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Research on the Construction and Influencing Factors of the International Competence Evaluation Index of Engineering College Students Under a "Dual Circulation" Development Pattern

Yang Yang[1,2,*], Jian Yang[1], Hua Ding[1], Ting Han[2]

[1]Jiangsu University, Zhenjiang, Jiangsu, China.
[2]Jiangsu University Jingjiang College, Zhenjiang, Jiangsu, China.

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Corresponding author: Yang Yang, Jiangsu University, Zhenjiang, Jiangsu, China; Jiangsu University Jingjiang College, Zhenjiang, Jiangsu, China.

Abstract

China has made a significant choice and implemented a "dual circulation" development pattern in response to abrupt changes in the country's and the world's political and economic conditions. It is suggested to follow a "dual circulation" growth pattern, in which technical innovation represents the breakthrough and capacity for globalization represents the benefit. Additionally, it provides a new direction for the training of higher education professionals in China, particularly engineering students with exceptional talent abroad who are deserving of reviving the country. In order to design and build an internationalization competency framework based on the traits of engineering students, this paper employs the literature method. It focuses primarily on the "attitude and values" dimension, the "skills" dimension, and the "knowledge and understanding" dimension, and also takes into account the internationalization experience dimension. Based on this, we suggest relevant remedies to strengthen engineering college students' capacity for internationalization.

Keywords

Internationalization Capabilities, A "Dual Circulation" Development Pattern, Engineering Students

1. Introduction

The global community is currently dealing with developments that have not been seen in a century: a new pneumonia epidemic that is destroying the globe, a slowing global economy, and a surge in anti-globalization movements. This is due to China's formal proposal to accelerate the creation of a significant domestic cycle as the primary body and the domestic and international double cycle to support each other's new development patterns in October 2020, adhere to the implementation of a broader scope, a wider field, and a deeper level of opening up to the outside world, promote international cooperation, and achieve mutual benefit and win-win outcomes. The key to building a "dual circulation" development pattern lies in solving various "neck" technical bottlenecks, and the inevitable requirement for doing so is scientific

and technological innovation and expanding openness. Higher education should take on the significant role of supporting national policies and bringing new knowledge and foreign talent to economic development and social progress as it serves as a "delivery room" for human resource training and technical innovation. The New Engineering Excellence Engineer Education and Training Program is an initiative from China with the goals of developing a group of outstanding scientific and technological engineering talent, creating a world-class engineering education system with Chinese characteristics, and boosting the nation's hard power and competitiveness abroad. The former is continued and sublimated in the Opinions of the Ministry of Education and Other Eight Departments on Accelerating and Expanding the Opening of Education to the Outside World in the New Era, which places an emphasis on "enhancing the international competitiveness of China's higher education talent cultivation and accelerating the cultivation of high-level international talents with a global vision." In order to advance higher education in a "dual circulation" development pattern, it is essential to cultivate engineering students with advanced, global, and creative youthful scientific and technological abilities (see Fig. 1).

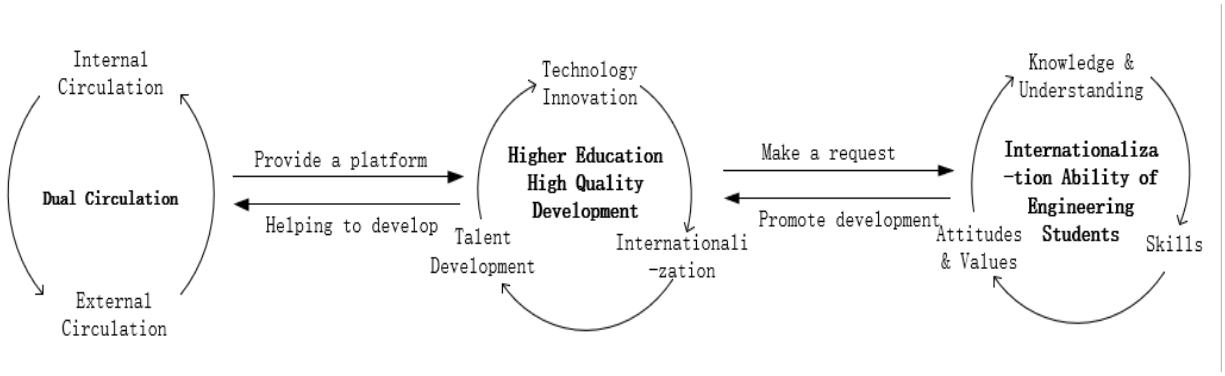

Fig. 1. The Interaction among the "Dual Circulation" Development Pattern, the High-quality Development of Higher Education, and the Promotion of the Internationalization Capacity of Engineering Students.

2. Literature Review

2.1 About Higher Education in the "Dual Circulation" Development Pattern

Many academics have begun to focus on the placement and growth of higher education since the advent of the "dual circulation" development pattern. Sui Yifan emphasized that it is the national mission and responsibility of universities to support the "dual circulation" development strategy of the economy. Universities must take the initiative to assume the mission and responsibility of promoting national knowledge and technological innovation, and they must continuously reform the mode of talent training and enhance the quality of talent training (Sui Yifan, 2021). Higher education's integration problems into the new development pattern were highlighted by Li Jie's analysis of the link between it and the "dual circulation" development pattern, and he proposed a path to optimize the development pattern of higher education (Li Jie, 2021). Fang and Zhong examined how to accomplish high-quality development of higher education under the new "dual circulation" development pattern based on the theories of structural supply-side reform and economic development (Fang Fang & Zhong Binglin, 2022).

Some academics concentrate on the globalization of higher education in the context of the current domestic situation in China, taking national factors into account. According to Jiang Kai, a high level of openness in higher education should be encouraged in the new growth pattern since it is a distinguishing trait and a critical factor in the modernization of higher education in China (Jiang Kai, 2021). Internationalization of higher education, according to Shen and Chen, must draw from past mistakes and lessons, comprehend the future development route under the "dual circulation" development pattern, take center stage, and pursue novel development avenues (Shen Yuan & Chen Mudan, 2021). Liu and Wu believed that Western universities should assess the benefits and drawbacks of globalization in light of their own historical perspectives on the new stage of growth (Liu Yibing & Wu Tong, 2021).

2.2 Internationalization Skills of University Students

At the macro level, research on the internationalization of higher education is currently fairly advanced, and academic

attention is now shifting to the internationalization skills of specific students as a crucial sign of the success of higher education in this area. Since the early 1990s, Schechter has advocated for internationalization in higher education as having as its ultimate objective preparing students with knowledge and skills in a global context, awareness of cultural differences, and cross-cultural sensitivity, or internationalization competence (Schechter M,1993). Experts and academics have started to examine the meaning of internationalization competence from a variety of angles since the idea of internationalization competence was introduced. Olson, Hunter, and other academics concur that there are three components to internationalization competence: "knowledge and understanding," "skills," and "attitudes and values" (Olson C, Lee C, & Kroeger K R, 2001; Hunter B, White G P, & GODBYE G C., 2016). Domestic researchers have begun to pay attention to this idea as the trend of globalization of higher education in China has gained popularity, primarily as represented by two scholars, Liu Yang and Hu Dexin. Liu Yang's team divided the internationalization capacity of college students into three dimensions and seven factors based on the research of foreign scholars, created a scale appropriate for Chinese college students, and then gradually advanced the study of individual students' levels of internationalization capacity (Liu Yang & Wu Ruilin, 2015). The scale was updated by Hu's team to create a scale with four primary indicators, eight secondary indicators, and 27 tertiary indicators, which is used to examine graduate students in China's capacity for internationalization (Hu Dexin X & Li Linlu, 2021).

In conclusion, the current body of research has the following issues: From a research perspective, there is no research on the microlevel of internationalization ability in connection with the new "dual circulation" development pattern. According to the study object, there is not much information on engineering college students' capacity for internationalization. The majority of engineering students focus primarily on mechanical, material, computer, and engineering courses, and they are accountable for the development of the nation through science and technology in addition to core courses like advanced mathematics, English, ideology and political theory, physical education, etc. Based on this, investigating engineering college students' capacity for internationalization can help them broaden their perspectives on the world, raise their internationalization awareness, and enhance their capacity for intercultural communication, ultimately assisting China's "dual circulation" new development pattern.

3. A Framework for Internationalization Competence of Engineering Undergraduates

The internationalization ability scale for Chinese university students was developed in recent years by two researchers, Liu Yang and Hu Dexin, and their teams based on their prior research. It primarily consists of three dimensions: "knowledge and understanding," "skills," and "attitude and values." College students, graduate students, doctoral students, and engineering students from China and Germany are the research subjects. Strategies to enhance one's capacity for internationalization are discussed in light of the situation at hand and the characteristics of the research subjects. Knowledge and expertise in internationalization are critical considerations for the foreign staff at Chang Tongshan (Chang Tongshan & Du Ruijun, 2013). The internationalization competency framework created by the previous authors is added to and improved upon in this study by combining the five competencies taken from the "New Engineering Excellent Engineer Training Program 2.0"; specifically, "knowledge and understanding" is divided into three factors: world knowledge, global understanding, and engineering knowledge; the engineering knowledge factor is added in accordance with the disciplinary characteristics of engineering students. The "skills" dimension includes tool use, cross-cultural engineering practice ability, and cross-cultural communication ability; the "attitudes and values" dimension is broken down into political quality, internationalization consciousness, and internationalization consciousness. The new cross-cultural engineering practice ability is also an essential criterion to highlight the internationalization of engineering students. Engineering ethics and professional ethics are added to reflect the engineering quality of engineering college students in the dimensions of "attitude and value" which are divided into political quality, international awareness, international attitude, engineering ethics, and professional ethics; "international experience" is the influencing factor in the framework system of internationalization ability, primarily including international courses, international internships, and international travel; it is used to gauge how engineering college students' experiences with internationalization have affected their capacity for internationalization. The "Internationalization Competence Framework for Engineering Undergraduates" has been established with 4 dimensions and 12 elements (Fig. 2), as well as Table 1's detailed explanations and illustrations of the framework's unique indicators.

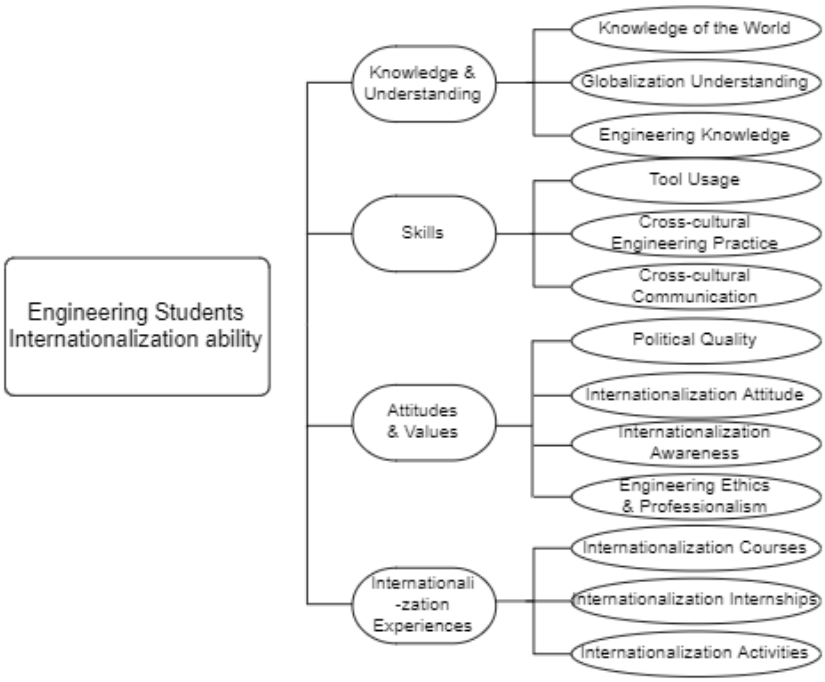

Fig. 2. Internationalization Competency Framework for Engineering Undergraduates.

Table 1. Description of Internationalization Ability Indicators for Engineering Undergraduates

Dimension	Factors	Descriptions
Knowledge & Understanding	Knowledge of the World	Knowledge of politics, history, culture, and law around the world
	Globalization Understanding	Understand the meaning of globalization, its development trend and international influence
	Engineering Knowledge	Understanding of international general engineering knowledge, standards and cutting-edge research in the field of study
Skills	Tool Usage	Ability to use foreign software and tools related to the profession
	Cross-cultural Engineering Practice	Ability to conduct professionally relevant research or collaborate in a cross-cultural environment
	Cross-cultural Communication	Ability to communicate with foreign students orally or in writing
Attitudes & Values	Political Quality	Awareness of the current domestic situation and political identity, understanding of current major national strategies and policies
	Internationalization Attitude	Maintain an open and tolerant attitude towards people of different nationalities, languages and foreign cultures
	Internationalization Awareness	Understand the internationalization process, have a good understanding of the importance of internationalization, and show understanding and respect for foreign cultures
	Engineering Ethics & Professionalism	Strengthen engineering ethics and abide by professional ethics with the concept of benefiting human beings and sustainable development
Internationalization Experiences	Internationalization Courses	Experience in taking foreign language courses or courses related to globalization and internationalization
	Internationalization Internships	Experience in internship and practice in overseas companies
	Internationalization Activities	Experience in overseas exchange, study, conference, study tour, etc. or published foreign language papers in SCI, EI

4. Conclusions and Recommendations

This study has favorable implications for understanding the variables affecting engineering college students' capacity for internationalization and, eventually, for raising such capacity. The following actions are advised to further increase the level of internationalization among engineering college students:

4.1 Knowledge & Understanding Level—Focus on Enhancing Engineering Students' Comprehension of World Knowledge, Engineering Knowledge and Globalization

It is not only required to improve the system for developing internationalization skills during the training process, but it is also essential to incorporate the traits of the modern era in order to achieve the objective of strengthening the internationalization capacity of engineering students. The "dual circulation" development pattern places an emphasis on economic cooperation, which inevitably involves the counterpart cooperation specialists required by nations with varying levels of economic development and political structures. As a result, college students must be very familiar with their professional knowledge as well as have a fundamental understanding of the basic situation of other nations in the world and a clear understanding of the international situation. The primary classroom channel should receive all the attention it deserves from the university. The university should give the classroom its due attention, broaden the curriculum, improve the lessons, and assist students in increasing their knowledge bases. Therefore, we should take these elements into account when developing the curriculum design system. Under the "dual circulation" development pattern, colleges should emphasize the "world knowledge" that engineering students neglected during their previous study period and offer corresponding courses in independent study and public electives, such as those on the global situation, each nation's political and economic structure, history and culture, human geography, etc. And provide additional courses on international integration and the profession's frontier development, which can both raise the bar for "engineering knowledge" in general and prepare engineering students to engage in cross-cultural engineering practice.

4.2 Skills Level—Enhance the Intercultural Communication and Teamwork Skills of Engineering College Students

Tool use, cross-cultural engineering practice, and cross-cultural communication abilities make up the skills dimension. The mastery and usage of at least one foreign language serve as the cornerstone for all of these abilities. As engineering students, the majority of them have a weak foundation in foreign languages, and some of them exhibit the traits of Chinese students, i.e., their output abilities, such as speaking and writing, are weaker while their listening and reading skills are slightly more significant. Therefore, in response to this characteristic, according to the existing curriculum structure, firstly, speaking and writing foreign languages can be introduced to the independent study section as independent courses to increase college students' output training in languages. Secondly, add bilingual professional courses and English lectures for professional courses, focusing on training engineering college students' cross-cultural ability in professional fields, familiarizing and mastering foreign language expressions such as professional vocabulary and experimental methods, as well as the use of overseas versions of professional software, etc., to overcome the language problem of cross-cultural engineering collaboration.

4.3 Attitudes & Values Level—Cooperative Efforts to Build an Open and Inclusive Worldwide Mentality among Engineering Students

Engineering college students, as contemporary Chinese youth, should set high expectations, consider the great rejuvenation of the Chinese nation as their responsibility, and improve the aspiration, backbone, and bottom strength of the Chinese people.

Counselors are the ideological and political leaders of college students, and they play an active role in controlling their critical principle concerns, such as ideology and state of mind. The lecturers in charge of the courses are the leaders of college students' learning knowledge and play a significant role in educating individuals in the courses. Students themselves are the leaders of self-actualization among university students, and they should, first of all, be willing to "open their eyes to the world". Second, college students should keep up with local, national, and international news, develop an open, tolerant, and global mindset, utilize the many international exchange platforms set up by the university, actively engage in international activities, raise their international level in those activities, and be willing to challenge and realize their potential. They should also improve teacher preparation, create a mechanism for selecting and sending students for study abroad, promote teacher development, and broaden teachers' exposure to foreign research and teaching.

4.4 Internationalization Experience Level—Making Every Effort to Boost the Dynamism and Efficacy of Engineering Students' Engagement in Internationalization Efforts

One of the leading causes of Chinese university students' general lack of ability to internationalize is that they still have a significant gap in experience participating in internationalization activities when compared to students at the top universities in the world, according to some studies. Therefore, under the new model, universities must improve the capacity of internal educational resources for internationalization, carry out extensive internationalization projects, and realize the internationalization of student flow both internally and externally in order to realize the internationalization of talent cultivation. To assist engineering students in developing high-quality sino-foreign cooperation resources, short- and medium-term overseas study and practice exchange programs, optimizing the education structure of international students, etc., universities should build platforms based on their own characteristics and advantages, establish internationalization supply chains, and collaborate resourcefully and complementarily with domestic and foreign universities.

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