Construction of an Innovative Talent Training System

On the basis of the construction of international interdisciplinary innovation carriers, an international collaborative training system is constructed (shown in Figure 2).

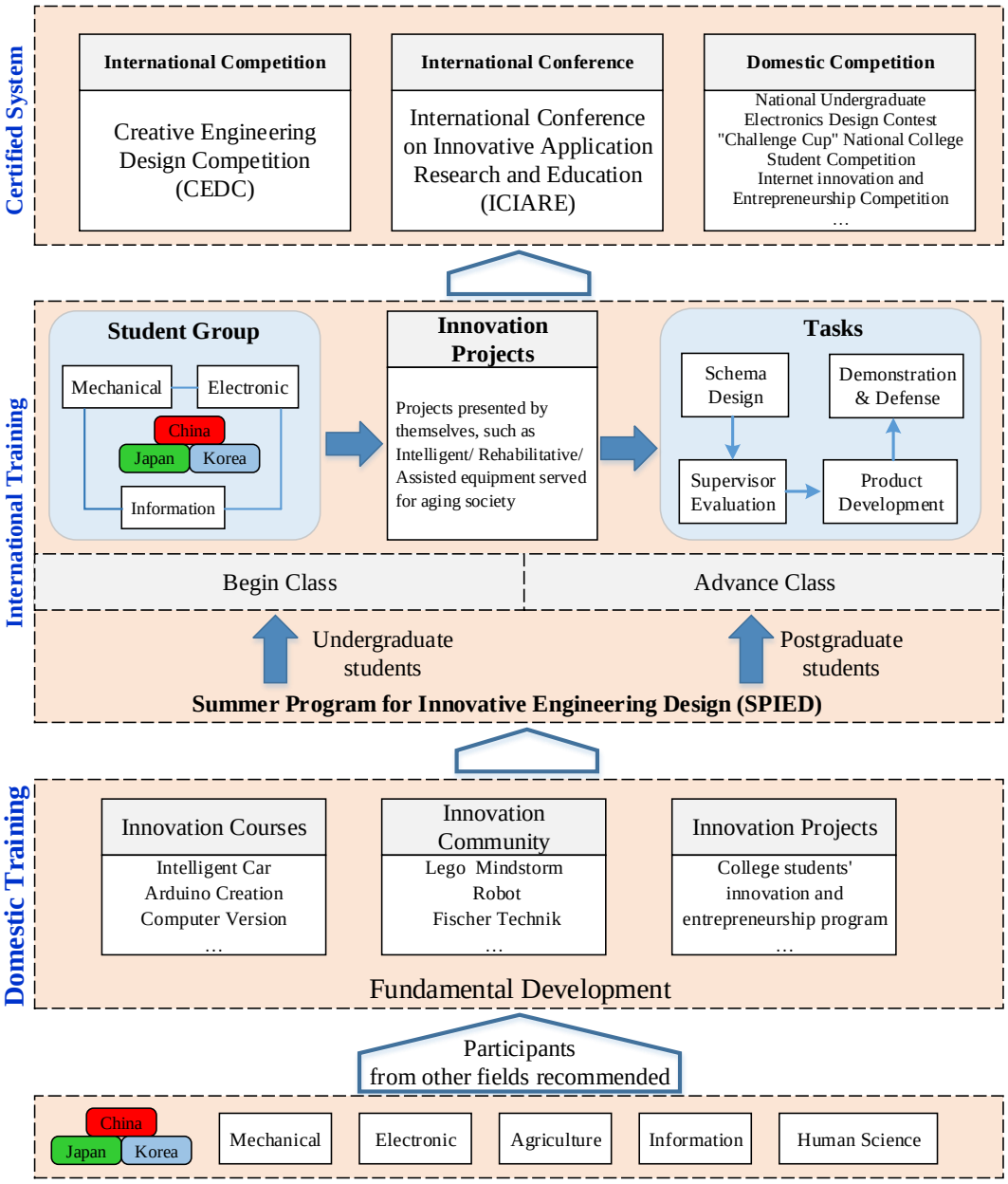

Figure 2. The international collaborative training system

The system is composed of "two major sections" (domestic innovation training and international innovation training), "three types of innovation training units" (innovation courses, innovation community, and innovation projects), "three international programs" (Summer Program for Innovative Engineering Design, SPIED, Creative Engineering Design Competition, CEDC, and International Conference on Innovative Application Research Education, ICIARE). The major fields of the proposed system include the creative engineering design and advanced manufacturing, which is formed by the fusion of the various fields of engineering such as, mechanics,

electronics, information, industrial design, material, etc. With a view to fostering open innovative talents with the strong cooperative and practical abilities among China, Japan and Korea leading international networks, students of other fields, such as the majors in technology management, economics, human science, medical, etc. are encouraged to participate in some parts of the program.

3.1 Domestic Innovation Training

There are three types of innovation training units for participants to obtain the fundamental knowledge.

(1) More than 20 innovation courses have been presented for participants, such as “design of mechanical and electrical products”, “Arduino program”, “computer vision”, “food processing machinery and equipment”, “food testing technology”, etc. About 700-1500 students/year in Jiangsu University learn those lectures.

(2) Several innovation communities has been formed which includes Lego Mindstorms, Robot, Fischer Technik, etc. About 150 students/year in Jiangsu University join those communities.

(3) Interdisciplinary solutions for the aging society have been explored. More than 100 national/provincial innovation training projects have been applied after students cultivated by the proposed training system.

In the domestic innovation training section, one group must contains students with different major fields (such as mechanical design, computer science, food engineering, etc.). The experiential education mode is taken in the training process (Wang, 2019). The Makers Space in the Industrial Center of Jiangsu University is set as a creative environment. Students exchange their idea, find solutions to list problems and experience the innovative process. After those training, students achieve the innovation awareness and engineering capabilities.

3.2 International Innovation Training

The international innovation training has been implemented by the Summer Program for Innovative Engineering Design (SPIED). SPIED was created by universities alliance from China, Japan, and Korea. Representive universities are Jiangsu University (China), Yamaguchi University (Japan) and Kunsan National University (Korea). After educated by the domestic innovation training through Moodle platform, participants will take international innovation training for two weeks at August ever year. In the first week, 3-5 students in one group seat together and propose schema design, and supervisors evaluate the proposed design and give some suggestions. The interactive session will be implemented several times. Then, the draft product will be finished in the following one week. Finally, participants will give the defense and demonstration. The key elements in SPIED and some activities in SPIED are shown in Figure 3 and Figure 4 respectively.

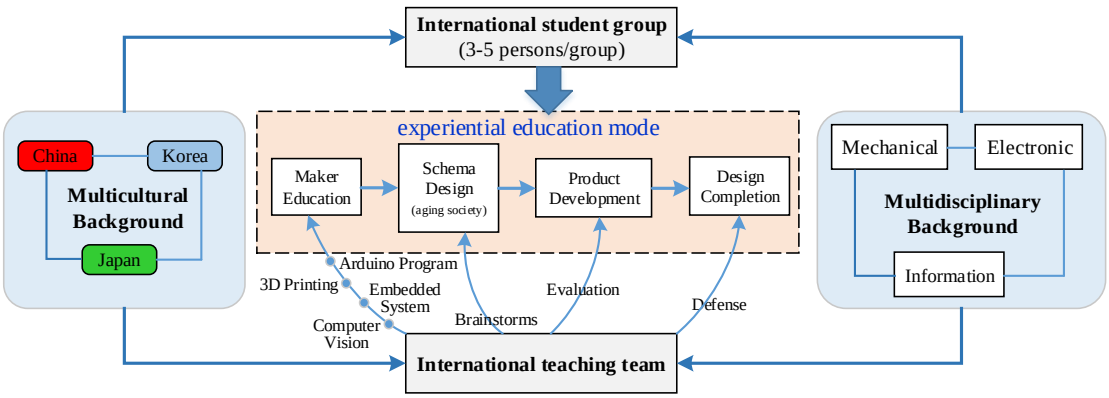

Figure 3. Key elements in SPIED

Through the “learning by doing” program, the innovation awareness and engineering capabilities of participants will be improved. In the past five years, more than 400 Asian students have attended the SPIED. SPIED has been implemented by three countries, China, Japan, Korea, at a rotation basis. Undergraduate and Postgraduate students have been invited to join the SPIED in the begin class and the advance class respectively.

Figure 4. Activities in SPIED

3.3 Certified System

Two international certified platforms, i.e. Creative Engineering Design Competition (CEDC) and International Conference on Innovative Application Research Education (ICIARE), have been taken for self-evaluation the proposed system. Domestic college student competitions (such as: national undergraduate electronics design contest, "Challenge Cup" national college student competition, internet innovation and entrepreneurship competition, etc.) have been taken for the third-party evaluation.

The CEDC and ICIARE will be held at December every year, at a rotation basis. After SPIED period, participants continue to contact with each other through the internet and improve their draft products designed in the summer time. Of course, students (especially for postgraduate students) will develop some innovative works (such as development of proplis, peptide foods, or new oral insulin etc.). The Joint Review Board consisting of trilateral faculty will certify grades and credits for the students. In the past five years, more than 1000 students join the CEDC and ICIARE activities. Some activities in CEDC and ICIARE are shown in Figure 5.

Figure 5. Activities in CEDC and ICIARE

4. Effectiveness of the Proposed System

Students cultivated by the proposed system have achieved many kinds of competition awards. Their abilities of innovation and engineering have been significantly improved, and the cross-disciplinary researches on mechanical engineering, electrical & electronica, and information science have achieved remarkable results. Many Asian universities have accept the international collaborative training system, and more than 20 universities joined the consortium. Furthermore, nearly 2,000 Asian students has participated in program. The training system has become an international joint training example of interdisciplinary engineering innovation capability with greater influence in Asia.

5. Conclusion

The core of the international collaborative teaching system is to educate innovation talents in the university. The

proposed system perfectly implements the educational objective of "facing the industry, facing the world, and facing the future", and cultivates engineering talents with innovation, interdisciplinary and high-level (Tu et al., 2015; Yang et al., 2016). The international teaching term takes inheritance and innovation, cross and integration, coordination and sharing as the main apaches, and designs the international collaborative teaching and interdisciplinary system. Furthermore, the proposed system emphasizes the differences between countries, cultures and disciplines etc. and highlights the collaboration and sharing. In short, the international collaborative teaching system is the first to fulfill the spirit of the new engineering talent training, which enriches the practice of new engineering education.

Acknowledgement

The authors would like to thank the financial support provided by Research Projects on Reform of Professional Teaching & Education, Professional Teaching Steering Committee of Automation (2019A40), Projects on Quality Engineering of Anhui Province (2019jxtd014 and 2019jyxm0060) and Industry-University Cooperative Research Projects Program, Ministry of Education (201802023006).

Reference

Chen, Q., Pan, T. H., Chen, S., Ahan, M. K., & Zhang, Z. W. (2018). Explore an international education for training the creative engineering talents. *International Journal of Learning and Teaching, 4*(2), 146-150. https://doi.org/10.18178/ijlt.4.2.146-150

Hu, X., Wan, H., Yang, D. J., & Shen, X. (2018). Organizational mechanisms and practice of innovative talents cultivation in local colleges-A case study of Hubei University. *Higher Education Studies, 8*(1), 65-71. https://doi.org/10.5539/hes.v8n1p65

Ministry of Education. (2007). Notice on the research and practice of new engineering discipline. Retrieved from http://www.moe.edu.cn/s78/A08/A08_gggs/A08_sjhj/201702/t20170223_297158.html

Nie, F. Y (2019). *Exploration and practice of innovation and entrepreneurship talents cultivation. Proceeding of 9th International Conference on Education and Social Science (ICESS 2019).* pp. 1781-1785, Yokohama, Japan.

Tu, Y. Q., Yang, H. Y., Shu, L., Tu, W. S., & Chen, B. X. (2015). A mode of government - enterprise - university -institute - employer cooperation for innovative postgraduate cultivation. *Universal Journal of Educational Research, 3*(2), 93-98. https://doi.org/10.13189/ujer.2015.030204

Wang, J. T. (2019). Innovative research on the training mode of applied talents in logistics management based on the integration of production and education and collaborative education. *Advances in Social Science, Education and Humanities Research, 340*, 132-134. https://doi.org/10.2991/iceiem-19.2019.17

Yang, J., Zhu, A. H., Yuanyuan Zhang, Y. Y., & Zhao, C. Q. (2016). The construction and practice of classified talent cultivation system combining with professional certification. *Eurasia Journal of Mathematics, Science and Technology Education, 12*(8), 2187-2197. https://doi.org/10.12973/eurasia.2016.1419a

Yao, S., Song, H., Li, Z. Y., & Li, D. F. (2019). Construction and continuous improvement of talent training system for pharmaceutical engineering professionals in China: exploration and practice of Sichuan University. *International Journal of Education and Research, 7*(6), 2013-114.

Copyrights

Copyright for this article is retained by the author(s), with first publication rights granted to the journal.

This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (http://creativecommons.org/licenses/by/4.0/).