

Beyond “Male versus Female”: Understanding the Dilemma of Chinese Female STEM Undergraduate Students through Intersectionality

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Abstract

Although the majority of undergraduate students in Chinese universities are women, those who choose to study science, technology, engineering and mathematics (STEM) face marginalisation and discrimination due to the traditional patrilineal society. However, while much of the existing literature investigates this population based on the traditional binary male/female perspective, it ignores the complexity of the societal “matrix of domination” and individual variations among this cohort. To better understand the obstacles female undergraduate STEM students face from their perspective, we propose using a theoretical and methodological framework of intersectionality to re-evaluate their educational experiences based on social categories. With three main intersectional paradigms, the intracategorical intersectionality can show the subgroup differences. Intercategorical intersectionality can investigate not only the process of identity formation based on intersecting social categories but also individual differences in constructing their identity when they study STEM. Systematic intersectionality examines how high-level educational and industrial policies influence these female students. Overall, intersectionality provides a solid research paradigm and theoretical framework to address the dilemma of Chinese female STEM undergraduate students.

Keywords: higher education; gender inequality; intersectionality



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Background: STEM, a Bumpy Road for Chinese Female Undergraduate Students

Since the Chinese 1979 reform, the number of female students has increased exponentially. In fact, 53.74% of Chinese undergraduate students are female as of 2018 (Ministry of Education 2018). Despite their dominance in numbers, over 60% of all female undergraduate students are still concentrated in non-STEM (science, technology, engineering, and math) majors (Wang 2015). The phenomenon of gendered subject segregation is caused by interconnected multilevel factors in China. From the macro social perspective, females play a subordinate role according to traditional Chinese Confucian values. Such values do not encourage females to participate in productive labour contributing to the family income (He 2018). As STEM majors often lead to occupations with higher economic returns, choosing to major in a STEM subject is often associated with a “lack of femininity” in the Chinese social context (Wang 2016). Also, the new two-child policy encourages Chinese companies and employers to assume each female STEM student would have more children, meaning a higher overall employment cost (Chen 2017; Song 2011). These potential financial burdens exacerbate the discrimination towards female STEM students in the Chinese job market, discouraging them from choosing these majors. From the micro individual perspective, female students are influenced by “gender socialisation”: the gender values created by the social system are psychologically internalised by female students themselves, which could stop them from choosing STEM majors (Yang and Gao 2019). As such, they would normalise the discrimination imposed by the Chinese cultural systems and stopping them from future development.

The existing research on female STEM students mainly focuses on the tensions between the male/female gender binary (He 2018; Peng, Gao, and Li 2017; Wang 2016). These studies generally reveal that discrimination against these students can be traced back to the educational system, which was found to be unequally biased against female STEM students despite their larger presence in numbers (Peng, Gao, and Li 2017). For example, teaching practice in Chinese universities prioritises male students who attract more attention from professors and who are offered more opportunities to engage in laboratory activities (Peng, Gao, and Li 2017). As such, pedagogical marginalisation of Chinese STEM female undergraduates in universities leads to psychological consequences. Although their academic records may be superior, Chinese female STEM students feel a lower sense of confidence about their résumé on the job market than their male counterparts (Xin and Hu 2018). Moreover, even when these STEM students have finished their doctoral degrees and pursue high-tech occupations such as scientists or university professors, they are still subjected to gender stereotypes, neglect, and marginalisation (Jiang and Zhang 2022; Zhou and Zhang 2020). In other words, their individual academic contribution could still be subject to *otherisation* due to their gender. Generally, the gender opportunity gap intensifies the major-related lack of self-awareness and weakened career empowerment, leading to greater difficulty for female STEM students to succeed in China (Peng, Gao, and Li 2017).

When most studies pay close attention to the disadvantaged gender role for Chinese STEM female undergraduates in their career development and educational experience, they ignore the complexities of their social class backgrounds and psychological identity within the cohort of Chinese STEM female undergraduates.

In other words, previous research has treated Chinese STEM female undergraduate students as a monolithic group with little variation within the group. Their ignorance of individual differences sets apart the academic investigation from real experience. This ignorance misses two major aspects that can lead to a better understanding of this group. First, Chinese STEM female undergraduates form a large population comprised of individuals with variations based on multivariate social identities (class, region, admission policy). Second, gender itself may not be able to explain fully the complexity of individual experience. Thus, only inspecting Chinese STEM female undergraduate students from a gender perspective might not go far enough to capture their real experience. Moreover, the existing literature has failed to discuss the interconnections between the influencing factors. Previous researchers discussed several contributing factors, including culture (Wang et al. 2009), psychology (Yang and Tian 2001), and society or family (Zhang and Zhen 2011), which influence the Chinese female STEM undergraduates' experience in school and employment. However, those discussions often treat these factors as separate and unrelated. As some factors remain on the macro (social, cultural) and micro (psychological, family) levels, these factors jointly shape their experience. Analysing the logical structure between these factors can help us better discuss how individual-level factors interact with macro social factors in the fast-changing Chinese society.

Not only do Chinese female STEM undergraduate students face gender discrimination within these disciplines, but they are also subjected to interconnected influencing factors due to the complex social environment, which has been ignored by the previous literature. Thus, we propose to apply intersectionality to critically evaluate the multivariate difficulties they might face beyond gender discrimination. Intersectionality, as both a theoretical framework and methodological approach (Choo and Ferree 2010), can systematically investigate the multiple interconnected aspects of discrimination, which might be able to reveal the complex social conditions and various identities within this student group in China from their own perceptions. In the following sections, we first briefly introduce the intersectionality paradigm and then discuss how it can be methodologically applied to the context of Chinese female STEM students in universities.

Theoretical Framework: Intersectionality in Higher Education Analysis

Intersectional Theory and Methodology

Although relevant thinking can be traced back to the 1960s, it was not until 1989 that Crenshaw comprehensively discussed the theory of intersectionality (Crenshaw 1989). The core concept of intersectionality is that females face discrimination that reaches

beyond gender. In their social lives, females can face multivariate discrimination based on several factors within the social hierarchy (e.g., class, “race”, or ethnicity), which create a “matrix of domination” to position females in a situation of multiple jeopardy (Tefera, Powers, and Fischman 2018). Because of the enormous variations within females’ experience due to their social positioning, simply imagining “female” as a collective entity is not enough to fully understand feminine behaviour and social experience. Intersectionality can fill such a gap. On the one hand, intersectionality examines the network of social locations, which interacts with the gender experience and other social identities (Collins 2012). These interactions form unique physical and mental experiences. On the other hand, intersectionality can illustrate the contextual differences of these social locations, because the power relations behind these social locations are conditioned based on historical and cultural relations. For example, the main component of the identity-power relation is “race” in the United States, while religion and citizenship are central factors in France due to contextual differences (Lamont 2009).

As a methodology, intersectionality has three main models to investigate the disadvantaged position of females (Choo and Ferree 2010; Su 2016). The first model is “intracategorical intersectionality” based on “inclusion-centered interpretations” (Choo and Ferree 2010, 132; Su 2016). This paradigm emphasises those females who are in the unique position of having intersecting identities, such as being a woman and part of a “racial” minority at the same time. The intention here is to reveal the life story of a hidden marginalised subgroup beyond gender differences (Choo and Ferree 2010; Su 2016). Second, “intercategorical intersectionality” pays attention to the process and relations between social categories, as individual female students could have different perceptive and behavioural differences even with the same combination of social positions (Choo and Ferree 2010; Su 2016). Third, systematic intersectionality connects social institutions and individual experiences. It tries to connect the interactions from the sociocultural environment and policies to individual behaviour and identities (Choo and Ferree 2010; Su 2016). Such a method breaks away from the traditional practice of an “anchor component” and tries to investigate how social categories are embedded within a larger structure, such as public policy or governmentality, to produce commonality to influence an individual female’s life (Su 2016). Finally, the social context needs to be examined to apply the specific methods, as sometimes the complex research questions might require a combination of more than a single intersectional method.

Internationality in Higher Education

Educational researcher pioneers have been introducing the intersectionality framework in educational studies since the 1990s. For example, Ladson-Billings and Tate (1995) used intersectionality to combine educational studies with “racial” identities and legal rights ownership, providing a new paradigm. By challenging the stability of traditional categories, intersectionality brings new breakthroughs for educational studies. From the perspective of the educational process, intersectionality re-examines disadvantages in

educational behaviour due to social categories; from the perspective of educational spaces, the method reminds one of the social interactional role of educational institutions; from the perspective of educational outcomes, it goes beyond the simple addition of factors towards students' academic performance (Bhopal and Preston 2011). For marginalised groups, understanding the interactions of social identities can better illustrate their unique educational experience in real life.

By examining the universities' location of social interaction based on variations in social categories (such as "race", class, gender), intersectionality moves beyond concentrating solely on gender differences, which oversimplifies the participating behaviour of females in higher education studies (Harris and Leonardo 2018). Through in-depth investigation of the domination matrix, intersectionality can diversify higher education analysis by repositioning originally marginalised groups and centring the discussion on them (Harris and Patton 2019). These marginalised groups include those who are experiencing various hardships beyond the male/female gender binary. For example, LGBTQ college students might experience more abusive behaviours from their intimate partners than heterosexual couples (Whitfield et al. 2021). They also include female college professors or administrators who are positioned at the juxtaposition of power. On the surface, they enjoy the structural advantage of being in an elevated position in the university's hierarchy. However, individual identity disadvantages often exclude female leaders from the central administration (Nielsen and Madsen 2019) or force them to serve as tokens for the gender quota without any designated power (Park 2020). For example, black female professors in the United States face more questions and challenges from students, and are forced to interact more defensively (Griffin and Reddick 2011).

In general, intersectionality can largely deepen our understanding of a group that was originally disadvantaged in the higher educational system. As female undergraduate STEM students in China continue to experience a conflict between more career opportunities and gender and class ceilings in their educational process under the Confucian patrilineal society, intersectionality serves as a solid methodological extension for the analysis of these students in China.

Application of Intersectionality: Understanding STEM Female Undergraduates in China

Intracategorical Intersectionality

Intracategorical intersectionality can be applied to reveal the above-mentioned "matrix of domination", which investigates the discrimination beyond gender identity that causes students to face social alienation (Tefera, Powers, and Fischman 2018), revealing the within-group diversity among such students in China. As the Chinese social structure was reordered after 1979 based on new reforms, we first argue that students' experiences are influenced by both their gender identity and the identity associated with social mobility factors. Starting from commonly known factors, the rural-urban divide

always marks the contrast in accessing higher education in China (Jain-Chandra et al. 2018; Marginson 2018). As most of the economic development was concentrated in the large Chinese cities, wealth status is often influenced by the rural-urban divide in China, which causes rural female students to possess a different identity due to their lower socio-economic status (Leng et al. 2020; Xue, Kerstetter, and Hunt 2017). This wealth gap influences STEM education when they are still in high school. As Chinese STEM majors in college require students to take relevant courses in high school, those from rural areas face shortages in both quantity and quality of STEM teaching resources (Peng 2018). For example, high schools located in rural areas often lack laboratory facilities for physics experiments and rely only on observation to understand the teaching curriculum (Peng 2018). Once they are admitted into colleges located in urban China, undergraduates from poor rural areas often feel culturally alienated and inferior because of their relatively deprived family background (Heinisch 2017; Yan and Wu 2020). This identity is not only generated from a financial perspective of being poorer but also comes from a contempt for female family members often seen in rural China. When the one-child policy is strictly followed in urban areas, families in rural areas are usually allowed to have more than one child if their first child is a girl (Hannum, Kong, and Zhang 2009). The persistence of patrilineal Confucian values makes rural parents feel there is less of a return from investing in a girl's education than a boy's education (Lui 2016). Also, STEM majors, such as engineering and mathematics, are highly associated with a lack of femininity in the traditional patrilineal values that persist in rural areas (Wang 2016). Thus, rural families would offer less support for their daughters in universities, not to mention for girls who choose STEM majors. As a result, these female students suffer from both subjection to dominant masculine practices in Chinese STEM higher education and a lack of support from their own families. Consequently, the urban-rural divide marked by *hukou* (household registration) became an axis of domination, which intracategorical intersectionality could address for those students.

In addition to the urban-rural divide, “ethnic identity” or “language identity” is a rarely studied social mobility factor also related to the experiential differences in college for female STEM students in China (Wanming and Jiang 2016; Wei 2017). Because “ethnic minority students” often reside in remote areas and have a relatively impoverished status (Zhu 2010), the central government has implemented various preferential policies to assist them, including lower admission scores and college preparatory courses (Wei 2017). For example, non-Han “ethnic students” could receive five to 20 extra points in the Higher College Entrance Examination compared with Han ethnic students. Also, if these students could meet the standard for being extremely impoverished and only living in a rural area, they could enjoy special pathway for college admission based on extra quota (Zhu 2010). Although these governmental policies have largely improved the ethnic minorities' access to higher education, the entire ethnic groups' status still does not represent individual equality in Chinese universities, especially for those who choose STEM majors (Xiang 2017). Therefore, ethnic minority students tend to opt for

language and liberal arts majors as their access to STEM education is still limited (Zhu 2010).

There are two major reasons for the lack of minority students in STEM majors. First, choosing STEM majors in Chinese universities requires studying relevant preparatory courses in high school. However, the ethnic minority K-12 students suffer from a lack of adequate and quality STEM course teachers in their native language (Wanming and Jiang 2016). As a result, most ethnic minority students are only able to choose liberal arts-related courses in high school. For example, over 75% of ethnic minority high-school graduates in Gansu province (that is, one of the remote provinces) chose liberal arts subjects tested in the national college entrance examination (that is, NCEE, or *Gaokao*) from 2012 to 2015 (Wanming and Jiang 2016). Second, many minority students participate in government-sponsored college preparatory courses that focus on language and the liberal arts (Wei 2017), which are intended to help those minority students to better integrate into urban college life (Zhu 2010). While such preferential policies encourage their exposure to the mainstream culture and ease their way into a liberal arts education due to path dependency (Zhu 2010), it also discourages them from taking a STEM major as these courses are less related to their life and academic preparation (Wanming and Jiang 2016). Based on these factors, ethnicity could be another axis of dominating identity for female STEM students in college.

Also, it is important to understand that intracategorical intersectionality often integrates extra social identities into the targeted categories without questioning the definition of these identities. As such, it might ignore the ever-changing definitions of gender itself. With the social transformation, gender identities other than the male/female gender binary (e.g., LGBTQ identities) gradually emerge from the shadows for young college graduates (Wei and Liu 2019). For female STEM students, the deviation from traditional female gender roles creates identity ambiguities that are worth investigating (Kersey and Voigt 2021). Moreover, intracategorical intersectionality overly emphasises the outcome of intersectional categories while ignoring the impact from the process of interacting identities for individuals (Ken 2008). From a methodological standpoint, the paradigm can be squared with qualitative approaches, including interviews and observational studies that focus on revealing individuals' interactions with society (Manongsong and Ghosh 2023). Therefore, in the following section, we propose to use intercategorical intersectionality to investigate the identity formation process.

Intercategorical Intersectionality

Intercategorical intersectionality investigates the experimental complexity within female STEM students in Chinese universities, even under similar sets of dominating identities. The intercategorical paradigm argues that when individuals are in multiple social categories simultaneously, they will reconstruct their combination of identities based on the social context (McCall 2005). At the same time, the traditional definition of social categories (“race”, class, gender) still persists, functioning as the “anchor point”

(Tam 2004). The paradigm of intercategorical intersectionality is able to compare how these “anchor points” shift their priorities for individuals in different social settings (McCall 2005). In the analysis of Chinese STEM students, these anchor points are subject to change.

An intercategorical study requires two steps. First, we must understand the specific process to create a social position based on the students’ multiple social identities (Choo and Ferree 2010; Su 2016). As each individual female student possesses various identities based on social categories, the network of these social categories creates unique social positions for each student (McCall 2005). As Chinese female STEM students are also associated with other social categories, their life experience in the university is based on a social position generated by combinations of these social categories. For example, Yan and Benxia (2019) reveal that a rural identity could surpass the ethnic identity of Tibetan STEM females in college, and a class-related identity would largely limit a female student’s access to STEM major information in the university (Zhou and Yu 2013). However, research studies often mechanically add the categories together without investigating their combined impact from the individual student’s own perspective. As the existing literature tends to find a “main identity effect” when studying female STEM students in China, these studies have often tried to find a more relevant and more important factor that can “magically” solve the majority of issues for them (Yan and Benxia 2019; Zhou and Yu 2013).

Instead, a more important inquiry is to delve into the process of identity formation among the combination of all social categories for each student (Choo and Ferree 2010). Because this process is heavily influenced by specific social contexts and individual agency (Choo and Ferree 2010), the second step of intercategorical intersectionality should be to interact with the student’s personal reactions based on their social categories within the social context of STEM education in China. Such a process should reflect how individual agents react towards these social categories. As females are still marginalised under their traditional gender role, they are stigmatised in the Chinese STEM education context (Peng, Gao, and Li 2017). This intersectional model needs to understand how female students create their own identity with a unique combination of social categories to cope with discrimination during their STEM studies. Such an investigation requires micro-level analysis beyond simply discussing the macro identity such as rural/urban, class, or ethnicity. Thus, the specific level of social categories, such as the family background of female undergraduates with science majors (Zhang and Zhen 2011), their psychological status (Lin, Song, and Zheng 2012), or their self-perception (Guan and Lian 2016), matters more towards comprehending the social experience of female students. Once the specific STEM settings are understood, the intercategorical intersectionality can compare how individual female students could construct their identity differently under each of the social scenarios (Choo and Ferree 2010). Also, comparison analysis between STEM and other social science disciplines such as psychology (Ireland et al. 2018) can better reveal the unique struggles of female STEM students in China as a result of the country-specific traditional patrilineal values

and domestically constructed masculinity in industrial-related STEM disciplines (Wang 2018).

One must also pay attention to social changes in female attitudes because the shift in social culture matters to the individual agents in a fast-changing society such as China's (Choo and Ferree 2010). The rapid market reforms have benefited some females with better educational resources who have acquired more awareness of feminist equal rights notions (Hannum, Kong, and Zhang 2009; Tian and Wang 2016). Although the STEM educational context still subjects females to bearing a disadvantaged status (Peng, Gao, and Li 2017), the traditional gender role is constantly challenged due to market reforms (Su 2016). Thus, female students have been showing improvement in their standing in the higher education system. A recent study showed that females seem to have better academic performance in examinations and in their attendance rate than males in Chinese universities, despite their difficulties in the job market (Li 2016). Cultural change has led to more competitive awareness and eagerness for learning among female students in Chinese STEM higher education (Yan and Shang 2018). Therefore, the process of identity formation has strong timeliness, which are subject to change based on the awareness of female rights (Choo and Ferree 2010).

There are also limitations associated with the intercategorical intersectionality when studying female students. First, overemphasising the individual micro reflection during the STEM educational process could lead to fragmentation of the outcome, which lacks structural representation for the whole group in China. For example, an interview with Chinese female students who were following their parents' engineering career path could hardly present the whole group, despite having family capital indications (Peng, Gao, and Li 2017). Second, intercategorical intersectionality might overemphasise the individual process while ignoring the logical relationship between social identities (Choo and Ferree 2010). The social identities influencing female STEM students could have level differences, which might be subject to the macro-level (urban/rural, gender) and to the micro-level (family background, individual experience) logical structure. Methodologically, this paradigm can accommodate quantitative analysis (e.g., regression, analysis of variance [ANOVA], and *t* test), which allows capturing and comparing differences between social categories (Jha and Wharton 2023). Thus, we propose to use the final paradigm, systematic intersectionality, to address the structural limitation within the intercategorical process model for Chinese female STEM undergraduates.

Systematic Intersectionality

As social categories are an outcome of the social structure, the third intersectional paradigm pays attention to the structural impact on one's identity and experience (Weldon 2008). Discrimination caused by social categories are usually embedded within a complex social system (Walby 2009). From a systematic perspective, social identity represents the power structure determined by social institutions (Su 2016). When studying universities where female STEM students study, systematic

intersectionality pays attention to the impact of the Chinese higher education system and relevant policies on individuals. The specific application is to examine how a combination of systematic social policies interacts with STEM education to shape their unique experiences (Choo and Ferree 2010).

The most direct factor within the social structure is the educational policy. Beginning with the university selection process, the admission policies are often intertwined with regional differences. Specifically, college admission policies and quotas are based on the particular province. Because each province has its own version of the college entrance examination and admission quotas (Pu 2020), the difficulty of being admitted to a STEM major also varies province by province (Gaokao.net 2017). Thus, the provincial identity is connected to student access to STEM opportunities (Wu and Li 2017). For example, “ethnic minority” students do not get extra points in Shanxi province, thus reconstructing their identity priorities during the admission process (News163.com 2020). Once a female student gets admitted to a university, the university-specific STEM teaching curriculum directly influences their social experience (Peng, Gao, and Li 2017). Although Chinese STEM education in general has distinguishing structural features that embody the patrilineal society (Wang 2018), the individual institution might introduce a neoliberal teaching methodology to innovate the course structure and student development plan, which could equalise gender opportunities (Chen and Chen 2017; Wu et al. 2019). The intersection of the above-discussed admission and teaching policies at both the social and school level knits a web of systematic domination for Chinese female undergraduates from an educational perspective.

In addition to the educational policies, the industrial structure might present another type of institutional influence on female students. As China is experiencing technological upgrading from traditional industries to information science industries, the demand for manual labour is being steadily replaced by mental work (Mi 2018). Generally, the traditional genders in East Asian society are experiencing a gradual shift in STEM education in alignment with the local industrial development (Kelkar and Nathan 2002). Technology updates have been reflected in China by the reduced gender differences in economic returns based on educational years (Li and Pu 2019). Marked by regional differences, Chinese regions with higher added value industries produce less gender bias in the local job market (Li and Pu 2019). As a consequence, female STEM undergraduate students would face a different degree of discrimination due to the systematic industrial upgrade. Both educational policy and industrial structure could create interconnected systematic identities influencing their experience. For example, a female STEM student from a college with a less gender-biased STEM curriculum located in Zhong Guan Village (that is, “Chinese Silicon Valley”), would probably have a very different educational experience than her counterparts from a lower-tier college close to traditional factories.

Systematic intersectionality presents two limitations. First, it requires strong familiarity with the local social background (Choo and Ferree 2010). Because various education policies operate simultaneously in the same region, understanding the local situation can allow identifying which policy matters most for the research at hand. Second, it requires a strong understanding of the actual implementation of policy. Because university administrators in China are directly appointed by the government, they possess unchallenged power at their respective universities. Beyond that, the implementation of policy at each university mostly depends on the governing strategy of the individual administrator. Thus, variation between universities is considerable when it comes to how the same policy could impact students' life experiences.

In general, systematic intersectionality provides a paradigm to examine the structural influence outside the traditional social categories, such as “race”, gender, and class. Although it can organically combine the social policy emerging from institutional structure and individual experience, it requires deep understanding of the historical development of Chinese STEM education and the gender context. Methodologically, the paradigm can be coupled with strategies for analysing policy, including the difference-in-difference method, to evaluate how policy and the administrative structure may impact the students in question. Moreover, a variation in policy differences complicates the discussion of the gendered STEM education context and requires collaboration among scholars from different regions, which increases the difficulty of the research project.

Discussion

Rethink the Meaning of “Racial/Ethnic” Categories

In the past 100 years, definitions and understandings of the terms “race” and “ethnicity” have largely shifted from focusing on biological differences to focusing on their own social constructedness (Morning 2008). Especially after the Nazi defeat in World War II and the Civil Rights Movement in the United States, academia has gradually realised that categorising humans based on so-called genetic or physical characteristics lacks concrete evidence (Rattansi 2020). Even so, several neo-racist attempts have been staged to hierarchically categorise humans under the guise of recognising cultural differences (Balibar 2008).

Originating from the unique social experience of African American women, the paradigm of intersectionality fully embraces the notion that “racial” and “ethnic” categories are products of social constructions. In other words, these categories are not real, as scientific facts are; instead, their definitions are created in line with the historical or social environment. In the Chinese context, the concept of ethnicity is more prominent than the similar concept of “race”, which is also a relatively flexible social construction that originated from recent historical and political movements. For example, the modern categorisation of Manchu ethnicity after 1949 includes Han families who served in the Manchu military of the Qing Dynasty before 1912 (Zheng

2018). Moreover, current Chinese legislation allows individuals to choose their officially registered ethnic group based on the lineage of either parent, which has led to fluidity in ethnic identities due to social factors.

Because Chinese ethnic categories and identities are largely shaped by social reality and policy reality instead of so-called scientific truth, we argue that it is critical to consider policy changes when analysing women students in China who study STEM subjects in terms of intersectionality. As mentioned, in the college admissions process, Chinese government policy affords different levels of preferential treatment for ethnic minority groups based on their region. Usually, these varying levels allow ethnic minority students to receive several extra points on the *Gaokao* (that is, the national higher education entrance examination). These policies emerged due to economic differences between the majority ethnic group of Han and less dominated ethnic groups at the time of the founding of the People's Republic of China in 1949 (Xu 2023). However, the economic reform and urbanisation process since 1980 have gradually shifted the consideration of difference to regional axes and the urban-rural axis. For that reason, the recent amendment to those policies combines both economic and ethnic considerations. For example, Jiangxi province plans to cancel province-wide preferential treatment for ethnic minorities and limit them within several less-developed counties in 2023 (Xinhua News 2019). Because ethnically based preferential policies could change their coverage in the future, they could create distinctive social realities and maybe even new identities on the ethnic axis for women students studying STEM subjects in China. As such, future studies on these students need to carefully examine social context and the premise for policy at the local level prior to defining ethnic categories in the intersectional analysis.

Emerging Categories: Urban Development

Four decades of social reform have dramatically changed social life in China. One of the most notable changes is the rapid urbanisation, wherein boundaries of “urban areas” have been largely expanded into previously impoverished rural areas (Lu et al. 2023). This process has resulted in the reconstruction of “urban-rural” categories. When applying intersectionality to female STEM students in China, future research should pay attention to the potential fuzziness when categorising their social identities in urban areas. For example, many originally “rural” students and villagers might become “urban” residents overnight due to re-zoning policies from government (Wu 2017). However, their living style retains a certain degree of ruralness, which could cause trouble when they are placed in the existing urban-rural categories. Hence, scholars can develop new concepts, such as “half-urban residents” (Wang 2006), to better describe the categorisation of urbanicity in this process.

Moreover, the expansion of “cities” reconfigures the space order, which requires the intersectionality paradigm to investigate how these students interact with such change. The process usually involves relocation and demolition of established educational facilities, which could largely impact the students' academic pattern at all levels (Chen

and Zeng 2023; Yi and Wang 2021). As such, the spatial change could shape new academic aspirations and paths for female STEM students (Chen and Ao 2023). The intersectionality approach should examine how these students interact with the urbanisation process, and how such interaction creates new dilemmas and life experiences for them (Huang and Jiang 2020).

Conclusion

An intersectional framework can help to meet the mounting need to understand women undergraduates studying STEM subjects in China from their own perspectives. On the one hand, the traditional man-woman dichotomy oversimplifies their difficulties. On the other hand, intersectionality could greatly deepen investigations, each with their own unique focus. The intracategorical method is suited for understanding the internal differences, whereas the intercategory method can help to clarify the construction of identity that considers multiple social categories. Moreover, the systematic method can connect STEM education policy with the experience of individual women students. Although each intersectionality paradigm emphasises different aspects of social domination, they can also be applied jointly when examining complex scenarios in China's ever-changing society. For example, the combination of three intersectional paradigms could be applied to research on the life development of female college students from mainland China who study in the special administration region (SAR) of Hong Kong. While the intracategorical method can be used to investigate internal differences between these students, the intercategory and systematic methods can be applied to how administrative and immigration factors shape their own identity formation and life experience when they are subjected to policy control from both mainland China and Hong Kong SAR of China.

It is also important to note the applicability of intersectionality in the Chinese context. As an Americanised theory, intersectionality has been developed based on the assumption of the antithesis of "state versus society" (Zhang 2018). However, the Chinese boundary between state and society is relatively blurred, for Chinese society is often coordinated with the state to create networks of power (Zhang 2018). Thus, social categories for female students need to be configured based on the specific Chinese social context, especially when it comes to "ethnic" categories due to their strong associations with government policy. Applying the lens of intersectionality could also enhance economically oriented research by giving consideration to the specific social context. For example, the poverty line of female students from coastal and urban regions should be higher than for their counterparts from other regions as they might be relatively richer. In other words, intersectionality reveals that the categorisation of a person's socio-economic status should reflect their social environment. Often, state and society hierarchies reflect different aspects of the same power domination. For female STEM students, many of the social categories discussed above, including ones due to the urban-rural divide, and college admission policies are initiated by the government. Then, those

newly emerged social categories penetrate into the public sphere and are internalised by the students based on social interactions.

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