

Navigating educational trajectories and transitions: A qualitative systematic literature review on international STEM doctoral students

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RESEARCH ARTICLE

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ABSTRACT

To date, much of the research on international science, technology, engineering, and mathematics (STEM) doctoral students has focused either on international academic mobility or on students' acculturation and adjustment challenges and coping mechanisms in foreign academic contexts. In comparison, very little attention has been paid to Asian doctoral students and their personal experiences from a life course perspective.

Based on a qualitative literature review, this article sheds light on the experiences of Asian doctoral students in STEM (science, technology, engineering, and mathematics) disciplines within a life-course theoretical approach, paying particular attention to their agency, socialisation, and educational trajectories and transitions. The process of migration/mobility and transition between academic institutions requires a reassessment of cognitive patterns, behaviours, learning mechanisms, and the exercise of agency and response. The findings highlight how the complex dynamics between agency, socialisation, cultural norms and values, economic factors, academic performance, and institutional parameters influence the educational trajectories and transitions of Asian STEM doctoral students abroad. The result contributes to a synthesis of research findings that could inform doctoral education policy.

KEYWORDS

international STEM Asian doctoral students, life course approach, agency, socialisation and educational trajectories and transitions, qualitative systematic literature review

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INTRODUCTION

The advancement of technological development over the last three decades has contributed to an increase in the number of students and fostered greater international academic mobility, especially among doctoral students. The Organisation for Economic Cooperation and Development (OECD) reported that only 1.3% of adults aged 25–64 in the thirty-eight OECD countries held a doctoral degree in 2021. While Germany reported a rate of 1%, the United States and Australia had a rate of 2%. Surprisingly, Slovenia had the highest rate among these countries, with a remarkable 5% of the adult population with a doctorate. In the context of knowledge societies and economies, countries such as the United States, Germany, France, Australia, and others rely heavily on innovation and talent development to maintain their global competitiveness. Although the structure of doctoral education has been critically examined, given that the introduction of simplified 'borrowing' of programmes from one country to another and efficiency-oriented assessment criteria leads to a homogenisation of higher education, which can have a negative impact on the quality and depth of research and learning (Nerad, 2020), several countries around the world have expanded their doctoral education in the last decade, recognising the potential of international doctoral students to drive innovation, research, and technological progress. Programmes and initiatives such as the European Research Area, the National Science Foundation in the USA, and government policies to increase the number of doctoral students in India, China, Singapore, Malaysia, and Thailand have been developed. However, the high number of doctoral students also means that there is strong competition for limited faculty positions (Bloch, 2018; Fernandes et al., 2020; Larson, Jarrett, Eckersberger, Smith, & Paterson, 2014) competition for research grants and funding, a lack of transparency in career outcomes and hiring practices, and in securing job offers (Williams & Ceci, 2015), and a certain failure to prepare graduates for non-academic post-PhD careers potentially posing major risks to their health and well-being (Wiesenthal, Gin, & Cooper, 2023; Zhang, Litson, & Feldon, 2022). Moreover, the high number of doctoral students raises also questions about the capacity of universities to offer good supervisory quality and individual mentoring (Schlosser & Kahn, 2007). From a macro perspective, the problem of brain drain (Commander, Kangasniemi, & Winters, 2003) is significant. Developing countries that mostly serve as sending countries, lose valuable expertise and talent, while host countries benefit from this brain migration (Khan, 2021; Tiechler, 2015). From an individual perspective, in today's globalised world, doctoral education trajectories and transitions are subject to a variety of different influences. These influences encompass a wide range of factors, from the pervasive impact of globalisation to contextual factors. Moreover, institutional factors such as the intricate design of higher education systems, higher education and migration policies, prevailing labour market conditions, career prospects and the permissibility of institutional structures also shape and determine the nature of these trajectories and transitions. Roberts (2009) notes that (doctoral) education decisions and agency are significantly influenced by contextual and institutional factors. The successful completion of a doctoral degree is dependent on the doctoral students' agency and readiness to invest considerable amounts of time, financial, social, and emotional resources.

Numerous studies have underlined the importance of contextual factors such as social background (Kwak & Kim, 2015; Vu & Tran, 2022), gender (Welde & Laursen, 2011), ethnicity (Lam & Curinga, 2020; Welde & Laursen, 2011; Whittaker & Montgomery, 2021) and language proficiency (Chang, 2020; Nishida, 2019; Sun, 2019; Yan & Berliner, 2013). Institutional factors,



including the level of degree aspired (Du, 2015; OECD, 2022), the field of study (Bhandari, 2019; Lingyu, Wenqin, & Kai, 2022), and the availability of social support (Lamothe et al., 1995; Tao et al., 2000; Thomas, 2002), exert a significant influence on the decision to study for a doctorate abroad. Nevertheless, studies addressing international doctoral students' agency from a life course perspective in STEM fields are scarce. This target group is increasingly coming into focus as numerous studies (Goel & Göktepe-Hultén, 2021; Teichler, 2015), have provided evidence of the positive impact that foreign researchers and international mobile scientists, particularly in science, technology, engineering, and mathematics (STEM) subjects, have on the development of innovation and economic growth. Especially for countries like Germany, the number of international students at German universities has almost doubled, from around 180,000 international students in 2000/2001 to almost 350,000 in 2020/2021 (Destatis, 2022a, 2022b). With a share of 31%, Asia and the Pacific are the most important region of origin for international students, who are primarily concentrated in STEM disciplines. Since 2006, the number of Indian students in Germany has almost quadrupled, so China and India now occupy the first two places in the ranking of foreign students in Germany with 60,000 students.

Germany has recently become the fourth most attractive country for international students, after the USA, the UK, and Australia (Destatis, 2022a, 2022b). Most of the existing literature on international doctoral students from Asia focuses on English-speaking countries with a longer tradition of attracting international students, such as the US, the UK, New Zealand, Canada, and Australia. However, there is a lack of literature examining the perspectives of Asian STEM doctoral students in Germany. This research aims to fill this gap by providing valuable insights from studies conducted in Germany that complement existing research from Asian countries (such as China, South Korea, India, and Japan) and European countries (such as France, Spain, and the Netherlands). The findings of this study will provide valuable insights into the challenges faced by international doctoral students during their education and doctoral trajectories and transitions within expanding international and mobility programmes. To achieve this, the study will primarily use qualitative literature reviews conducted by the doctoral students themselves.

After this introduction, a concise overview of the importance of STEM education will be provided, followed by a theoretical outline of the life course (Elder, 1994; Wingers, de Valk, Windzio, & Aybek, 2011). The subsequent methodological section explains the aim of the literature review, outlines the research questions, and describes the rigorous process of article selection and identification. The results section presents the findings of the literature review, organised thematically to highlight the key findings from the literature. In addition, the limitations of this work are pointed out and recommendations for future research are given. The concluding section summarises the key findings and emphasizes the importance of supporting the target group in its academic endeavour.

STEM EDUCATION

A growing body of STEM research and research literature has been noted in recent years, as demand from global markets for STEM professionals has led governments worldwide to prioritize and drive policies that promote STEM education (over other forms of education), research, and industry. Public spending on education has increased in recent years, for example in



Germany by 3.3% in 2021 (Destatis, 2022a, 2022b), including €19.2 billion for university research and development (p. 20). In addition, new English-language PhD degree programs are being created. In Germany alone, 208 doctorates in STEM subjects were available at German universities, universities of applied sciences, and non-university research institutes such as Max Planck, Fraunhofer, Leibniz, and Helmholtz institutes in the winter semester of 2022/2023 (DAAD, 2023). However, it should be noted that this shift in education from a holistic perspective to a more utilitarian educational trajectory emphasising investment in skills and educational qualifications which are directly applicable to the labour market, including a strong emphasis on STEM subjects, raises concerns and has been critically discussed (Apple, 2000; Biesta, 2010; Sahlberg, 2018).

Systematic literature reviews on STEM are fragmented and scattered across different disciplines, including education, migration, sociology, psychology, medicine, and other fields. These reviews address different aspects of STEM education and science, thereby adding to a rich understanding of the field. For example, some systematic reviews focus on significant empirical studies in STEM education and mainly describe trends and offer recommendations on teaching practices, quality assessment, and methods (Li, Wang, Xiao, & Froyd, 2020a, 2022). Other literature reviews deal with the evolution and development of science in STEM. They investigate key theoretical frameworks and identify emerging trends and research questions (Chomphuphra, Chaipidech, & Yuenyong, 2019). This study is suitable for researchers and practitioners who want to understand the development and future of STEM education. Furthermore, there are systematic reviews that explore the concept of individual STEM identity and its impact on STEM education and careers. These reviews focus on factors that influence the development of STEM identity, its relationship to academic achievement and career choice, and strategies to promote positive STEM identity in students (Simpson & Bouhafa, 2020). In addition, the review study done by Tytler (2020) has a broader focus and deals with science as a whole. The current state of research on STEM, literature gaps, and future trends in STEM are also explored. Overall, these literature reviews bring new key findings from a multidisciplinary perspective and stress future research directions.

INTERNATIONAL (ASIAN STEM) DOCTORAL STUDENTS AND AGENCY FROM A LIFE COURSE APPROACH

The traditional purpose of a doctoral degree is to prepare doctoral students to become professional researchers and independent scholars. Nevertheless, doctoral students differ in their demographics from undergraduate and graduate students. Their doctoral experiences are primarily shaped by financial obligations (such as supporting their independent lives, children and family, and tuition); their reliance on relationships with faculty, such as supervisors and colleagues; and filling multiple and often conflicting roles, such as being a doctoral student while having teaching, advising, and research obligations. Being an international doctoral student introduces new dimensions of vulnerability resulting from even greater financial obligation, mostly due to tuition fees and immigration costs, greater dependence on faculty relationships, and acculturation and adjustment issues that require developing greater resilience mechanisms.



As an approach, the life course is a multilevel phenomenon "ranging from structured pathways through social institutions and organisations to social trajectories of individuals and their developmental trajectories", with issues of lives and historical times, linked lives and human agency identifying "key mechanisms through which environmental changes and trajectories influence the course and substance of human life" (Elder, 1994: 5). In other words, life course theory is fundamentally concerned with individual biography, structural context and historical time. However, no life stage can be understood in isolation from people's earlier personal and professional experiences, as well as from the social, legal, and institutional context. These multiple roles and parallel paths that a person passes through in the course of his or her life are best exemplified by periods of educational transitions, unemployment, transitions from school to work, and migration processes, which are often accompanied by sudden changes in social, occupational and family life histories. Therefore, the central idea of the life course approach is that the micro-level of individuals' life with their timing, pacing, and sequencing of life events is interconnected with the complex dynamics of social structures and institutions at both the meso- and macro levels. As such, agency refers in general to the inherent capacity to make choices and act, but also the resources or characteristics of a person that come into play when acting. The agency is also associated with individualisation and responsibility for one's success and failure. Moreover, "individuals construct their life courses as self-monitored agents. By evaluating structural opportunities and institutional constraints, they pursue their own goals and biographical plans" (Wingens et al., 2011). Since the agency is crucial in the life course, it also implies certain competencies and skills that are necessary to master one's life, which is derived from individual characteristics, socioeconomic position, and education, as well as through the network in which one is involved. The vulnerability of international doctoral students possibly stems from the fact that one's agency and skills that exist in the home country do not always transfer to the new host country, as structures, institutions, and mentalities differ. Furthermore, doctoral students often face precarious conditions due to insecure contracts, low remuneration, and limited legal protections for temporary workers. Additionally, they may experience a sense of invisibility within their academic community (Bozzon, Murgia, & Poggio, 2019; Deem, 2022). Like Bloch (2018) state this precarity is due to an overproduction of PhDs. On the other hand, Deuchar (2022) and Heng (2020) point out that studies that focus on the "experiences" of international students tend to focus on what happens to them in higher education rather than how they actively shape these institutions. Focusing on their "experiences" consequently frequently underplays their agency and solidifies their understanding as a passive group.

METHODOLOGY

A qualitative systematic review was employed, as it is the most common approach that uses repeatable methods to find, select, and synthesize available evidence and identify literature gaps (Bearman & Dawson, 2013). Moreover, a systematic research approach was employed to ensure transparency and accuracy in reporting the search process and selecting relevant articles. The guidelines of the PRISMA statement (Moher, Liberati, Tetzlaff, Altman, & PRISMA Group, 2009) were followed, which provides an optimal approach for generating a comprehensive overview of the available evidence and identifying gaps in the literature. This method is particularly useful for decision-making processes. Therefore, I apply systematic review techniques and



adhere to the guidelines outlined in Fig. 1 of the PRISMA statement (Moher et al., 2009) to ensure transparency and rigour in reporting the search process and selecting relevant articles.

Aim

The overarching goal of this study is to contribute to the literature gap on international Asian STEM doctoral students abroad. Currently, no known literature reviews exist on this research combination. The existing literature reviews primarily address international academic mobility

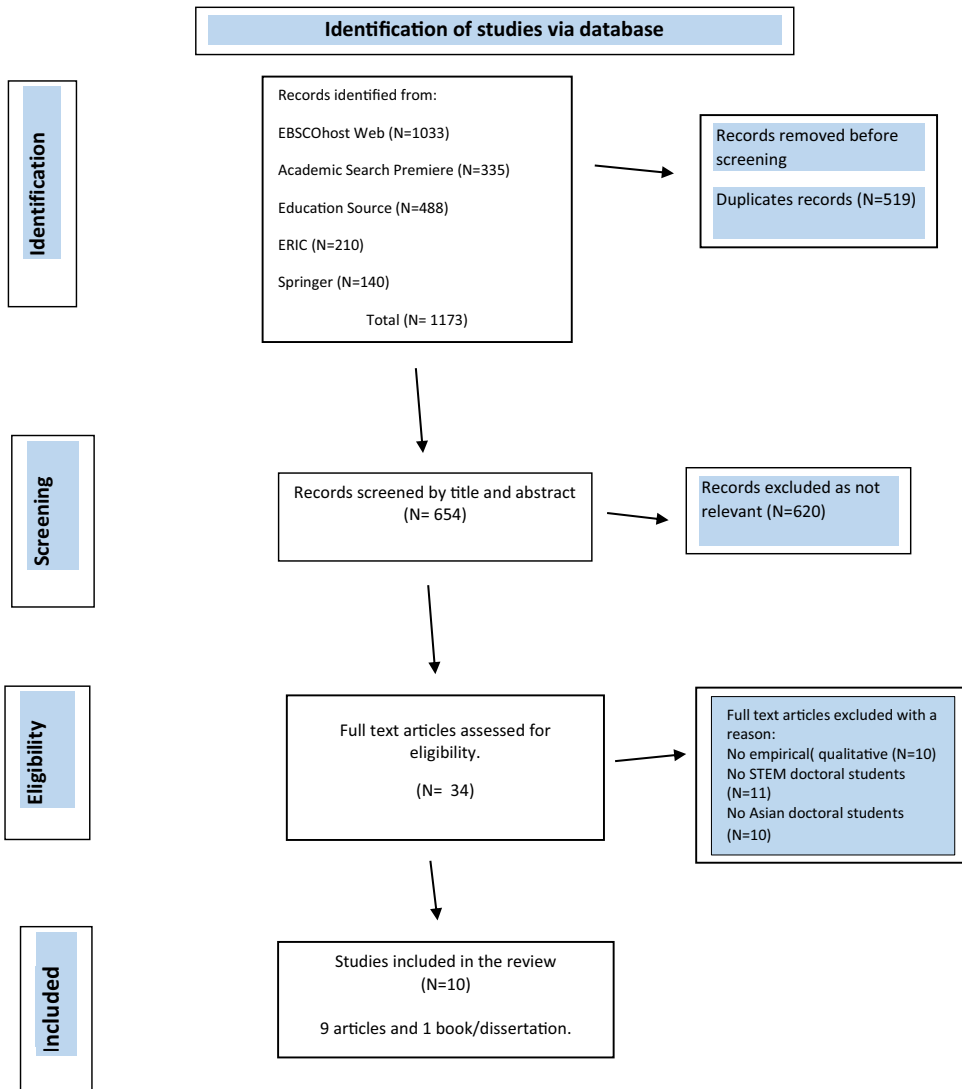


Fig. 1. PRIMA flow diagram screening process (Moher et al., 2009)



of (doctoral) students, STEM education, higher education, or institutional contexts and personal challenges. In this study, I aim to analyse aspects of agency and educational trajectories and transitions from a life course perspective (Elder, 1994; Wingens et al., 2011), through the lens of Asian doctoral students themselves and how they perceive their entry into a foreign academic context. The expansion of formal education and the acquisition of educational credentials within foreign higher educational institutions means not only dealing with new institutional characteristics but also navigating the complex dynamics and tensions that arise from positioning oneself in these unfamiliar education settings. The educational self cannot be viewed in isolation, as it is intertwined with societal and global events and other institutional roles. However, during the doctoral journey, the educational self is compelled (even more than during other educational trajectories) to continuously strive for self-improvement or development. The doctoral students are thus “entrepreneurs of the self” (Du Gay, 1996). In this context, the timing and effective leveraging of the agency during the doctoral process is critical. Doctoral students need to understand and navigate the complex dynamics of academia, using agency to actively shape their educational journey. By quickly learning how these dynamics work and strategically positioning themselves in academia, doctoral students can achieve personal growth and development.

Research questions

The aim of this article is two-fold: firstly, to examine the agency of international Asian STEM doctoral students about their educational trajectories and transitions, and secondly, to highlight qualitative research studies conducted in Germany on this group, which has previously been overlooked. Germany is the fourth most popular destination country for a PhD worldwide, and the qualitative research conducted in this country should also be reflected in the current literature reviews. STEM subjects were chosen as the field of study because doctorates in this field are the most prevalent, and engineering and science professionals are in high demand worldwide (see Immigration Acts addressing this target group worldwide). This paper is a literature review that serves as a background for ongoing empirical research on international Asian STEM doctoral students in Germany and their motivation to pursue doctoral studies at German higher education institutions (HEIs). To address this research aims, the following broad questions are posed: How do international STEM Asian doctoral students perceive their educational transition to a new academic context? And to what extent are they able to navigate the complex dynamics and tensions that arise from their positioning in these unfamiliar education settings?

This study uses qualitative research, ideally conducted by doctoral students themselves to understand the perspective of international Asian STEM doctoral students regarding their doctoral trajectories in universities both globally and specifically in Germany. I will also investigate whether there are any variations in how individuals perceive the doctoral process within these settings.

Articles identification and selection

Database searches began with a comprehensive and qualitative systematic review of international STEM doctoral students. Table 1 summarizes the protocol used during this step and includes the critical evaluation of publications related to my topic. The theoretical approach and its categories were not considered in this step. The period analysed is 2010–2022. The search included three semantic blocks of terms: (international doctoral students or phd students or



Table 1. Protocol for the first identification of the articles potentially relevant for a qualitative literature review

Period of study	2010–2022
Type of documents and journals	Full length articles, peer reviewed Original research articles Indexed in EBSCOhost Web, Academic Search Premiere, Education Source, ERIC and SpringerLink
Source types	Academic journals
Subject	Higher Education/Universities and Colleges
Language	English
First identification of potentially relevant articles	Keyword search in EBSCOhost Web, Academic Search Premiere, Education Source, ERIC and Springer (December 2022, January/February 2023) Title/abstract/keywords list: international Asian doctoral students or phd students or research students/doctoral students or phd students or research students literature review/experience/perception science, technology, engineering, and mathematics/STEM/engineering/science/physics/mathematics/technology international doctoral students or phd students or research students/doctoral students or phd students or research students Asia* or Asian or from Asia science, technology, engineering, and mathematics/STEM/engineering/science/physics/mathematics/technology international Asian doctoral students or phd students or research students/doctoral students or phd students or research students agency or life course theory or educational trajectory science, technology, engineering, and mathematics/STEM/engineering/science/physics/mathematics/technology

Protocol for articles identification, selection, and analysis.

Phase 1.1 First identification of the articles potentially relevant for the research: International doctoral students abroad

Phase 1.2 Period of study: 2010–2022. The starting year is the first year when Germany actively engaged in attracting IT professionals from India. The end of the period is set for 2022, as most articles published in 2022 have already been submitted to journals, reviewed, accepted and published.

Phase 1.3. Type of research: peer-reviewed full-length articles published in indexed academic journals. The peer-review brings a dimension of “objectivity” and “reliability” that gives a journal a certain quality.

Phase 1.4. Databases: EBSCOhost Web, Academic Search Premiere, Education Source, ERIC and SpringerLink. These data bases are the most common one used by our university and the access is granted for free due to the licence.

Phase 1.5. Language: English, as it is seen as the “lingua franca” in international higher education context and most common used in international journals.

Phase 1.6. identification of the first relevant articles for this study. The keyword search was performed from December 2022 to January/February 2023, and I was looking for all the articles including in their title, abstract, or keywords list the word international doctoral students/PhDs/Research students, qualitative study and science, technology, engineering, and mathematics/STEM/engineering/science/physics/mathematics/technology. Extending the search afterwards to specific life course approach as to agency or life course theory or educational trajectory



research students/doctoral students or phd students or research students) AND (science, technology, engineering, and mathematics/STEM/engineering/science/physics/mathematics/technology) AND (literature review/experience/perception).

More than 500 potentially relevant abstracts were read, interpreted, and carefully selected to be included in this step. In the second step, I selected only the studies that employed qualitative methods and addressed the target group AND Asia*/Asian/Chinese/Indian and elements from the life course approach AND Agency/Transitions/Educational. After excluding the studies that were not relevant to my research, a total number of nine peer-review journal articles and one dissertation published between 2010 and 2021 focusing on the experiences of STEM Asian doctoral students were identified (see [Annex 1](#)).

Inclusion and exclusion criteria

Studies had to meet the following criteria to be included in the study: (a) peer-reviewed; (b) from the last 12 years; (c) written in English; (d) empirical-qualitative; (e) with Asian STEM PhD students among the participants; and (f) collect accounts on participants' experiences during their foreign doctoral programmes. I have excluded studies that deal with doctoral fields other than STEM subjects, as their characteristics differ significantly. In addition, I discarded studies that did not collect first-person narratives (here was not always easy to tell if the authors were doctoral students or not) and studies focused on the general STEM population, where the nationality of the respondents was not clear enough.

IDENTIFICATION OF RELEVANT QUALITATIVE LITERATURE AND ARTICLES

In the following section, an overview of the studies conducted on Asian STEM doctoral students over the last 12 years is provided. These findings apply to the context of higher education both globally and in Germany and are analysed thematically. Ten articles could be included in this review, as seen in [Annex 1](#). Except for one study conducted in Finland, all studies were from Germany, the USA, Canada, and Australia and dealt mainly with Chinese doctoral students and focused mainly on education. Most studies used a qualitative approach (9), while one study used a mixed method. The most common themes were the overall doctoral experience, and the interaction with the supervisors and faculty members, while other themes referred to the influence of parents and peers, as well as their motivation to do a PhD abroad and the support received.

NAVIGATING DOCTORAL TRAJECTORIES ABROAD: FACTORS INFLUENCING INTERNATIONAL ASIAN STEM STUDENTS' EDUCATIONAL TRANSITIONS

Doctoral trajectories and educational transitions are mostly shaped by personal, economic, and social factors. The opportunities mostly arise either from the cooperation between the home and host countries or from PhDs' desire for academic achievements that subsequently distinguish them on the labour market.

As [Marginson \(2016\)](#) has noted, "education is a positional good subject to an absolute scarcity of high-quality opportunities" (p. 430). This means that international mobility has



opened up new opportunities for students regardless of their social background. [Yang, Volet, and Mansfield \(2018\)](#) study of Chinese STEM doctoral students found that one-third of the participants came from low socioeconomic rural backgrounds and in some cases had illiterate parents. However, their parents' unconditional support for a PhD abroad boosted their self-confidence. The progress of the PhD was positively influenced by both the home and host supervisors, which can be attributed to the long-term research collaboration between the home and host institutions.

The doctoral process is associated with the expectation of personal and professional development, and their satisfaction stems from the doctoral project itself and from the fact that sufficient project funding is secured by the host supervisors before the start of the doctorate. In the study by [Lee, McMahon, and Watson \(2018\)](#) on the career decisions of international Chinese PhD students, all participants went through a self-discovery process to understand their inherent characteristics such as personality, interest, aptitude, and attitude. In terms of personality, working independently, being motivated by the research topic, and research interest were named as motivators for the doctoral journey. In terms of attitude, inquisitive nature and exploration of the world around them were named. In terms of post-doctoral plans, innate characteristics such as aptitude, interest, an exploratory attitude, and working abroad were similarly influential.

The findings of this study are consistent with [Zhou's \(2015\)](#) qualitative research, which discovered that international doctoral students were motivated to pursue and complete their studies in the U.S. based on four factors, despite the obstacles they encountered. These factors included intrinsic interest in research, intrinsic interest in teaching, the high utility value of a U.S. doctoral degree, and the significant emotional and social costs associated with dropping out. In contrast to [Yang et al. \(2018\)](#) study, most research indicates that students often face challenges in their relationships with their supervisors. These difficulties are primarily caused by mismatched expectations and the supervisors' personal needs, as found by [Zhou \(2015\)](#). Another study by [Zhang, O'Shea, and Mou \(2021\)](#), which examined the decisions and motivations of international doctoral students to pursue a PhD in Canada using a push-pull model, found that the decision to go to Canada was influenced at the individual level by academic interest and characteristics such as passion and personal research interest. Some students were attracted to particular lecturers, not only because of their common academic interests but also because of their particular approaches to research and scholarship. Moreover, their educational trajectories were also shaped by their aspirations, searching for challenging new life experiences and breaking the status quo. [Choi, Nieminen, and Townson \(2012\)](#) discovered that the reputation of supervisors as a pull mechanism was observed among international PhD students in physics studying in Australia. The reputation of a well-known research group or research leader was critical in the PhD's choice of PhD destination, rather than the destination itself. Conversely, the unavailability or perceived weakness of research opportunities in their home countries acted as push factors.

In his article, [Bilecen \(2013\)](#) defines international doctoral students as cosmopolitans whose identification is co-constructed as a combination of their own identity and that of other international doctoral students. Dichotomies such as "we" and "they, the Germans" are used to create new 'differently centred worlds'. In general, research on international students from Asia often uses generalisations describing them as uncritical, passive, obedient, incapable of analysis and argumentation, and even incapable because they are "Asian" ([Samuelowicz, 1987](#)). In the



interaction, their ‘otherness’ is reinforced although they see themselves as different. If in the pre-migration Chinese students are more dependent on mono-cultural networks, in the initial phase support is also received from university staff, team, and other German peers. This phase also coincides with the development of strategies to interact with their supervisor, by finding a balance between being too demanding and being passive (Wu, 2017). In summary, the doctoral trajectories and educational transitions of international Asian STEM students are influenced by personal, economic, and social factors. International mobility offers new opportunities for students, seemingly regardless of their social background. The (financial, social and emotional) support of parents, the cooperation between home and host institutions, and the influence of supervisors have a positive effect on doctoral students’ academic transitions. Factors such as personal and professional development, project funding, and intrinsic motivation add to students’ satisfaction and success. In addition, cultural values, societal expectations, and career prospects shape the decisions and experiences of Asian doctoral students.

NAVIGATING INDIVIDUAL AGENCY WITHIN SOCIAL STRUCTURES: EXAMINING EDUCATIONAL TRAJECTORIES

From a life course perspective (Elder, 1994), individual age and academic/professional and family roles are likely to influence the dynamics of educational and employment trajectories. This concept refers to embeddedness in social relationships and emphasizes the important role that other people’s lives play in shaping and influencing transitions and life courses over the course of one’s own life. Students are influenced by their parents in terms of activities, career orientation, and interests, and therefore develop a specific personality profile and behavioural repertoire (Holland, 1985; Rothland, 2014). Moreover, according to Huang and Gove (2012) (as cited by Lei, 2017), children’s education in China is a “family business” that can enable future advancement in the social hierarchy and honouring of ancestors. As such, Chinese parents have high expectations of their children. The decisions Chinese children make are much more about the interests of the whole family, like choosing a university, gaining recognition in social groups, and starting a family of their own (Kane, 1985; Chow, 2007; as cited by Lei, 2017). Consequently, the failure of children is not only seen as an individual experience but also means the loss of honour of the whole family. Thus, the responsibility and pressure to be successful are very high (p. 48). Regarding Chinese students and their intention to obtain a doctorate, the study by Lingyu et al. (2022) confirmed that “in comparison with an in-country doctoral education, master’s students with a better family background had a greater tendency to receive a doctoral education overseas. The higher the educational level of the mother, the more likely the child was to pursue doctoral studies after obtaining a master’s degree (Lingyu et al., 2022). Furthermore, there was a positive correlation between the prestige of a university (“Double First Class”), family background, academic performance, and intention to pursue a PhD abroad. When referring to the field of studies, Lingyu et al. (2022) state that “[f]or students with a good family background, their majors for their master’s degree were distributed among majors in the categories of humanities and social sciences categories, while students of ordinary family background conversely tended to be distributed among majors in the categories of natural sciences and engineering”. This result is consistent with the findings of Yang et al. (2018) study of STEM doctoral students from low socio-economic status and in some cases with illiterate parents.



Furthermore, they found that family, teachers, and peers influence Chinese students' decision to pursue STEM doctoral studies in Australia. In addition, five other main motivations for STEM doctoral study abroad were identified: enriching life experiences, self-cultivation, broadening research perspectives, enhancing career prospects, and contributing to the betterment of life. These themes appeared to be interwoven, and their combined influence motivated the students to achieve high goals. These drivers are also consistent with those of Chinese doctoral students researching STEM disciplines in Germany (Zhang, 2014). In the pre-migration phase, these motivations are very important as they play an important role in decision-making for migration/international mobility. However, after arrival in the host country, in the post-migration phase, many challenges emerge. According to Hunter-Johnson (2022), international students have to "adapt greatly to differences in the learning environment, language barriers, and combating stereotypes" when transitioning into US higher education institutions. Moreover, Chinese international students faced language and communication barriers (Choi et al., 2012; Ye & Edwards, 2017; Zhou, 2015), prejudice and racism, especially during the COVID-19 pandemic (Xu et al., 2021), negative interactions (Wang & Rähä, 2021; Yao, Briscoe, & Rutt, 2020), a sense of isolation and lack of collegiality, and difficulties in balancing work and family life (Seagren & Wang, 1994; Skachkova, 2007; Wang, 2009; Wang & Rähä, 2021; Zhou, 2015).

In addition, the Chinese context with its values and beliefs reflected in social practices, also referred to as Chinese Relationism or Confucian Relationism, also influences the career decisions of Chinese students. The "Chinese self is expected to subjugate personal needs to those of the group" (Lee et al., 2018). The study done by Lee et al. (2018) on career decisions of international Chinese doctoral students is also consistent with other studies done on Chinese (doctoral) students that see Chinese children as an extension of their parents and their actions not only honour or shame themselves, but also their parents and family. Nevertheless, according to their findings, parental influence had largely disappeared in the decision to pursue a doctoral degree. All female participants acknowledged their traditional roles as "breadwinners" and "child bearers", which were reinforced by their parents and present and future partners. Even participants without partners have stated that they also intended to prioritize their future partners and their jobs over their careers and ambitions. Since the Chinese labour market, and especially the access to post-doctoral positions, is highly competitive, a foreign doctoral degree makes a difference and increases attractiveness on both the Chinese and global labour markets.

As the above research shows, the decision-making process for agency choice and educational trajectory is influenced by socialization and social factors, which depend on both exogenous and endogenous factors such as institutional characteristics and individual preferences and circumstances. Looking at the experiences of Asian STEM promoters globally and in Germany, there are hardly any differences, as the patterns of educational trajectory are almost the same. The main distinction arises from the unfamiliarity with the learning practices, habits, and settings within the German educational system, which is also applicable in the Finnish context.

EMPOWERING STEM DOCTORAL STUDENTS: AGENCY AND SOCIALIZATION IN ACADEMIC TRANSITIONS

Learning takes place through participation in various social practices that are shaped over time by involvement in any kind of enterprise. Institutional/structural educational transitions, such as



from higher education and/or professional life to another higher education context shape the individual, his or her patterns of learning, thought, perception, and agency, and not least the corresponding coping strategies in dealing with these learning transitional situations. The new academic context forces international doctoral students to revise their academic identity, socialisation practices, their values, and agency. Academic structures mostly include universities and similar higher education institutions, disciplines, and departments. In general, doctoral education is mainly based on supervision by an "individual" professor, the system depicts an "apprenticeship model" (Schneijderberg & Teichler, 2018) that is shaped by informal learning processes, expectations, and sanctions. As such, faculty and project-related environments are the primary instances in which structural and academic learning is mediated. Thus, international doctoral students learn *from* and influence their new academic community. In this context, international academic mobility can be seen as a way of gaining, retaining, and disseminating information and knowledge that promotes flexibility and adaptation to different academic settings. Furthermore, it should be noted that the very knowledge and skills acquired before the doctorate lead to the attainment of the doctoral position and are of great value in the transition to a new academic environment. However, as the new academic structures are defined by new forms of interaction, doctoral students will have to update and adapt their skills and strategies accordingly during the acculturation process, which may pose significant challenges. In their qualitative study, Wang and Rähä (2021) observed that during the acculturation process of Chinese doctoral students in Finland, they acquired new learning practices that combined their pre-existing learning habits from their home country with those from the host country. Notably, as their learning experiences deepened, their academic difficulties decreased.

In the given context, the concept of "agency" refers to the individual's ability to affect and change the world around them. According to Gecas (2013), humans are "agentic, self-reflective, self-regulating, creative, and proactive" and not simply reactive beings acting on external events. Snyder (1981, as cited in Gecas, 2013) states that individuals play a very active part in choosing, influencing, and structuring the situations in their lives, in keeping with their self-conceptions as well as attitudes and dispositions. Nevertheless, the attitudes and dispositions of international doctoral students often clash with local academic structures during learning transitions, especially as hierarchy rather than freedom is central to academic relations in Asia, and students are discouraged from interacting or discussing with professors (Altbach, 2010). Asian international students often bring with them the values of their own culture's philosophy, such as Confucianism, which teaches them to remain in harmony and respect authority (Lee et al., 2018; Martinez & Colaner, 2017). And, as Clark (1983) points out, universities are still characterised by a distinctive system of values and norms, so that especially those who are unfamiliar with them have to learn them in an agentic or passive way as they transition into a new academic environment. The academic world is a cultural community with norms and rules of the game that foreign-born students are often unaware of. Socialisation means not only adapting to new learning processes (Óhidy, 2008, p. 25) but also learning how to be academics by observing others and interacting with them (Lave & Wenger, 2002). In particular, the new academic communities hold great significance as they help international doctoral students in achieving their learning goals, namely obtaining their doctorate and establishing themselves academically in the new academic community. According to Gardner's (2009, 2020) three-phase socialisation model, doctoral students develop an academic identity during the entry, integration, and candidacy phases of the PhD, with the scope of integrating into the new academic community. Since



this English model does not fit German doctoral training, we could translate it into entry, integration, and establishment or completion phases. Each phase is connected to challenges especially when transitioning academic environments and accessing new academic structures. Based on [McAlpine, Amundsen, and Turner \(2014\)](#), the extent to which individuals can exercise agency and reflect on their developing academic identity as they experience the socialisation process can result in the potential transformation of both the individual and the workplace. However, according to [Harrison \(2009; cited in Lopes & Lourenço, 2019\)](#), pursuing a doctorate within new academic structures involves navigating through “thresholds of self-perception” perceived as „stuck places“ of anxiety and insecurity that are resolved through a process of self-presentation and repositioning, particularly concerning knowledge and what it means to be a connoisseur. As such, a process of reflection on learning and what it means to be a learner takes place, and thus the new academic community, with its norms, conventions, and values, is analysed, and its learning strategies are adapted. Numerous studies have addressed the challenges of adapting to and interacting with academic structures, including interactions with supervisors, academic peers, language and cultural barriers, isolation, and discrimination, as previously discussed. All of these types of socialization have an impact on doctoral students’ learning. [Morita \(2004\)](#) notes that academic socialisation involves learning to participate simultaneously in a range of learning communities, including the academic community, the disciplinary community, and the institutional community, but also localised learning communities in the workplace. As such, a more appropriate pedagogy for international doctoral students should be developed in which learning within the academic communities is co-constructed, emergent, and responsive and their academic socialisation enhanced.

Overall, doctoral trajectories and learning, rely on three elements: 1) institutional, departmental, and disciplinary parameters and interactions; 2) supervision-related characteristics such as intensity and quality of supervision, and the relationship with supervisor and principal investigator; 3) agentic freedom/control and personal characteristics (e.g. age, racial and ethnic identity, gender); and psychological and behavioural characteristics such as self-efficacy, involvement, curiosity, motivation, sense of belonging, dealing with stress and pressure. Understanding these factors can contribute to a better understanding of the intricate nature of the dynamics of doctoral education and support the development of effective strategies to help doctoral students.

NAVIGATING ACADEMIC TRANSITIONS: AGENCY AND LEARNING

The studies reviewed show that family members, peers, and supervisors play an important role in the doctoral process. In general, parental influence on the academic mobility process is high ([Choi et al., 2012; Wang & Rähä, 2021; Zhang, 2014; Zhang et al., 2021; Zhou, 2015; Zhu, 2012](#)). Parents not only have an important role in deciding the destination country but also ensure that marriage traditions are respected and that women, in particular, do not marry later than the age of 27, otherwise they run the risk of becoming a “leftover woman” (a term used by the official Chinese media since 2007) ([Lee et al., 2018; Wang & Rähä, 2021](#)).

Well-being and mental health issues are mostly due to unsatisfactory socialisation ([Zhou, 2015](#)), resulting from discrepancies between supervisor expectations and own imaginaries. A variety of factors contribute to this dissatisfaction, such as different research interests, financial needs, limited supervisor support, and the feeling of being overwhelmed by high research



expectations. Additionally, some may realise that a future career in academia is not the right choice for them. As doctoral students progress through their educational experiences, their motivations may change despite the challenges they face and the agentic freedom/control they have over their choices. Some students demonstrate will and perseverance, a strong sense of self-abilities, and an unyielding dedication to research, paired with a strong desire for competence and success.

In his study, [Zhu \(2012\)](#) analysed the process of academic adjustment across four phases: pre-departure, initial, developing, and final. Each phase employs various forms of social support. As such in the pre-migration and initial phase the Chinese students have easier access to their co-national students and turn to them for help, due to their insecurity regarding their language proficiency, and different communication and learning styles among others. Furthermore, they used various sources to inform themselves about Germany and German higher education prior to their arrival in Germany. The sources of information were news articles, online forums, advice from Chinese students who have studied in Germany, the official websites of German universities, German language courses, and German friends. The results are consistent with the studies conducted by [Jayadeva \(2020\)](#) on Indian students in Germany and [Lee et al. \(2018\)](#) on Chinese PhD students in Australia. While some students chose Germany because other peers or partners have also applied to German HEIs, others were motivated by their family members who have previously studied in Germany. Academic adjustment is not only dependent on social ties and information but also the types of academic mobility whether it is done in groups or individually. In the developing phase, the support of lecturers and peer German students plays an important role in supporting academic adjustment at German universities. In addition to co-national Chinese friends, Chinese students have some international student friends, whom they regard as “fellow-sufferers”. Friendship with German peers is defined as ‘hi-bye friends’ ([Zhu, 2012](#)). According to [Bilecen \(2013\)](#), as identification with inter- or out-groups confers low or high social status, international doctoral students tend to perceive themselves as legitimately high-status and class due to their advanced education, which leads to a positive differentiation from comparison groups, in this case, immigrant groups - from their country of origin. If the association with the inter-group is positive, they maintain their positive distinctiveness, while unfavourable comparisons with out-groups give them low status, as individuals seek membership in groups that give them a positive social identity.

Based on a study conducted by [Zhang \(2014\)](#) regarding Chinese students in Germany, there are various reasons why many of them choose to study there. These include expanding their knowledge in fields such as advanced science, technology, and management, which are relevant to China’s modernisation efforts. Additionally, they aim to promote international exchange in diverse areas such as art, culture, science, and education. They also hope to contribute to the world and conduct renowned research. Other factors include financial benefits, the opportunity to study, live and reside in a Western country, learning a unique language such as German, and the absence of tuition fees. Finally, returning to China as a “du jin” or “gold-coated” individual, who has studied abroad, grants them more honour, respect, and better job opportunities than those who have not had this experience. According to [Bhandari’s \(2019\)](#) research on Indian students, their primary motivation for studying in the West is not cultural exchange or learning a foreign language. ‘Rather, their considerations are more pragmatic, driven by the insufficient capacity of high-quality Indian institutions and their desire for professional advancement’ (p. 6). International doctoral students who are pursuing physics in Australia are primarily more



interested in engaging in high-quality research and working with reputable research leaders rather than immersing themselves in the Australian life experience (Choi et al., 2012).

The agency of Asian (doctoral) students is severely limited during the initial phase of their PhD due to differences in learning traditions and settings like in the case of Chinese doctoral students in Finland (Wang, 2021). (Doctoral) students must first build their social identity by negotiating the dialectic of similarities and differences and overcoming the overwhelming feeling created by the heavy workload and lack of language and study skills. Once they have access to information on decoding local academic conventions, a stronger sense of agency develops, which translates into changed study habits, more confidence, more sharing with others, and the enjoyment of newly acquired autonomy. The agency is contextual and can change depending on the nature of the interaction and power relations.

UNLEASHING POTENTIAL: THE INFLUENCE OF AGENCY AND SOCIALIZATION ON LEARNING TRAJECTORIES

The reputation of quality education in Anglophone and European countries continues to be highly esteemed by Chinese students when selecting a foreign destination for their doctoral studies, according to studies by Choi et al. (2012) and Lee et al. (2018). This is similar to the findings of Han et al.'s (2015) research on foreign-born STEM students in the US. Overall, these studies highlight that the decision-making for doctoral studies abroad is shaped by their preference for the good reputation of countries' education institutions and the perceived benefits of studying there, including research opportunities and career prospects. As such, this finding confirms Chen's (2007) findings that international students prioritize programs rather than countries. Nevertheless, at the beginning of the doctoral journey, they feel overwhelmed by the workload during their PhD (Wu, 2017; Zhou, 2015), and also by the lack of clear delineation of tasks and expectations of the supervisor, which leads to a higher workload and a sense of insecurity and dissatisfaction (Wu, 2017). According to Schneijderberg and Teichler (2018), German doctoral training has been criticised for having an excessive workload, which leaves little time for dissertation work. However, Yang et al. (2018) suggest that intrinsic motivation could act as a mediator in the relationship between the learning experience and academic performance.

During the process of socialisation in a new academic environment, international students might initially experience confusion and disorientation due to unfamiliarity with the structure of foreign higher education and different learning traditions (Wang & Rähä, 2021; Zhu, 2012). These studies describe academic adjustment as the ability to learn in an intercultural environment. According to Bilecen (2013), the process of adjusting to new academic environments is constantly evolving. The interviewees in the study had their academic identities constructed, reconstructed, and negotiated as they gained international and educational experiences and adopted new positions. When self-efficacy is reinforced through intellectual and emotional support, individuals gain confidence in their new academic identity and develop greater agency (Bilecen, 2013; Choi et al., 2012; Wang & Rähä, 2021). International doctoral (mixed) students interviewed by Bilecen (2013) reported positive learning experiences in Germany, benefiting from their studies and appreciating the opportunities they received. Similarly, the international PhD students in physics in Australia displayed enthusiasm for learning, with scholarship and high-quality research playing a central role when deciding to come to Australia. On the other



hand, the Chinese doctoral students interviewed by Zhu (2012), Wu (2017), and Wang et al. (2021) expressed feelings of isolation and frustration when dealing with differences in expectations between their old and new learning environments. The academic contexts in Finland and Germany present inherent challenges and insecurities for doctoral students, as they differ significantly from their previous learning environments and traditions. These differences include the need for greater academic independence and self-reflection, less support, a more hierarchical relationship with supervisors, the need to learn an additional foreign language, and unfamiliarity with the social and cultural environment. As a result, doctoral students may initially experience greater uncertainties and difficulties in adapting to these new academic environments. Wang et al. (2021) observed that international doctoral students in Finland experienced academic development and personal growth after the initial phase of confusion and disorientation. This growth included the development of learning skills, tolerance of academic differences, and self-identity development.

In summary, the decision-making process of international students who choose to study for a doctoral degree abroad is strongly influenced by the reputation of prestigious educational institutions and perceived benefits such as research opportunities and career prospects. Nevertheless, adjusting to a new academic environment can be challenging, with issues such as workload, unclear expectations and unfamiliar structures and learning traditions leading to dissatisfaction and uncertainty. Despite these challenges, international doctoral students report positive learning experiences and personal growth, including the development of study skills, tolerance of academic differences and the development of their own identity. Ultimately, the advantages of having an international doctoral degree can surpass the challenges and lead to academic and personal growth.

LIMITATIONS AND FUTURE RESEARCH

The focus of this research was to examine the available peer-reviewed qualitative literature on international Asian STEM doctoral students studying abroad, as written by doctoral students themselves. It should be noted that there may be more research on this topic, beyond what was included in this study. The selection of literature was based on specific keywords combination, which may have overseen some appropriate literature. Additionally, certain literature was not available for review or focused on other aspects of academic mobility and therefore was not included. Although only articles written in English were selected for this study, another limitation of this study could be my lack of proficiency in Asian foreign languages, which would have provided a more comprehensive perspective for this study. The majority of the literature used in this study comes from Western, and Anglophone countries, as well as from Asian countries, especially China. A more diverse set of studies that include STEM populations from other Asian regions, ethnicities, genders, and science fields (engineering and computer science were predominant) would certainly add additional nuance and complexity to these findings. Although STEM doctoral students are the most prevalent in the world, there are few studies on how they fare in foreign academic contexts. Moreover, as each STEM discipline is separately researched, there is a lack of disciplinary differences. More attention on each STEM field and its effects on the life course of international doctoral students is needed. In this context, it would be particularly informative to examine how time, age, and gender affect the experiences of Asian STEM PhD students.



CONCLUSIONS

This study investigated how agency based on educational doctoral trajectories and transitions are impacted by the international academic mobility of Asian doctoral students in STEM subjects abroad. This study takes a life course perspective to examine the educational and career trajectories of Asian STEM doctoral students and explores the influence of agency, socialisation, and self-efficacy mechanisms on their experiences in foreign academic systems. Based on empirical research, the study examines how individual experiences develop over time and how the interplay between social ties, institutional structures, and self-efficacy shapes the academic success and integration of Asian STEM doctoral students into the local academic community. The findings highlight the importance of understanding the complex dynamics between agency and socialisation, and the role of self-efficacy in addressing the challenges and opportunities of Asian STEM doctoral students. As the literature review has shown, the educational trajectory of Asian STEM PhD students is influenced by family background, socialisation, cultural values, and challenges faced during the doctoral journey. In addition, personal and economic factors are also of central importance. Age, parental influences, marital status, own personal ambitions and the desire for change shape the decision-making process for the PhD. Other than that, it is important to develop one's self-efficacy and self-esteem when balancing parental ambitions, social and cultural norms, family, supervisors' expectations, and environmental constraints. By considering their diverse experiences in a foreign academic system, this study provides insights into how to better support and promote the integration and success of Asian STEM doctoral students in their academic endeavours.

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Annex 1

Studies included for review from EBSCOhost Web, Academic Search Premiere, Education Source, ERIC and SpringerLink

Author	Country	Target group characteristics	Research Aims	Data collection	Key terms
Lihe, H. (2015). Improving Intercultural Education at Chinese Institutions from German Experience, Journal of International Students, v5 n2 p201–203	People's Republic of China (PRC)	own experience in Germany as a visiting scholar	to improve the intercultural education at Chinese institutions from German Experience	auto-biographical	Positive aspects of internationalisation: service for international students; intercultural competence training; building of campus diversity; and intercultural activities organization. Contact with multi-cultural networks with the purpose of learning about new cultures. Agency: Power position as he later gets the chance to meet the at the time German president and German chancellor.
Bilecen B. (2013) Negotiating differences: cosmopolitan experiences of international doctoral students, Compare: A Journal of Comparative	DE	international doctoral students of 20 different nationalities with a wide range of ethnic and religious	To discuss theories of identity from a social constructionist perspective. He uses the term	Qualitative content analysis: extensive semi-structured interviews with international doctoral students	social identities are constructed through negotiating the dialectic of similarities and differences. Dichotomies of “us” and “them, the (continued)





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Author	Country	Target group characteristics	Research Aims	Data collection	Key terms
and International Education, 43:5, 667–688, DOI: 10.1080/03057925.2013.821329		backgrounds. They were between 25 and 41 years old	of “identification” instead of “identity” to describe a dynamic process through which students negotiate the meaning of their identities in different societies and communities.	(21 female and 14 male) from two universities in Germany	Germans” as negotiations. negotiation of difference or sameness as crucial in creating ‘differently centred worlds’ Multi-cultural network as a mean to learn from cross- country encounters. Agency: positive learning experiences, in which they embraced the difference. Embracing a cosmopolitan behaviour Agency and socialisation.:Tendency to remain among other Chinese students Bi-cultural networks play an important role during the developing and final phase: openness towards “friendly” German fellow students in the final phase they are
Zhu, J. N. (2012). Academic adjustment of Chinese students at German universities. Berlin: Humboldt Universität zu Berlin, Diss. Available online under the following URL: http://edoc.hu-berlin.de/dissertationen/zhu-	DE	Chinese students from various disciplines, including Bachelor’s, Master’s and PhD students. German lecturers and one international student. Average age of	To explore the academic adjustment of Chinese students in German higher education institutions.	Mixed research method: both qualitative and quantitative Interviews: N = 18 Case study: N = 6 and a questionnaire N = 31	Agency and socialisation.:Tendency to remain among other Chinese students Bi-cultural networks play an important role during the developing and final phase: openness towards “friendly” German fellow students in the final phase they are

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Author	Country	Target group characteristics	Research Aims	Data collection	Key terms
jiani-2012-11-21/PDF/zhu.pdf		25.6 years. Three doctoral students aged between 25 and 32. Mixed disciplines, from humanities to STEM subjects, with limited previous international exchange experience or idea of Germany or the German higher education system			more courageous and appreciate the academic freedom of choice and collaboration with other fellow students Agency: limited at first during the discrepancies in learning traditions and settings. Overwhelmed by study-planning and selection of courses. in final phase greater agentic freedom: changed learning habits, more confidence, more exchange with others, enjoying the newly acquired autonomy
Wu R. (2017)	DE	Chinese doctoral students from all of the doctoral training models. Most of them are external doctoral students.	To examine the academic socialization of Chinese doctoral students in Germany selected from 8 universities across 7 federal states.	A mixed- method explorative research. Nineteen Chinese doctoral students from University Halle-Wittenberg (MLU) were chosen for qualitative	Agency: In the anticipatory or novice stage, a sense of insecurity prevails. Hierarchical relationship with supervisors. Only through interactions with colleagues and peers do (continued)





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Author	Country	Target group characteristics	Research Aims	Data collection	Key terms
Choi, S. H.-J. Nieminen, T.A. and Townson P. (2012) Factors influencing international PhD students to study	AUS	eleven international PhD physics students- all male age: 26–36 years old.	To investigate personal and social factors that influenced the decision for international	interviews. A quantitative survey was designed to test the hypothesis ($n = 51$) In-depth interviews with twenty-one students from different disciplines, including two focus group interviews (eight students for each). Using the concept of academic socialisation and the four-stage model by Stein and Weidman individual in-depth interviews	the doctoral students learn more about formal norms from regulative agreements. They have more agentic control in this formal phase. In the informal phase, they learn more about informal expectations. At the end of the process, they are independent researchers. Enthusiasm for learning in the specific field Motivation: A well-known research group or reputable research leader as critical factor

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Author	Country	Target group characteristics	Research Aims	Data collection	Key terms
physics in Australia, Innovations in Education and Teaching International, 49:3, 309–318, DOI: 10.1080/14703297.2012.703017		Time spent at Australian universities: three months to three years and five months.	PhD students to study physics in Australia.		in the choice of the destination for a PhD study in physics. Financial factors: The availability of a scholarship Life experiences: more interested in engaging in high-quality research than Australian life experience English proficiency The marital status affected the decision to do a PhD in Australia Prior positive internship or exchange programme experiences Findings: Intercultural learning challenges, Language insufficiency which create emotional pressure, Knowledge gap from the differences between the Chinese and Finnish curricula, Interactions with supervisors- challenges that occur <i>(continued)</i>
Wang, L., and Rähkä, P. (2021). Academic Acculturation of Chinese Doctoral Students in Finland. TRAMES: JOURNAL OF THE HUMANITIES AND SOCIAL SCIENCES, 25(3), 295–310. [2]. https://doi.org/10.3176/tr.2021.3.02	FIN/PRC	with 9 Chinese doctoral students, 4 in STEM, 2 in Education, 1. Psychology and one in Business	Academic Acculturation Of Chinese Doctoral Students In Finland strategies model for acculturation	A case study design: in- depth qualitative interviews	





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Author	Country	Target group characteristics	Research Aims	Data collection	Key terms
Zhang, Y., O'Shea, M., & Mou, L. (2021). International Students' Motivations and	CA	participants are from different fields of study (humanities,	International Students' Motivations and Decisions to do a	20 interview participants are from different fields of study	from too high expectations from the supervisor. Explicit and rigid supervision vs. individual freedom and self-motivated learning Expectations from Chinese family- age 25-36, 2 married, 7 single, expectations from their families to date and get married. The term 'leftover woman' has been used by official Chinese media since 2007. <i>Academic acculturation strategies, Academic development and personal growth of the participants, Learning ability development, Tolerance with academic differences, Self-identity development</i> Motivations to study in Canada. Individual factors: Academic interest was a crucial <i>(continued)</i>

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Author	Country	Target group characteristics	Research Aims	Data collection	Key terms
Decisions to do a PhD in Canada: Proposing a Three-Layer Push-Pull Framework. Canadian Journal of Higher Education, 51(2), 61–73. https://doi.org/10.47678/cjhe.vi0.189027		social sciences, engineering, and natural sciences). 10 from China and 3 from India.	PhD in Canada: Proposing a Three-Layer Push-Pull Framework. The study aims to explore which factors influence international students' decision to pursue doctoral studies in Canada	(humanities, social sciences, engineering, and natural sciences). 10 from China and 3 from India.	factor, Some students were attracted to particular lecturers, not only because of their common academic interest, but also because of their particular approaches to research and scholarship. Doctoral studies are primarily driven by passion and personal research interest.
Yang, Y., Volet, S., and Mansfield, C. (2018) Motivations and influences in Chinese international doctoral students' decision for STEM study abroad, Educational Studies, 44:3, 264–278, DOI: 10.1080/03055698.2017.1347498	AUS	35 Chinese International Doctoral Students (CIDS) from seven universities in four Australian states 8 female aged 23–25 27 male aged 26–30	Motivations and influences in Chinese international doctoral students' decision for STEM study abroad	in-depth conversational-style interviews with Motivation from a social–cognitive perspective. Four components of subjective task-value: intrinsic value (students' interest in pursuing a higher degree for its own	Motivation to pursue a PhD abroad: Enriching life experiences, Self-cultivation, Broadening perspectives in research, Improving career prospects, Contributing to life betterment, External influences that played a role in their decision: Both micro-level (family, teachers and <i>(continued)</i>





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Author	Country	Target group characteristics	Research Aims	Data collection	Key terms
				sake) attainment value (the importance of doing well), utility value (how the completion of a PhD is aligned with future plans) and relative cost (refers to additional personal resources and may take time away from other pursuits).	peers) and macro-level (institutional, supervision and financial) Own decision to study abroad being willing to invest effort and be persistent. Students themselves appeared to be the key decision-makers. Macro-level: Institutional, supervision and financial influences: International institutional cooperation Schools' and universities' ranking Financial influences: availability of a scholarship A third of the participants were from low socio-economic rural backgrounds and in some cases, with illiterate parents. <i>(continued)</i>

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Author	Country	Target group characteristics	Research Aims	Data collection	Key terms
Lee, M. C., McMahon, M., and Watson, M. (2018). Career decisions of international Chinese doctoral students: The influence of the self in the environment. Australian Journal of Career Development, 27(1), 29–39. https://doi.org/10.1177/1038416217743023	AUS, RSA	10 participants across three universities in Queensland, Australia	Career decisions of international Chinese doctoral students: The influence of the self in the environment Insights about the influence of the Chinese context on the career decisions of international Chinese PhD students	interviews with 10 participants across three universities in Queensland, Australia Theoretical background: review of Chinese relationalism and the Systems Theory Framework (STF) Equal number of male and female participants.	Interrelationships between the self and the environment as all participants made career decisions that balanced their aspirations against those of family and society in order to maintain harmony. The Chinese context: Chinese relationalism or Confucian relationalism Three common influences personal aspirations, parents, and desire for career advancement Discovering Self working independently, the research topic and the research itself Discovering environment: Families Labour markets Societal values Spiritual forces <i>(continued)</i>



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Author	Country	Target group characteristics	Research Aims	Data collection	Key terms
Zhou J. (2015). International students' motivation to pursue and complete a Ph.D. in the U.S. Higher Education 69(5): 719–733. doi:10.1007/s10734-014-9802-5.	U.S.	international doctoral students from all disciplines. 9 from STEM disciplines 6 from China and 3 from India.	International students' motivation to pursue and complete a Ph.D. in the U.S. Higher Education	19 interviews with international doctoral students from all disciplines. 9 from STEM disciplines 6 from China and 3 from India. Methodology: Interpretive processes. Value-expectancy achievement motivation theory	Despite challenges, four motivations: (a) intrinsic interest in research, (b) intrinsic interest in teaching, (c) high utility value of a PhD earned in the U.S., and (d) high emotional and social costs of quitting. These motivations changed over time during as students' educational experiences have progressed Agency: will and perseverance, strong sense of self-abilities and unyielding dedication to research, paired with a strong desire for competence and success. Socialisation: interaction with students keep them motivated

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