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Returnee STEM Scholars from Japan: Impacts on Research Capacity and Internationalization in Chinese Universities

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ABSTRACT

This study explores Chinese STEM graduates from Japanese universities who returned to China, highlighting their significant contributions to education, research, and international collaboration at home institutions. Findings reveal that returnees significantly enhance laboratory standards, the quality of graduate education, research, and international collaborations at their home institutions. They apply Japanese-style supervision methods, facilitate global academic partnerships, and elevate their institutions' international standing. However, challenges persist, including limited research time, frequent evaluations, and political influences on academic exchanges. Social networks within academia also affect the implementation of new programs. Despite these challenges, returnees contribute to patent development and technological advancements, demonstrating their broader societal impact.

Keywords: Chinese Returnees, Study Abroad Experiences, Japan, STEM Researchers

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INTRODUCTION

Studying abroad at the graduate level has a profound impact on individuals' career trajectories, the development of personal and professional skills, and the expansion of international networks (Collins et al., 2017; Enkhtur, 2019; Holloway et al., 2012; Jiang et al., 2020). For returnees, these experiences often translate into contributions to workplaces through technology transfer, enhanced research productivity, and advances in international collaboration (Jiang & Shen, 2019; Ma & Pan, 2015; Makundi et al., 2017). In other words, beyond individual outcomes, returnees influence the organization culture, practice, and development (Campbell, 2016; Enkhtur, 2019). While considerable scholarship has examined Chinese returnees in industry, academia, and their role in innovation and technology development (Liu et al., 2022; Welch & Hao, 2013; Zweig & Wang, 2013), majority focuses on returnees from English-speaking countries with less research on the significant population trained in Japan (Wang et al., 2024). Japan remains a leading destination for Chinese students outside of English-speaking countries, with approximately 60% of Chinese graduate students in Japan enrolled in STEM (Science, Technology, Engineering, and Mathematics) fields as of 2022. Japanese universities provide a unique academic environment–emphasizing standardized laboratory systems, pragmatic approaches to applied research, close industry-academia collaboration, and a distinctive supervision culture–that differs both from Chinese and Anglo-American models (Enkhtur, 2019; MEXT, 2015).

This study investigates the organizational-level contributions of Chinese STEM graduates who studied in Japanese graduate schools and returned to Chinese universities. Rather than focusing only on returnees' personal achievements or China's macro-level policy strategies, it highlights how individuals reshape their home institutions–with particular attention to their roles in education, research, and technological innovation. By situating their experiences at the intersection of STEM education, transnational mobility, and Japanese graduate training, this research addresses an overlooked dimension of returnee studies: how Japan-trained graduates serve as institutional change agents in Chinese higher education.

LITERATURE REVIEW

Government Strategies on Chinese Student Mobility

Since the late 20th century, China's policies on overseas education and talent repatriation have undergone significant transformation, reflecting evolving national priorities and global engagement strategies. The foundational regulatory framework was established in January 1958, when the Ministry of Higher Education and the Ministry of Foreign Affairs jointly issued the Regulations on the Management of Students Sent Abroad (Yang & Hui, 2024), marking the formal beginning of state-managed overseas education programs.

A major milestone occurred at the end of 1972, when the Ministry of Foreign Affairs selected the first seven government-sponsored language students to study in Japan, symbolizing a cautious reopening to international academic exchange. Following the initiation of China's reform and opening-up policy, the Ministry of Education issued the Notice on Expanding the Selection of Overseas Students and Researchers in August 1978,

increasing the annual quota of students studying abroad to over 3,000—a significant expansion of international education efforts (Yang & Hui, 2024).

In 1990, the State Education Commission established the Research Fund for Returned Overseas Students, which was renamed in 1997 as the Research Start-up Fund for Returned Overseas Students, institutionalizing support for the reintegration and research development of returnees. In parallel, the government's stance on overseas study was clearly articulated in 1993 with the formulation of a tripartite policy: "Support studying abroad, encourage returning, and ensure freedom of movement" (*Zhichiliuxue, Gulihuiguo, Laiquziyou*). This principle was further reaffirmed in September 1997 at the 15th National Congress of the Communist Party of China, which called on overseas students to either return or contribute to national development from abroad.

To facilitate the return of high-level talent, a joint directive entitled Opinions on Establishing a Green Channel for the Return of High-Level Overseas Talent was issued in February 2007 by sixteen ministries. This policy emphasized streamlined procedures and support mechanisms to attract and retain overseas-trained professionals.

On the 100th anniversary of the Western Returned Scholars Association in October 2013, President Xi Jinping expanded the country's overseas education policy, reiterating the foundational tripartite principle and adding a fourth element: "Promote contributions" (*Fahuizuoyong*). This marked a shift toward not only encouraging returnees but also emphasizing their active involvement in national development.

By March 2019, the scale of China's overseas education had expanded dramatically. According to the Ministry of Education, a cumulative total of 5.86 million Chinese students had studied abroad from 1978 to 2018, of whom approximately 3.65 million had returned after completing their studies. To further support this population, the National Employment Service Platform for Overseas Talents was launched in September 2022, offering a centralized resource for job placement and career development.

Most recently, in September 2024, the Opinions on Implementing an Employment-First Strategy reaffirmed the equal employment rights of returned overseas students, reflecting ongoing institutional commitment to integrating global talent into China's domestic labor market (Yang & Hui, 2024).

Chinese Student Mobility to Japan and Government Policies on Talent Recruitment Programs

Japan stayed a leading study abroad destination for Chinese students, particularly among non-English-speaking countries due to its geographical proximity, cultural ties, and high-quality education system. According to recent statistics, a total of 123,485 Chinese students are currently studying in Japan, comprising approximately 37% of the international student population in the country (JASSO, 2025).

Chinese students studying abroad show a strong preference for disciplines in STEM (Science, Technology, Engineering, and Mathematics), aligning with both global trends and national development priorities. In response to the growing importance of international academic mobility, the Chinese government has been actively recruiting foreign-trained Chinese scholars to return to China since the Chinese brain drain began (Meng & Shen, 2024), and the Chinese government has implemented a series of talent recruitment initiatives aimed at attracting high-caliber Chinese graduates and researchers from overseas institutions.

Among these initiatives, the "Thousand Talents Program (TTP)", launched in 2008, targets the recruitment of senior overseas Chinese professionals to return to China. Complementing this, the "Young Thousand Talents (YTT) Program", introduced in 2010, specifically focuses on exceptional young scholars under the age of 40 in STEM fields. More recently, the "Outstanding Young Talents Program (Overseas)", established in 2021 by the National Natural Science Foundation of China, aims to attract promising young scientists under the age of 40, including both overseas Chinese and non-Chinese researchers, to undertake research in China. These programs reflect the country's strategic emphasis on reversing brain drain and strengthening domestic research capacity through the reintegration of globally trained talent. And these initiatives have proven successful by offering competitive salaries, substantial research funding, and access to advanced laboratory resources, making China an increasingly attractive destination for returnees with international academic experience.

Returnees as Organizational Change Agents in Universities

Globally, STEM internationalization is understood as a key driver of higher education reform. Research emphasizes how cross-border mobility shapes STEM curriculum design, governance models, and industry partnerships, preparing universities to participate in a globally interconnected knowledge economy (Wagner, 2024).

In China, empirical studies have indicated that returnees under the Young Thousand Talents (Y1000T) scheme, have demonstrated higher levels of research productivity compared not only to their counterparts working abroad but also to domestically trained scholars in similar institutional environments (Han & Appelbaum, 2018; Marini & Young, 2021). This influx of highly qualified returnees has further contributed to intensified competition within China's academic landscape, especially in elite universities increased pressure on early-career scholars (Lin et al., 2024). In response, many Chinese universities have adopted more competitive employment models, including the cancellation of guaranteed faculty staffing and the implementation of "up or out" systems modeled on the Western tenure-track framework (Lianmei & Lin, 2021). While these policies aim to enhance academic productivity, they often do so at the expense of job security, fostering a high-pressure environment where success is increasingly measured by research output (Gao & Li, 2020; Wang & Jones, 2021; Yang et al., 2024).

The return and reintegration of internationally educated scholars into their home academic systems are complex processes influenced by multiple factors. As Mawer (2016) and Enkhtur (2019) suggest, the extent to which returnees can apply their overseas-acquired knowledge and skills depends not only on the depth and quality of their learning abroad but also on the broader political and economic conditions of their home country (Campbell, 2016). Additionally, employment opportunities and institutional work environments play a crucial role in shaping their reintegration experiences (Perna et al., 2014; Vanichakorn, 2006). Within academia, the nature of teaching and research roles provides comparatively more opportunities for returnees to utilize their skills and contribute meaningfully to institutional development (Mawer, 2018).

METHODOLOGY

This study employed an explanatory sequential mixed-methods design to investigate the impact of Japanese study abroad experiences on Chinese researchers in STEM (Science, Technology, Engineering, and Mathematics) fields. The research aimed to evaluate how knowledge and skills acquired abroad influence returnees' contributions to their home institutions and broader society. In doing so, the study addressed a critical gap in assessing the effectiveness of international education in developing countries.

To guide this evaluation, the study adopted Kirkpatrick's four-level evaluation model, as adapted by the Institute of International Education (Martel, 2018), which allows for the analysis of outcomes across individual, organizational, and societal levels. This model provided a conceptual framework for both data collection and interpretation, contributing to the development of tailored evaluation metrics with potential utility for policymakers and educators (Campbell, 2016; Footitt, 2014; Perna et al., 2017).

Our research explored several interrelated questions, including how the knowledge and skills acquired during study abroad in Japan influence the professional trajectories of STEM researchers from China, what factors facilitate or hinder the effective application of these skills within their home institutions, how returnees contribute to research, innovation, and curriculum development in Chinese higher education institutions, and what is the broader societal impact of these contributions. We placed particular focus on investigating their roles in education, research, and technological innovation that generate significant societal benefits.

Table 1

Kirkpatrick's model of education and training outcomes

Levels of impact	Kirkpatrick's five levels	Description
Individual	Reaction	Goals for participating in the program, satisfaction, challenges, and support during study in Japan
	Learning	Acquiring research, professional skills, technical & theoretical knowledge, building social networks
	Application	Post-graduation trajectory to academia, applying knowledge, skills, and attitudes to workplace
Organizational	Organizational results	Actions and initiatives in academia: Research and innovation, teaching and sharing knowledge, curriculum development
Society	External results	Concrete actions and behaviors to make a wider difference in the community

Note. Adapted by Institute of International Education (Martel, 2018)

Data Collection

The study first conducted a survey targeting Chinese STEM researchers who had studied in Japan, ensuring diversity in disciplinary background, geographic location, and years since return. The survey instrument consisted of 18 closed-ended items and 8 open-ended questions, designed to capture both measurable indicators and qualitative insights regarding participants' experiences and perceived impacts. A total of 41 responses were collected. We invited all respondents to give a more detailed interviews, and 17 participants agreed to provide an interview. In this study, we focus on and report the findings from these semi-structured interviews, drawing on the phenomenological research method (Schutz, 1972). The interviews, conducted in Chinese, lasted approximately one to two hours each and explored their learning experience in Japan, their path to China, their employment at Chinese higher education institutions, and how they utilize their skills and knowledge, and the impact of these contributions in the home universities, aligning with the Kirkpatrick-based framework. The interview provided rich insights into the long-term influence of study abroad on individual careers, institutional practices, and national development.

Data Analysis

The overall study employed a mixed-methods approach to generate empirical evidence on the individual and collective impacts of international education and to propose practical evaluation metrics for future program design and policy development, whereas this paper focuses on and reports the findings from the semi-structured interviews.

Quantitative survey data were analyzed using SPSS. Descriptive statistics summarized participants' profiles and responses, while inferential analyses included the Mann-Whitney U test to compare group differences and linear regression to examine relationships among variables.

For the qualitative component highlighted in this paper, all interview data were transcribed into text and imported to NVivo software. A phenomenological thematic coding process was applied, involving the identification of recurring patterns, categorization of data, and development of themes. The respondents were all engaged in academic or research activities in their home universities (see Table 2).

Among them, 70.5% were employed as full-time faculty members, while 23.5% worked as full-time researchers. In terms of prior work experience, 5.9% had previous work experience. This suggests that for over 90% of participants, their overseas education in Japan served as a crucial starting point for their academic careers, highlighting the foundational role of international study in shaping their professional trajectories.

Table 2

Demographics of interview participants

	Interview** participants: n=**17	
Gender	**n**	**%**
Female	1	6
Male	16	94.1
Age		
31-35	8	47
36-40	2	11.7
41-45	5	29.4
46-50	0	
51 and above	2	11.7
Graduated in		
2021-2023 (within 2 years)	3	17.6
2018-2020 (3-5 years ago)	3	17.6
2014-2017 (6-9 years ago)	3	17.6
Before 2013 (10+ years ago)	8	47
Degree		
Master's	1	0.06
PhD	10	58.8
Postdoc	6	35.2
Current job position		
Full-time faculty member	12	70.5
Full-time researcher	4	23.5
Worked at HEI before studying in Japan		
Yes	1	5.9
No	16	94.1

FINDINGS

The Factors Influencing Graduates' Impact on Their Home Institutions

Graduates returning to their home institutions after studying in Japan often follow diverse post-graduation trajectories, including securing postdoctoral positions or academic roles either in Japan or other countries such as the UK, Singapore, and Australia before ultimately returning home. This varied experience contributes to a competitive advantage in the job market and enriches their academic and professional perspectives.

Upon returning, many graduates actively apply the knowledge, skills, and attitudes acquired in Japan to the laboratories and research environments of their home institutions. They implement Japanese-style lab structures and operations, which tend to be more standardized and pragmatic compared to local practices. Although these standards may initially seem cumbersome, they ultimately improve efficiency and help filter out unsuitable experimental plans. Similarly, attention to lab safety learned in Japan emphasizes prevention from the root cause. Moreover, some graduates have introduced

specific management mechanisms from their Japanese experience, such as the implementation of "6S laboratory construction", which has been adopted by their institutions.

"The laboratory management and operation are indeed different from China. They are more standardized, which might seem troublesome for those applying or conducting experiments, but in the long run, it's more efficient and filters out unsuitable experimental plans." (Full-time researcher, Lasers)

"Regarding lab safety… In Japan, prevention starts from the root." (Associate Professor, Grain and Oil processing)

"In my workplace, I applied the management mechanism from Japan. (Researcher, Information Technology)

When I first came here, I made a suggestion to the college, and now it has been adopted, called 6S laboratory construction." (Professor, Chemistry)

Closely related to this is the transfer of Japanese-style supervision methods to home country institutions. Graduates often adopt Japanese-style supervision and teaching methods when they return to their home institutions. The patient, problem-solving-oriented guidance they observed in Japan significantly shapes their mentoring approach, which many believe leads to improved student learning and more effective training. This style emphasizes patience in explaining concepts and working collaboratively with students to solve practical problems. Even those who had little prior teaching experience feel confident, supported by their strong professional knowledge and deep understanding in their fields.

"The way teachers at the laser institute guided students and handled problems has greatly helped me. I'm now using similar methods to train students, and I believe they're learning a lot and being well-trained." (Full-time researcher, Lasers)

"My experience as a student abroad taught me a lot. I've actually adopted many of the teaching methods of foreign teachers, especially being patient in explaining and solving problems together with students, teaching them how to solve practical problems." (Associate Professor, Joining and Welding Science)

"Even though I hadn't taught before, having professional knowledge ensures you can teach well. Broad knowledge, deep understanding, so it's definitely a big help." (Professor, Metallurgy)

The development of an awareness of applied research and innovation is another notable impact. Graduates often report that their experiences in Japan shaped their understanding of patenting, technology transfer, and the broader implications of research commercialization.

"I had two patents in Japan. After returning to Beijing University of Science and Technology in these eight years, I've been granted at least thirty or more patents, forming a group…We've won a lot of provincial awards recently. And many are now industrialized, in use. The awareness of applying for patents, etc., was learned abroad." (Professor, Metallurgy)

Industry collaboration also figures prominently in graduates' work after returning. Experiences with industry-academia-research projects in Japan cultivate a clear understanding of industry needs and research capabilities, fostering ongoing partnerships. This approach to integration continues to influence their home institutions.

"When I was in Japan, most of the work that my mentor assigned to me was a kind of industry-academia-research work. So today, we have a very clear understanding of the needs of companies and our own research and development capabilities." (Associate Professor, Engineering)

"The impression left by studying in Japan is the integration of industry, academia, and research…this thing I was deeply impressed with in Japan, and now I'm still working on industry-academia-research." (Professor, Metallurgy)

Graduates frequently serve as bridges for institutional collaboration and international exchange. Their experience abroad positions them to initiate and sustain cooperative relationships between their home institutions and foreign partners, especially Japan.

"Future cooperation will be smoother. There might be other collaborations….(acting as a bridge for more cooperation) is a very important process. Without going out and coming back, it's impossible to break that wall." (Associate Professor, Joining and Welding Science)

"Especially in terms of international exchanges, studying in Japan provides a lot of conveniences." (Researcher, Information Technology)

In some cases, graduates' experiences also contribute to broader societal engagement, like knowledge sharing. Their international education experience equips them with insights and practices that they apply in outreach projects related to community health, safety, and education.

"We've worked with communities and affiliated schools on nutrition, health, and safety outreach." (Associate Professor, Grain and Oil processing)

Challenges remaining

Challenges remain for many returnees in re-establishing their academic careers, particularly around the timing of their return. Opportunities tend to be more favorable before the age of 40, especially around 35, due to eligibility for programs like the "Thousand Talents Program (TTP)" which target younger scholars. Age restrictions pose a significant hurdle; many talent recruitment and research grant programs are limited to

applicants below a certain age, making it difficult for those who spent extended periods abroad to qualify once they return.

"The common term in China for accumulating titles is "Wearing hats". There are many programs in China, such as Outstanding Youth, Distinguished Young Scholars…etc." (Associate Professor, Joining and Welding Science)

"There are age limits. If you're over forty, they probably won't want you anymore." (Professor, Metallurgy)

"A lot of things are age-restricted in China, and when I returned to China, because I stayed abroad for too long, there are a lot of things that can't be declared due to the age restriction." (Professor, Chemistry)

In addition to age-related constraints, many returnees struggle to reintegrate into domestic academic networks and adapt to the local research environment. The highly competitive "Up or Out" system, which emphasizes rapid publication and career advancement, often places returnees at a disadvantage. They may face misalignment with domestic expectations and metrics, particularly when returning from academic cultures that prioritize thoroughness over speed.

"Despite calls to break away from the "four onlys" (only papers, only degrees, only titles, only awards), the situation is getting worse, focusing only on impact factors. Those of us who returned from Japan are at a particular disadvantage under this evaluation system…We wait until our work is perfect before publishing, while others rush to publish flawed work." (Associate Professor, Grain and Oil processing)

Moreover, building or rebuilding professional relationships poses a serious challenge. Domestic academic circles are often tightly knit, with PhDs from local institutions forming exclusive networks. Returnees educated in Japan sometimes find themselves doubly disadvantaged—lacking both the language familiarity of Europe- or US-educated scholars and the local academic ties necessary to navigate institutional cultures and social dynamics.

"Domestic PhDs form their own circles. Those educated in Europe or America at least have a language advantage, but those of us from Japan miss out on both sides." (Associate Professor, Grain and Oil processing)

"The real difficulty is interpersonal relationships. Interpersonal relationships abroad are relatively light, while domestic ones are more intense, so our painful things are here. I'm not a graduate from here, so I also face exclusion." (Professor, Metallurgy)

"We lacked the experience of networking with our colleagues who developed locally. We have to make up for that slowly. This is true everywhere in China, the importance of relationships is unquestionable." (Associate Professor, Engineering)

A further complication arises from the increasingly politicized landscape of global science. Political tensions can restrict academic exchanges and collaborations,

undermining the notion of science as a universally shared endeavor. For example, Professor of Metallurgy said, *"It used to be said that science has no borders, now science has boundaries."*

The impact that graduates have on their home institutions is shaped by a complex interplay of individual, institutional, and national factors. At the individual level, faculty members' research skills, academic knowledge, and teaching experience play a critical role. These competencies enable them to introduce new teaching methods, develop innovative curricula, and contribute to the academic advancement of their institutions. Furthermore, experience in applied research and involvement in global academic networks enhance their ability to initiate collaborative projects and incorporate international standards into domestic educational practices.

Institutional and national contexts also significantly influence the effectiveness of graduates' contributions. Supportive national policies and institutional frameworks, along with a conducive working environment, can amplify the faculty's ability to apply their skills and knowledge. Access to domestic academic networks allows for broader dissemination and implementation of their expertise within the national academic community.

At their current institutions, graduates contribute through knowledge transfer and the integration of new teaching and research methodologies, directly improving educational and research capacities. Their involvement in international and industry collaborations, as well as societal engagement, extends their institution's global reach and relevance. Overall, the synergy between personal expertise, institutional backing, and broader policy contexts determines the degree to which graduates can make a meaningful and sustained impact on their home institutions.

DISCUSSION AND CONCLUSION

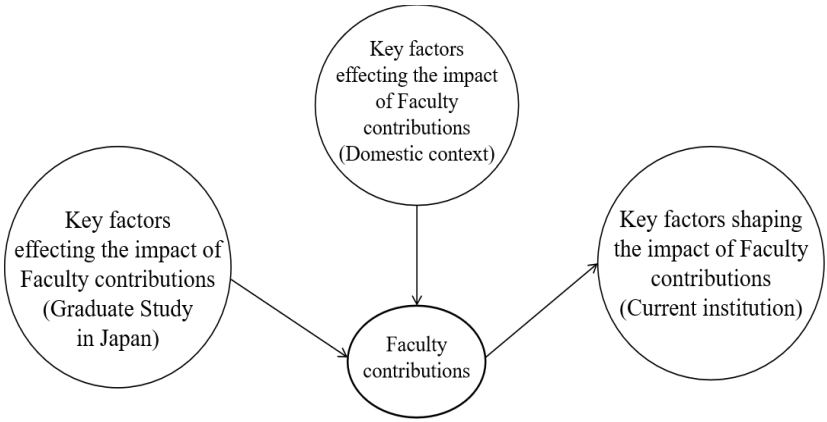
The impact that graduates, particularly faculty with overseas training, have on their home institutions is shaped by a complex interplay of factors at the individual, institutional, and external levels (Enkhtur et al., 2025). These individuals often serve as key agents of change, contributing significantly to research productivity, curriculum development, laboratory management, and the establishment of international collaborations. Their efforts not only elevate academic standards but also enhance their university’s visibility and engagement on a global scale.

However, the degree of impact is influenced by national and institutional conditions (Campbel, 2016). In this study, we also found that national policies, including those related to faculty employment and mobility, played a critical role in determining the long-term stability and effectiveness of returning faculty. At the institutional level, the presence of supportive structures—such as clear tenure paths, adequate funding, and opportunities for interdisciplinary and international collaboration—greatly facilitated faculty contributions.

Despite their potential, returnees often face considerable challenges. These include difficulties in reintegrating into domestic academic networks and adjusting to the working environment at their home institutions. Such barriers can hinder their ability to fully utilize their international experience and limit their broader institutional impact.

Figure 1

Key factors effecting/shaping the impact of Faculty contributions



Limitations

Although qualitative interviews provided valuable insights into the experiences and impact of returnees, several limitations of this study should be acknowledged. First, the relatively small sample size of the interviews may not fully represent the diversity of perspectives across institutions and disciplines. Second, as the research employed a cross-sectional design, it does not capture long-term career trajectories or institutional changes that may unfold over time. Future research could address these limitations by drawing on larger and more diverse samples, extending the scope to additional disciplinary contexts, and using long-term or follow-up studies to better trace returnees' evolving roles and impacts.

Conclusion

Returnees play a crucial role in enhancing the academic and research standards of their home institutions. Their influence is evident in the improvement of laboratory conditions, the quality of graduate education, and the advancement of research output. By introducing Japanese-style supervision methods and fostering international academic partnerships, returnees not only contribute to institutional development but also enhance their universities' global visibility and reputation. Their involvement extends beyond academia, as seen in their contributions to patent development and technological innovation, underscoring their broader impact on society.

Despite these contributions, returnees face persistent challenges. These include frequent administrative evaluations, constrained research time, and the political sensitivities surrounding international academic exchanges. Additionally, social dynamics and networks within the academic community often influence the successful implementation of new initiatives, sometimes limiting the effectiveness of returnees' contributions.

While previous studies, such as Meng et al. (2024), emphasized the role of university prestige and rankings in academic job placement in China, this study highlights the importance of graduates' academic networks and learning experiences. For international students in Japan, particularly those aiming for careers in China, practical experience, such as internships or industry engagement during their studies, positively impacts career development and job-hunting outcomes.

Given China's rapidly evolving STEM job market, further research is needed to explore the transition of Ph.D. graduates between academia and industry. To support this transition and fully leverage returnees' international training, Chinese universities should develop structured integration programs. Such programs can ensure that the returnees' global perspectives and expertise are effectively applied in research, teaching, and curriculum reform.

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