



Supervisor conscientiousness and professional identity for graduate students: A moderated mediation model

Xiaoyuan Chu^{1,*}, Alafate Litifu^{1,#}, Zhaoyi Zhu², Qing Tan¹, Shihao Ma¹, Jingyue Yu^{1,3}, Lipeng Yin⁴, Li Lei⁵ and Si Han^{6,*}

¹School of Economics and Management, Beijing University of Posts and Telecommunications, Beijing, China

²HSBC Business School, Peking University, Shenzhen, China

³Academic Affairs Office, The Open University of China, Beijing, China

⁴Department of Psychology, The University of Hong Kong, Hong Kong, China

⁵School of Education, Renmin University of China, Beijing, China

⁶School of Information Management for Law, China University of Political Science and Law, Beijing, China

*Correspondence: Si Han, hansi@cupl.edu.cn

#These authors are the co-first authors

Received: 19 November 2025; Accepted: 06 May 2026; Published: 30 June 2026

Abstract: This study examined the mediating role of perceived supervisor–student relationship quality and the moderating role of student extraversion in the relationship between supervisor conscientiousness and graduate students’ professional identity. A total of 450 graduate students completed surveys of supervisor conscientiousness, perceived supervisor–student relationship quality, professional identity, and extraversion. Results of a moderated mediation model testing showed that supervisor conscientiousness was associated with higher graduate students’ professional identity. Perceived supervisor–student relationship quality mediated this association, with higher supervisor conscientiousness linked to better perceived supervisor–student relationship quality, which in turn related to higher levels of professional identity. In addition, student extraversion moderated the link between supervisor conscientiousness and perceived relationship quality, such that this association was stronger among students low in extraversion. These findings extend social learning theory by showing that supervisors’ personality traits shape graduate students’ professional identity through relational mechanisms, while also indicating this process may operate through relationship-based need satisfaction, as proposed in self-determination theory. By implication, fostering conscientious supervisory practices and supportive relationships may facilitate professional identity development, particularly among students low in extraversion.

Keywords: Professional identity; supervisor conscientiousness; perceived supervisor–student relationship quality; extraversion; graduate students

Introduction

Supervisors’ supervisory practices, characterized by conscientiousness, may play a particularly important role in shaping professional conduct and clarifying expectations for graduate students. Conscientiousness positively correlates with perspective taking (Song & Shi, 2017), communication skills (Melchers et al., 2016), and interpersonal competence (Górska, 2011), making interactions with conscientious individuals more rewarding. Conceivably, through these supervisory interactions, characterized by productivity, responsibility, organization, and diligence, graduate students interpret, internalize, and construct their professional self-concepts. There is evidence to suggest that supervisor qualities and behaviors are associated with graduate students’ academic thriving (Wu et al., 2025). However, despite its potential relevance, the role of supervisor conscientiousness in graduate students’ professional identity formation remains largely unexplored. Addressing this gap, the present study develops and tests a moderated mediation model to clarify the role of the supervisor–student relationship quality and student personality traits in the relationship between supervisor conscientiousness and graduate students’ professional identity.

Supervisor conscientiousness and graduate students’ professional identity

Conscientious individuals are typically characterized by self-discipline, responsibility, reliability, and persistence in accomplishing tasks despite distractions (Roberts et al., 2014). In line with these characteristics, in the supervisory context, a supervisor’s conscientiousness is typically manifested in consistent and goal-directed supervisory behaviors that are observable to students, including organized planning of research activities, diligent and reliable engagement in academic guidance, sustained follow-through on supervisory responsibilities, efficient management of research-related tasks, and focused attention to students’ academic progress. Conscientious teachers are perceived as more cooperative, helpful (Aftab et al., 2018), and academically supportive (Kim et al., 2018), and students tend to favor them (Chamorro-Premuzic et al., 2008). Supervisors serve as role models in the academic lives of graduate students (Orer, 2020). Supervisors who display such qualities can therefore serve as positive role models for students, helping them recognize the importance of professional behaviors and thereby supporting their academic and



career development (Baldwin et al., 2017). A meta-analysis reveals that teachers' conscientiousness positively predicts teaching effectiveness across multiple outcomes, including student achievement (Klassen & Tze, 2014), thereby highlighting the critical role of this trait in fostering student development. Similarly, research with Chinese graduate students demonstrated that supervisor guidance is positively associated with graduate students' professional identity (Mao & Sui, 2018), underscoring the importance of supervisory behaviors in the development of students' professional identity. Taken together, these findings suggest that supervisor conscientiousness may be positively associated with graduate students' professional identity by fostering reliable guidance and professional role modeling.

Perceived supervisor–student relationship quality (PSSRQ) as a mediator

The perceived supervisor–student relationship quality (PSSRQ) is likely to play a crucial role in the association between supervisor conscientiousness and graduate students' professional identity. PSSRQ refers to graduate students' overall evaluation of their relationship with their supervisor, reflecting perceived trust, supportive commitment, understanding, and the supervisor's willingness to invest resources to facilitate students' research progress (Yu et al., 2017). Empirical studies provide indirect support for this theoretical account. Supervisor conscientiousness may enhance graduate students' PSSRQ. A meta-analysis shows that higher conscientiousness correlates with increased partner satisfaction in family settings (Malouff et al., 2010), and similar trends have been documented in professional settings (Yao et al., 2013). A high level of PSSRQ may in turn facilitate graduate students' professional identity development. Meta-analytic evidence shows that PSSRQ exerts a broad influence on students' attitudinal, behavioral, career-related, and health-related domains, including academic life (Eby et al., 2013). Extending this, empirical studies reveal that positive supervisor–student interactions and high-quality relationships enhance academic self-efficacy, improve learning adaptation, facilitate learning engagement, and strengthen professional identity (Wang et al., 2022; Wei & Chen, 2015; Zhu et al., 2025), while reducing academic procrastination (Wang et al., 2022). Although no empirical studies have directly tested the mediating effect of PSSRQ in linking supervisor conscientiousness to students' professional identity, existing evidence provides a basis for anticipating that supervisor conscientiousness may shape PSSRQ, which in turn contributes to the development of students' professional identity.

The moderating role of graduate students' personality traits

Previous studies have shown that lower extraversion is linked to higher relationship dissatisfaction (Dashineau et al., 2024; Körner & Altmann, 2023; Stroud et al., 2010) and diminished perceived relationship quality (Dant et al., 2013). Moreover, graduate students' extraversion, defined as the tendency to be talkative, energetic, and actively engaged in social interactions (John et al., 1991; John

& Srivastava, 1999), would likely moderate the association between antecedent factors and supervisor–student relationship quality. Extraversion is closely related to social engagement and emotionally responsive engagement in interpersonal interactions (John & Srivastava, 1999; Wilmot et al., 2019), making it a theoretically relevant boundary condition for differences in relationship quality perceptions under similar supervisory conditions. Conceivably, when supervisor conscientiousness is low, students low in extraversion may be less likely to thrive than their more extraverted counterparts. Extraverts and introverts differ systematically in both attention deployment and response modulation stages in the process of emotion regulation (Gross, 2001). Specifically, with regard to attention deployment, introverts tend to focus more on negative stimuli (Yuan et al., 2012) and exhibit slower redirection of their attention from these stimuli (Derryberry, 1987). In terms of response modulation, introverts are more vulnerable to negative events and have more difficulty managing negative emotions (Yuan et al., 2012).

Theoretical foundations

Social learning theory proposes that individuals acquire behaviors and attitudes by observing role models and internalizing symbolic interpretations of their actions (Bandura, 1977, 1986), particularly when they share close relationships (Bandura, 1977) or similarities (Bandura et al., 1961). Self-determination theory further posits that the internalization and identification of socially approved behaviors, attitudes, and norms depend on the satisfaction of basic psychological needs (Ryan & Deci, 2000). Among these needs, relatedness facilitates the internalization of extrinsic motivation (Zhang et al., 2010; Deci & Ryan, 2002) and supports the incorporation of professional standards into one's self-concept, thereby underpinning the development of professional identity (Fitzgerald, 2020; Simmonds & Dicks, 2018). Given that internalization typically occurs within close relationships (Lewis et al., 2025), high-quality supervisor–student relationships foster graduate students' sense of relatedness and belonging (Khosha et al., 2024; Matheka et al., 2025). Through these processes, students are more likely to develop a coherent professional identity (Hunter et al., 2007; Trede et al., 2012). Accordingly, PSSRQ functions as a relational pathway through which supervisors' conscientiousness, as expressed in day-to-day supervisory behaviors, is translated into the development of graduate students' professional identity. In addition, drawing on the process model of emotion regulation, extraverts and introverts differ systematically in stage-specific regulatory processes, leading to differential responses to adverse stimuli (Gross, 2001; Gross & John, 2003), thereby providing a theoretical basis for considering extraversion as a moderating variable in this study.

The Chinese context

In 2024, China had approximately 4.10 million postgraduate students enrolled (i.e., students currently in school) (Ministry of Education of the People's Republic of China, 2026), reflecting the scale of graduate education in China.

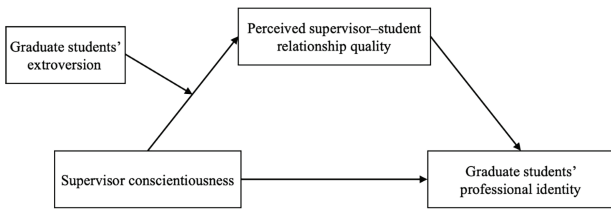


Figure 1. The proposed moderated mediation model

Chinese graduate students also demonstrate high major-employment alignment (Hu & Jiang, 2021), highlighting the critical role of professional identity in their career development (Mao & Sui, 2018). Accordingly, identifying key determinants of professional identity among Chinese graduate students is essential.

In the Chinese graduate single-supervisor system, supervisors occupy a structurally central role. In particular, the Shi-men structure, widely adopted in Chinese graduate education, denotes a supervisor-centered, quasi-familial academic community organized around a single supervisor, and has been identified as a key training practice shaping students' learning communities and research culture (Dai & Elliot, 2023). Within this semi-formal academic community, supervisors shape graduate students' academic aspirations and developmental trajectories (Liu & Dong, 2025) and serve as key agents of academic socialisation, facilitating students' integration into disciplinary communities through sustained interaction and cognitive engagement (Li et al., 2024). At the cultural level, these dynamics are rooted in Confucian traditions emphasizing hierarchy and authority, under which supervisors are more likely to be perceived as authoritative figures whose evaluations are likely to play an important role in shaping students' academic development and future opportunities (Zhuang & Kong, 2023). Consistent with this context, evidence from Chinese graduate student samples shows that supervisor support is positively associated with graduate students' creativity (Chang et al., 2025) and enhances their creative self-efficacy and innovative research behavior (Han et al., 2022), while the supervisor-student relationship promotes their academic aspirations and engagement in research learning (Zhang et al., 2024). Taken together, the Chinese context provides a particularly salient setting in which supervisor-related factors may exert an amplified influence on graduate students' professional development, including the formation of professional identity.

Goals of the Study

This study examines the mediating role of perceived supervisor-student relationship quality and the moderating role of student extraversion in the relationship between supervisor conscientiousness and graduate students' professional identity. Figure 1 presents the conceptual model. Specifically, three hypotheses were tested in this study:

- (H1) Supervisor conscientiousness is associated with higher levels of graduate students' professional identity;
- (H2) The PSSRQ mediates the positive association between supervisor conscientiousness and graduate students' professional identity, such that higher supervisor

Table 1. Demographic characteristics of participants

| Category | Frequency | Percent |
|------------------------|-----------|---------|
| Gender | | |
| Male | 232 | 51.56 |
| Female | 218 | 48.44 |
| Age (years) | | |
| 21 | 18 | 4.00 |
| 22 | 100 | 22.22 |
| 23 | 193 | 42.90 |
| 24 | 97 | 21.56 |
| 25 | 33 | 7.33 |
| 26-29 | 9 | 1.99 |
| Major | | |
| STEM | 380 | 84.44 |
| HSS | 70 | 15.56 |
| Degree type | | |
| Professional | 135 | 30.00 |
| Academic | 315 | 70.00 |
| Place of origin | | |
| Rural | 242 | 53.78 |
| Urban | 208 | 46.22 |

Note. N = 450; STEM, Science, Technology, Engineering, and Mathematics (here, Science refers specifically to natural sciences); HSS, Humanities and Social Sciences.

conscientiousness is associated with higher levels of PSSRQ, which in turn is associated with higher levels of professional identity;

(H3) Graduate students' extraversion moderates the indirect association between supervisor conscientiousness and graduate students' professional identity via PSSRQ, such that the positive association between supervisor conscientiousness and PSSRQ is stronger among students with lower levels of extraversion.

Method

Participants and setting

Study participants were 458 Chinese students. After removing cases with missing data using listwise deletion, the final analytical sample consisted of 450 graduate students. The sample comprised 232 males (51.56%) and 218 females (48.44%). The majority of participants (84.44%) were pursuing degrees in Science, Technology, Engineering, and Mathematics (STEM; here, Science refers specifically to natural sciences), while 15.56% were enrolled in programs related to Humanities and Social Sciences (HSS). Participants had an average age of 23.13 years (SD = 1.07), with ages ranging from 21 to 29 (see Table 1).

Measures

Professional identity

Professional identity was assessed using the 4-item professional identification scale developed by Lammers et al. (2013). All items were rated on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). An example statement is, 'I feel I have much in common with others in my profession.' Higher average scores reflect stronger professional identity. In the current study, the

professional identity scale demonstrated good reliability, with a Cronbach's α of 0.83.

Supervisor conscientiousness

Supervisor Conscientiousness was assessed using the conscientiousness subscale of the Big Five Inventory (John et al., 1991), which consists of 9 items. A sample item is, 'My supervisor is systematic, and likes to keep things in order.' Responses were rated on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). The average score across all items was calculated to represent supervisor conscientiousness, with higher scores indicating greater conscientiousness. The Cronbach's α coefficient for the conscientiousness subscale was 0.84 in the present study.

PSSRQ

The 7-item Supervisor–Student Relationship Quality Questionnaire developed in Chinese by Yu et al. (2017) was used to assess PSSRQ. An example item is, 'My supervisor understands my research interests, needs, and expertise very well.' Items were rated on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). The mean score of all items was calculated to represent PSSRQ, with higher scores indicating a more positive relationship. The Cronbach's α coefficient in the present study was 0.86.

Graduate students' extraversion

Graduate students' extraversion was assessed using an 8-item extraversion subscale of the Big Five Inventory (John et al., 1991). A sample item is, 'I am someone who is outgoing, sociable.' Items were rated on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). The mean score across all items was computed to represent extraversion, with higher scores indicating higher levels of extraversion. The Cronbach's α coefficient for the extraversion subscale was 0.72 in the present study. Item-level factor loadings, composite reliability, and average variance extracted for all measures are reported in Appendix A (Table A1).

Covariates

Gender and age were included as covariates throughout the analyses, consistent with common practice in prior research (Biehl et al., 2025; Wang & Jiang, 2025). Academic major was additionally controlled to account for potential disciplinary differences.

Procedure

This study was approved by the Human Research Committee of Beijing University of Posts and Telecommunications (BUPTSEM-LL-18011). Participants provided informed consent and were informed of the study's purpose and the voluntary nature of their participation. The survey was completed in class.

Statistical analysis

The mediating role of PSSRQ in the link between supervisor conscientiousness and professional identity was assessed using the PROCESS macro Model 4 (Hayes,

2013). Afterward, Model 7 of the PROCESS macro (Hayes, 2013) was applied to test the moderating effect of graduate students' extraversion on the first pathway of the mediation model. Before conducting the analyses, all continuous variables were standardized, and interaction terms were computed based on these standardized scores. A bootstrapping procedure with 5000 resamples was employed, providing bias-corrected 95% confidence intervals to assess the significance of the effects. To further clarify the interaction effect between supervisor conscientiousness and students' extraversion on PSSRQ, a simple slopes analysis was performed. All analyses were conducted using IBM SPSS Statistics (Version 29.0) with the PROCESS macro (Version 4.1). Variance inflation factors (VIFs) were examined to assess potential multicollinearity among predictors in each regression equation of the PROCESS Model 7 analysis. All VIF values ranged from 1.01 to 1.14, indicating no multicollinearity concerns.

Check for common method bias

To assess potential common method bias, Harman's single-factor test was conducted using exploratory factor analysis. In addition, a single-factor confirmatory factor analysis (CFA) was performed as a supplementary check. The unrotated exploratory factor analysis showed that the first principal component accounted for 22.59% of the variance, well below the 50% threshold (Podsakoff & Organ, 1986). The single-factor CFA also demonstrated poor model fit ($\chi^2/df = 7.05$, RMSEA = 0.12, CFI = 0.40, TLI = 0.36), suggesting that common method bias was unlikely to be a serious concern.

Results

Preliminary analysis

Table 2 presents the means, standard deviations, and correlations among the study variables. The findings revealed that supervisor conscientiousness was positively associated with students' professional identity. Moreover, PSSRQ was positively linked to both supervisor conscientiousness and graduate students' professional identity. Prior to hypothesis testing, the assumptions of regression analyses, including linearity, normality, and homoscedasticity, were examined and found to be satisfactory. Detailed diagnostic results are provided in Appendix A (Table A2 and Figures A1–A6).

Supervisor conscientiousness, PSSRQ, and students' professional identity

To examine the hypothesized mediation model involving supervisor conscientiousness, PSSRQ, and students' professional identity, PROCESS macro Model 4 (Hayes, 2013) was utilized. Using this model, the total association between supervisor conscientiousness and graduate students' professional identity was firstly estimated. As shown in Table 3 (Model 1), supervisor conscientiousness was positively associated with professional identity ($b = 0.21$, $p < 0.001$), providing support for H1.

The mediating role of PSSRQ

Building on this main effect, supervisor conscientiousness showed a positive association with PSSRQ ($b = 0.33$,

Table 2. Descriptive statistics and correlations

| | | <i>M</i> | <i>SD</i> | 1 | 2 | 3 | 4 |
|----|-------|----------|-----------|---------|---------|---------|---|
| 1. | PI | 3.72 | 0.56 | 1 | | | |
| 2. | SC | 3.89 | 0.63 | 0.19*** | 1 | | |
| 3. | PSSRQ | 3.25 | 0.68 | 0.35*** | 0.32*** | 1 | |
| 4. | GSE | 3.04 | 0.57 | 0.20*** | 0.10* | 0.19*** | 1 |

Note. *N* = 450; PI, professional identity; SC, supervisor conscientiousness; PSSRQ, perceived supervisor–student relationship quality; GSE, graduate students’ extraversion. **p* < 0.05, ****p* < 0.001.

Table 3. The mediating rolw of PSSRQ in the relationship between supervisor conscientiousness and professional identify

| Predictor | Model 1: PI | | | Model 2: PSSRQ | | | Model 3: PI | | |
|-----------------------|-------------|-----------|----------|----------------|-----------|----------|-------------|-----------|----------|
| | <i>b</i> | <i>SE</i> | <i>t</i> | <i>b</i> | <i>SE</i> | <i>t</i> | <i>b</i> | <i>SE</i> | <i>t</i> |
| Gender | −0.24 | 0.10 | −2.50* | −0.10 | 0.09 | −1.10 | −0.21 | 0.09 | −2.27* |
| Age | −0.04 | 0.05 | −0.75 | 0.01 | 0.05 | 0.28 | −0.04 | 0.05 | −0.87 |
| Major | 0.18 | 0.14 | 1.35 | 0.17 | 0.13 | 1.29 | 0.13 | 0.13 | 1.00 |
| SC | 0.21 | 0.05 | 4.41*** | 0.33 | 0.05 | 7.35*** | 0.10 | 0.05 | 2.17* |
| PSSRQ | | | | | | | 0.31 | 0.05 | 6.64*** |
| <i>R</i> ² | | 0.06 | | | 0.12 | | | 0.15 | |
| <i>F</i> | | 4.03*** | | | 8.27*** | | | 9.39*** | |

Note. *N* = 450; PI, professional identity; SC, supervisor conscientiousness; PSSRQ, perceived supervisor–student relationship quality. Gender was dummy coded as 0 for male and 1 for female. Major was dummy coded as 0 for Science, Technology, Engineering, and Mathematics (STEM; here, Science refers specifically to natural sciences) and 1 for Humanities and Social Sciences (HSS). ****p* < 0.001, **p* < 0.05.

p < 0.001), and PSSRQ was positively associated with students’ professional identity (*b* = 0.31, *p* < 0.001). Additionally, the bias-corrected Bootstrap test confirmed the significance of the indirect pathway from supervisor conscientiousness to students’ professional identity through PSSRQ (indirect effect = 0.10, *SE* = 0.03, 95% CI [0.05, 0.16]). Importantly, a statistically significant direct effect was also observed between supervisor conscientiousness and students’ professional identity (direct effect = 0.10, *SE* = 0.05, 95% CI [0.01, 0.19]). Therefore, these findings support H2, demonstrating that PSSRQ partially mediates the association between supervisor conscientiousness and graduate students’ professional identity.

Testing for moderated mediation

H3 proposed that students’ extraversion moderates the first pathway of the mediation model, specifically the relationship between supervisor conscientiousness and students’ professional identity, with PSSRQ as a mediating variable. To evaluate this hypothesis, PROCESS macro Model 7 (Hayes, 2013) was applied, with the results shown in Table 4. The results indicated that graduate students’ extraversion was not only positively associated with PSSRQ (*b* = 0.15, *p* < 0.001), but also significantly moderated the association between supervisor conscientiousness and PSSRQ (*b* = −0.12, *p* < 0.01). The moderated mediation model was further validated by the bias-corrected bootstrap results (index of moderated mediation = −0.04, *SE* = 0.02, 95% CI [−0.08,

−0.01]). These results suggest that the strength of the mediating association via PSSRQ varies as a function of graduate students’ extraversion. To further elucidate, we plotted supervisor conscientiousness against PSSRQ (see Figure 2) for two groups of graduate students: those with high extraversion (defined as 1 *SD* above the mean) and those with low extraversion (defined as 1 *SD* below the mean). Simple slope analyses revealed that the positive relationship between supervisor conscientiousness and PSSRQ was stronger among students with low extraversion levels (*b*_{simple} = 0.43, *t* = 6.89, *p* < 0.001) compared to those with high extraversion levels (*b*_{simple} = 0.19, *t* = 2.85, *p* < 0.01). Consistent with this pattern, conditional indirect effect analyses showed that at low levels of extraversion (1 *SD* below the mean), the indirect effect of supervisor conscientiousness on professional identity via PSSRQ was stronger (indirect effect = 0.13, 95% CI [0.07, 0.21]). By comparison, at high levels of extraversion (1 *SD* above the mean), the indirect effect was weaker but remained significant (indirect effect = 0.06, 95% CI [0.01, 0.11]). Collectively, these findings supported H3.

Discussion

Supervisor conscientiousness is associated with higher graduate students’ professional identity. This finding aligns with social learning theory, which posits that modeling facilitates learning through their informative functions, leading observers to acquire symbolic representations of

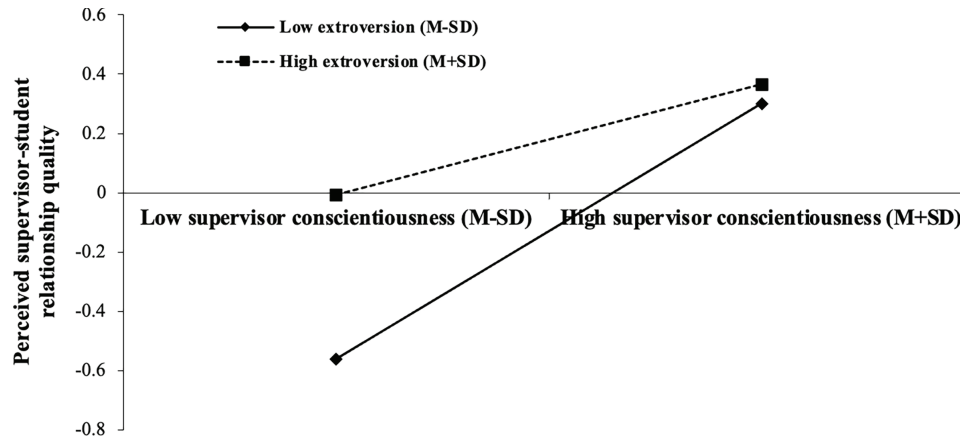


Figure 2. Simple slope tests

Table 4. Testing the moderated mediation model

| Predictor | Model: PSSRQ | | |
|-----------------------|--------------|-----------|----------|
| | <i>b</i> | <i>SE</i> | <i>t</i> |
| Gender | -0.08 | 0.09 | -0.87 |
| Age | 0.01 | 0.05 | 0.32 |
| Major | 0.13 | 0.13 | 1.03 |
| SC | 0.31 | 0.04 | 6.91*** |
| GSE | 0.15 | 0.04 | 3.47*** |
| SC × GSE | -0.12 | 0.05 | -2.66** |
| <i>R</i> ² | | 0.15 | |
| <i>F</i> | | 8.69*** | |

Note. *N* = 450; PI, professional identity; SC, supervisor conscientiousness; PSSRQ, perceived supervisor-student relationship quality; GSE, graduate students' extraversion. Gender was dummy coded as 0 for male and 1 for female. Major was dummy coded as 0 for Science, Technology, Engineering, and Mathematics (STEM; here, Science refers specifically to natural sciences) and 1 for Humanities and Social Sciences (HSS). Table 4 reports the first-stage moderated regression predicting PSSRQ; the regression predicting professional identity is identical to that reported in Table 3 and is therefore not repeated to avoid redundancy. ****p* < 0.001, ***p* < 0.01.

modelled activities (Bandura, 1977, 1986). Besides, learning is more probable when the role model shares a close relationship with the observer (Bandura, 1977), or exhibits similarities (Bandura et al., 1961). Hence, supervisors who often engage in extensive interactions and work in the same research field with graduate students are anticipated to act as role models in students' academic lives (Orer, 2020). Although a previous study found a positive correlation between supervisor guidance and the graduate students' professional identity (Mao & Sui, 2018), this research represents the first empirical study to confirm the positive linkage between supervisor conscientiousness and graduate students' professional identity. Notably, the magnitude of this association was modest, which is theoretically expected given that professional identity is a complex and long-term developmental construct shaped by multiple socialization agents and contextual influences.

Taken together, these findings suggest that supervisor conscientiousness plays a meaningful, albeit partial, role in shaping graduate students' professional identity. Considering that high supervisor conscientiousness may facilitate graduate students' professional identity, supervisors are encouraged to enhance their sense of responsibility and maintain consistent engagement in academic guidance, especially when supervising students.

Building on this direct association, the findings further suggest an underlying relational mechanism, whereby PSSRQ mediates the association between supervisor conscientiousness and graduate students' professional identity. Supervisors who are more conscientious tend to cultivate stronger and more supportive relationships with their students. These high-quality relationships, in turn, are associated with greater professional identity development for students. This finding is consistent with prior evidence that conscientious individuals exhibit better interpersonal skills (Górska, 2011; Melchers et al., 2016; Song & Shi, 2017), and these skills may foster more supportive supervisory relationships in academic contexts (Aftab et al., 2018; Kim et al., 2018). Importantly, earlier research has mainly emphasized the detrimental consequences of poor supervisory relationships. For example, abusive supervision has been linked to severe risks such as suicidal ideation among graduate students (Yao et al., 2023). By contrast, the present findings highlight the beneficial role of positive supervisory relationships in supporting students' professional identity. This finding also aligns with evidence from occupational research indicating that supportive supervisory perceptions are positively associated with vocational identity (Chen & Zhang, 2020) and work engagement (Heyns et al., 2021), suggesting that such perceptions are linked to the development of professional identity across different contexts. By clarifying this mediating pathway, the study contributes novel evidence regarding how and why supervisor conscientiousness is related to graduate students' professional identity.

In addition to identifying this mediating mechanism, the findings also indicate a boundary condition, such that lower extraversion is associated with poorer PSSRQ and strengthens the negative association between low supervisor conscientiousness and PSSRQ. To our knowledge, little previous research has investigated personality-based

moderators in this link, which makes the present findings an important extension. These results are consistent with emotion regulation theory (Gross, 2001; Gross & John, 2003). Prior studies have shown that introverts focus more on negative stimuli (Yuan et al., 2012), disengage from them more slowly (Derryberry, 1987), and are more vulnerable to adverse events (Yuan et al., 2012). In addition, meta-analytic evidence indicates that individuals low in extraversion are less likely to use adaptive strategies such as reappraisal and more likely to rely on suppression (Barańczuk, 2019), a strategy that carries interpersonal costs (Chervonsky & Hunt, 2017; Gross, 2001; Gross & John, 2003; Yan et al., 2022). Taken together, these mechanisms may help explain why the detrimental impact of low supervisor conscientiousness on relationship quality was particularly pronounced among introverted students.

Implications for theory, research and practice

The findings extend theoretical understanding by revealing both the process mechanism and boundary conditions of how supervisor traits affect students' professional identity, while also offering practical implications for fostering identity development in graduate education. Importantly, the observed associations were modest in magnitude, suggesting that supervisor conscientiousness represents one contributory factor among multiple individual, relational, and contextual influences shaping graduate students' professional identity. Moreover, the strength of these associations may vary across disciplinary, institutional, and graduate training environments, underscoring the context-dependent nature of the present findings and cautioning against overgeneralization.

Building on this, the findings further clarify the underlying mechanism. To our knowledge, this is among the first studies to test this mediating model, thereby addressing a notable gap in the literature. These findings not only extend theoretical understanding of professional identity formation, consistent with self-determination theory's emphasis on relatedness (Ryan & Deci, 2000; Deci & Ryan, 2002; Zhang et al., 2010), but also offer practical guidance for fostering graduate students' development through supportive supervisory relationships. Moreover, they underscore the need for graduate programs to provide training and institutional support to supervisors so as to cultivate constructive supervisory relationships that promote students' professional growth and well-being. At the same time, the indirect effect through PSSRQ was modest, indicating that relationship quality represents one theoretically grounded pathway among several potential mechanisms linking supervisor characteristics to professional identity. Alternative explanations cannot be ruled out. For instance, the observed associations may partly reflect reciprocal processes or broader contextual influences operating at the program level.

The findings also identify an important boundary condition. These findings highlight graduate students' extraversion as a meaningful boundary condition, clarifying for whom supervisor conscientiousness is more strongly associated with perceived supervisor-student relationship quality. From a practical perspective, graduate programs should provide targeted support for introverted

students supervised by less conscientious faculty. Such support may operate at both the individual and structural levels, for example by offering training in adaptive emotion regulation strategies and by implementing structured mentoring arrangements, such as co-supervision or committee-based guidance.

Limitations and future directions

This study develops a theoretical model to explain the relationship between supervisor conscientiousness and graduate students' professional identity. Despite its contributions, there are some limitations. Firstly, this study solely focused on the influence of supervisor conscientiousness, while other personality traits, along with the cognition, emotion, or behaviors of the supervisor, could also be critical for the development of graduate students' professional identity. Therefore, the conclusions should be interpreted as reflecting the specific role of supervisor conscientiousness, rather than a comprehensive account of all supervisory characteristics that may shape graduate students' professional identity. Secondly, further studies are necessary to fully clarify the mechanisms connecting supervisor conscientiousness with the professional identity of graduate students by exploring additional mediators. Specifically, we primarily focused on the need for relatedness according to self-determination theory (Ryan & Deci, 2000), highlighting the PSSRQ as a key mediator. Accordingly, the mediating pathway identified here should be viewed as one theoretically grounded mechanism, and additional mediators may operate in parallel to further explain the association. Future research can enhance our model by exploring the potential roles of competence and autonomy. Thirdly, the cross-sectional design of this study limits the ability to draw causal inferences regarding the observed relationships. Accordingly, the findings should be interpreted in terms of theoretically informed associations rather than causal effects. Future longitudinal or experimental studies would be valuable for examining temporal ordering and strengthening causal interpretations. Fourthly, supervisor conscientiousness was assessed using student-reported observer ratings, which reflect students' perceptions of their supervisors' personality traits. Although observer ratings have been shown to be informative in prior research (Srivastava et al., 2010), reliance on a single data source may still introduce potential response bias. Future research could strengthen measurement robustness by incorporating multi-source assessments, such as supervisor self-reports or peer evaluations. Finally, the sample was drawn from three universities located in Beijing, and STEM majors as well as academic degree programs were overrepresented. This sampling characteristic may limit the generalizability of the findings to non-STEM fields, professional degree programs, and graduate students from other regions or cultural contexts. In the broader context of graduate education in China, national statistics indicate that STEM disciplines constitute a relatively large proportion of graduate enrolment (Ministry of Education of the People's Republic of China, 2023). Nevertheless, the proportion of STEM students in the present sample exceeded national averages. Therefore, caution is warranted when extending the findings to

non-STEM populations. Future research should employ more diverse and representative samples and conduct systematic comparisons across STEM and non-STEM fields, degree types, and educational and cultural contexts, including direct comparisons between STEM- and non-STEM-oriented higher education institutions, to enhance the external validity of the conclusions.

Conclusion

This study developed a moderated mediation framework to clarify how supervisor conscientiousness contributes to graduate students' professional identity by identifying relational mechanisms and individual boundary conditions. Overall, the findings indicate that supervisor conscientiousness is positively associated with graduate students' professional identity through PSSRQ, and that the association between supervisor conscientiousness and PSSRQ is moderated by students' extraversion, with this indirect effect being more pronounced among students low in extraversion (i.e., more introverted students). From a theoretical perspective, these findings extend research on professional identity development by clarifying the relational mechanism through which supervisor conscientiousness is associated with graduate students' professional identity, as well as the individual boundary condition under which this mechanism is strengthened or weakened. Together, these insights advance understanding of both how and when supervisory characteristics are differentially associated with graduate students' professional identity within graduate training contexts. Practically, the results underscore the importance of fostering conscientious supervisory practices and high-quality supervisor–student relationships in graduate education. They further suggest that targeted support may be particularly beneficial for introverted students, who appear more sensitive to variations in supervisory conscientiousness. Together, these insights offer actionable implications for graduate supervision and mentoring practices aimed at promoting students' professional identity development.

Acknowledgement: The authors would like to thank Ms. Fen Zou, who provided assistance in collecting data. We thank all the participants who contributed to this study by providing important personal data.

Funding Statement: This study was supported by the Postgraduate Education and Teaching Reform and Research Project of Beijing University of Posts and Telecommunications (Grant No. 2021Y034); the China Scholarship Council (Grant No. 202406470101); and the Fundamental Research Funds for the Central Universities, Research Innovation Project of China University of Political Science and Law (Grant No. 10823544).

Author Contributions: Conceptualization, Xiaoyuan Chu, Si Han; Methodology, Xiaoyuan Chu; Investigation, Xiaoyuan Chu; Formal analysis, Alafate Litifu;

Writing—Original Draft, Xiaoyuan Chu and Alafate Litifu; Writing—Reviewing and Editing, Xiaoyuan Chu, Alafate Litifu, Zhaoyi Zhu, Qing Tan, Shihao Ma, Jingyue Yu, Lipeng Yin, Li Lei, Si Han. Xiaoyuan Chu and Alafate Litifu share first authorship. All authors reviewed and approved the final version of the manuscript.

Availability of Data and Materials: The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Ethics Approval: The materials and procedures were approved by the Human Research Committee of School of Economics and Management, Beijing University of Posts and Telecommunications (BUPTSEM-LL-18011). Informed consent was obtained from all participants.

Conflicts of Interest: The authors declare no conflicts of interest.

Appendix A. Supplementary Statistical and Measurement Information

Table A1. Item-level factor loadings and reliability statistics for study variables

| Variables and items | Factor loading | Cronbach's α | CR | AVE |
|---------------------|----------------|---------------------|------|------|
| PI | | 0.83 | 0.83 | 0.56 |
| PI1 | 0.72 | | | |
| PI2 | 0.84 | | | |
| PI3 | 0.87 | | | |
| PI4 | 0.81 | | | |
| SC | | 0.84 | 0.83 | 0.55 |
| SC1 | 0.70 | | | |
| SC2 | 0.50 | | | |
| SC3 | 0.70 | | | |
| SC4 | 0.62 | | | |
| SC5 | 0.63 | | | |
| SC6 | 0.70 | | | |
| SC7 | 0.78 | | | |
| SC8 | 0.71 | | | |
| SC9 | 0.63 | | | |
| PSSRQ | | 0.86 | 0.87 | 0.48 |
| PSSRQ1 | 0.63 | | | |
| PSSRQ2 | 0.75 | | | |
| PSSRQ3 | 0.81 | | | |
| PSSRQ4 | 0.72 | | | |
| PSSRQ5 | 0.80 | | | |
| PSSRQ6 | 0.75 | | | |
| PSSRQ7 | 0.72 | | | |
| GSE | | 0.72 | 0.64 | 0.40 |
| GSE1 | 0.72 | | | |
| GSE2 | 0.60 | | | |
| GSE3 | 0.47 | | | |
| GSE4 | 0.58 | | | |
| GSE5 | 0.60 | | | |
| GSE6 | 0.45 | | | |
| GSE7 | 0.44 | | | |
| GSE8 | 0.78 | | | |

Note. $N = 450$; PI, professional identity; SC, supervisor conscientiousness; PSSRQ, perceived supervisor–student relationship quality; GSE, graduate students' extraversion; CR, composite reliability; AVE, average variance extracted.

Table A2. Skewness and kurtosis statistics for study variables

| Variables | Skewness | SE of skewness | Kurtosis | SE of kurtosis |
|-----------|----------|----------------|----------|----------------|
| PI | -0.30 | 0.12 | 1.16 | 0.23 |
| SC | -0.14 | 0.12 | -0.60 | 0.23 |
| PSSRQ | -0.37 | 0.12 | 0.93 | 0.23 |
| GSE | 0.25 | 0.12 | -0.83 | 0.23 |

Note. $N = 450$; PI, professional identity; SC, supervisor conscientiousness; PSSRQ, perceived supervisor–student relationship quality; GSE, graduate students’ extraversion. Skewness values within ± 2 and kurtosis values within ± 7 indicate no severe departures from normality.

Regression diagnostics for the mediator equation (PROCESS Model 7: PSSRQ as mediator)

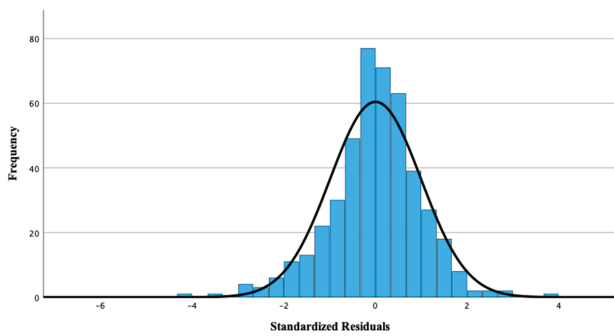


Figure A1. Histogram of standardized residuals for the mediator equation. *Note.* The distribution is approximately symmetric and centered around zero, indicating no substantial departures from normality.

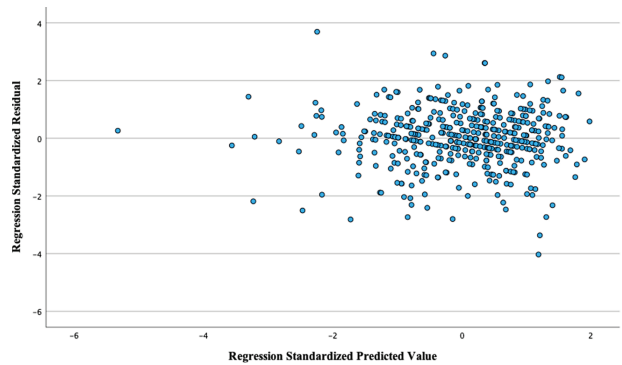


Figure A3. Residuals vs. predicted values for the mediator equation. *Note.* Residuals are randomly scattered around the zero line with no clear curvature or funnel-shaped pattern, supporting linearity and homoscedasticity.

Regression diagnostics for the outcome equation (PROCESS Model 7: Professional identity as outcome)

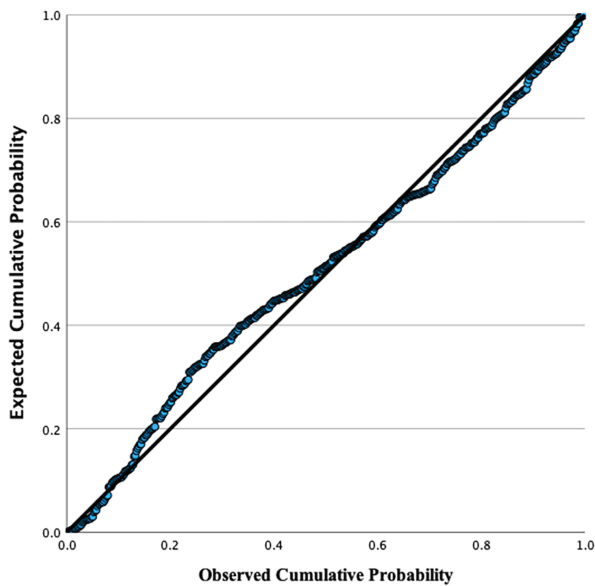


Figure A2. Normal P–P plot of standardized residuals for the mediator equation. *Note.* Points lie close to the diagonal line, indicating that the residuals are approximately normally distributed.

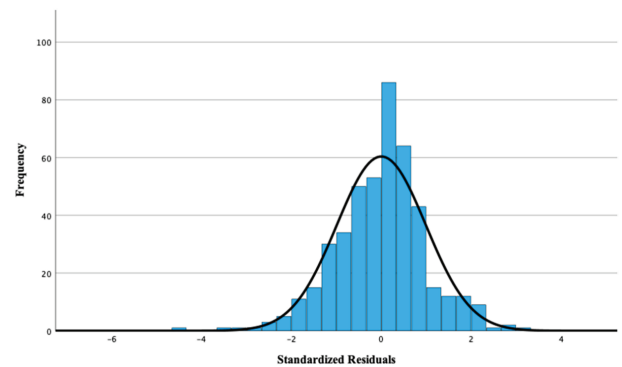


Figure A4. Histogram of standardized residuals for the outcome equation. *Note.* The distribution is approximately symmetric and centered around zero, indicating no substantial departures from normality.

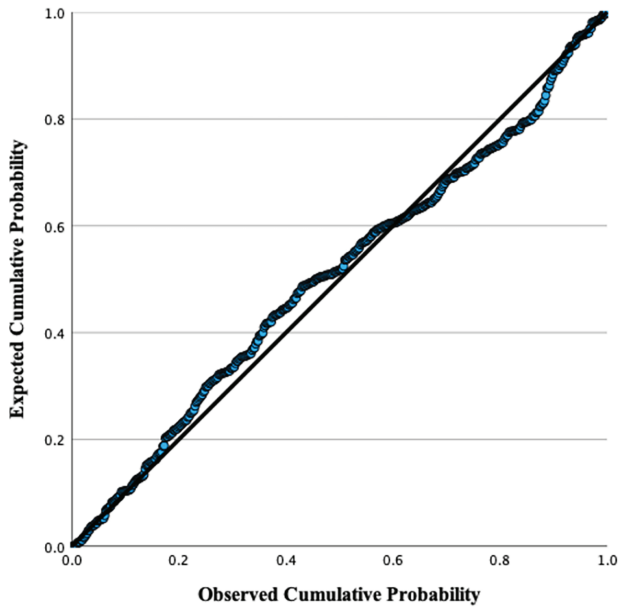


Figure A5. Normal P-P plot of standardized residuals for the outcome equation. *Note.* Points lie close to the diagonal line, indicating that the residuals are approximately normally distributed.

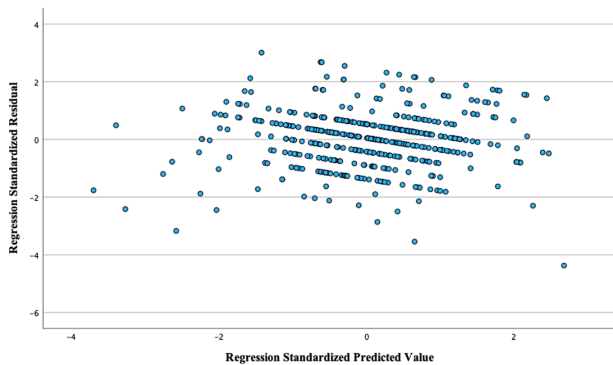


Figure A6. Residuals vs. predicted values for the outcome equation. *Note.* Residuals are randomly scattered around the zero line with no clear curvature or funnel-shaped pattern, supporting linearity and homoscedasticity.

References

- Aftab, N., Rashid, S., & Ali Shah, S. A. (2018). Direct effect of extraversion and conscientiousness with interactive effect of positive psychological capital on organizational citizenship behavior among university teachers. *Cogent Psychology*, *5*(1), 1514961. <https://doi.org/10.1080/23311908.2018.1514961>
- Baldwin, A., Mills, J., Birks, M., & Budden, L. (2017). Reconciling professional identity: A grounded theory of nurse academics' role modeling for undergraduate students. *Nurse Education Today*, *59*(4), 1–5. <https://doi.org/10.1016/j.nedt.2017.08.010>
- Bandura, A. (1977). *Social learning theory*. Englewood Cliffs, NJ, USA: Prentice-Hall.
- Bandura, A. (1986). *Social foundations of thought and action: a social cognitive theory*. Englewood Cliffs, NJ, USA: Prentice-Hall.
- Bandura, A., Ross, D., & Ross, S. A. (1961). Transmission of aggression through imitation of aggressive models. *The Journal of Abnormal and Social Psychology*, *63*(3), 575–582. <https://doi.org/10.1037/h0045925>
- Barańczuk, U. (2019). The five factor model of personality and emotion regulation: A meta-analysis. *Personality and Individual Differences*, *139*(1), 217–227. <https://doi.org/10.1016/j.paid.2018.11.025>
- Biehl, V., Bänziger, A., & Wieber, F. (2025). A longitudinal study on the professional identity formation of health promotion practitioners: Evidence from undergraduate students in Switzerland. *Frontiers in Medicine*, *12*, 1491467. <https://doi.org/10.3389/fmed.2025.1491467>
- Chamorro-Premuzic, T., Furnham, A., Christopher, A. N., Garwood, J., & Martin, G. N. (2008). Birds of a feather: Students' preferences for lecturers' personalities as predicted by their own personality and learning approaches. *Personality and Individual Differences*, *44*(4), 965–976. <https://doi.org/10.1016/j.paid.2007.10.032>
- Chang, Q., Han, H., & Hu, D. (2025). Meta-analysis of supervisor support and postgraduate creativity: Evidence from a sample of Chinese students. *Frontiers in Education*, *10*, 1490322. <https://doi.org/10.3389/educ.2025.1490322>
- Chen, N., & Zhang, L. (2020). Mediating role of meaningful work and vocational identity on the relationship between perceived family supportive supervisor behaviour and career satisfaction. *Journal of Psychology in Africa*, *30*(4), 295–299. <https://doi.org/10.1080/14330237.2020.1796024>
- Chervonsky, E., & Hunt, C. (2017). Suppression and expression of emotion in social and interpersonal outcomes: A meta-analysis. *Emotion*, *17*(4), 669–683. <https://doi.org/10.1037/emo0000270>
- Dai, K., & Elliot, D. L. (2023). Shi men' as key doctoral practice: Understanding international doctoral students' learning communities and research culture in China. *Oxford Review of Education*, *49*(5), 588–603. <https://doi.org/10.1080/03054985.2022.2123309>
- Dant, R. P., Weaven, S. K., & Baker, B. L. (2013). Influence of personality traits on perceived relationship quality within a franchisee-franchisor context. *European Journal of Marketing*, *1*(2), 279–302. <https://doi.org/10.1108/030905613111285556>
- Dashineau, S., Napolitano, S., & South, S. C. (2024). The association between personality, relationship satisfaction, and psychopathology in a three-wave, longitudinal study. *Journal of Personality*, *92*(6), 1541–1555. <https://doi.org/10.1111/jopy.12910>
- Deci, E. L., & Ryan, R. M. (Eds.) (2002). *Handbook of self-determination research*. Rochester, NY, USA: University of Rochester Press.
- Derryberry, D. (1987). Incentive and feedback effects on target detection: A chronometric analysis of Gray's model of temperament. *Personality and Individual Differences*, *8*(6), 855–865. [https://doi.org/10.1016/0191-8869\(87\)90137-1](https://doi.org/10.1016/0191-8869(87)90137-1)
- Eby, L. T. D. T., Allen, T. D., Hoffman, B. J., Baranik, L. E., Sauer, J. B., et al. (2013). An interdisciplinary meta-analysis of the potential antecedents, correlates, and consequences of protégé perceptions of mentoring. *Psychological Bulletin*, *139*(2), 441–476. <https://doi.org/10.1037/a0029279>
- Fitzgerald, A. (2020). Professional identity: A concept analysis. *Nursing Forum*, *55*(3), 447–472. <https://doi.org/10.1111/nuf.12450>
- Gross, J. J. (2001). Emotion regulation in adulthood: Timing is everything. *Current Directions in Psychological Science*, *10*(6), 214–219. <https://doi.org/10.1111/1467-8721.00152>
- Gross, J. J., & John, O. P. (2003). Individual differences in two emotion regulation processes: Implications for affect, relationships, and well-being. *Journal of Personality and Social Psychology*, *85*(2), 348–362. <https://doi.org/10.1037/0022-3514.85.2.348>

- Górska, M. (2011). Psychometric properties of the polish version of the interpersonal competence questionnaire (ICQ-R). *European Journal of Psychological Assessment, 27*(3), 186–192. <https://doi.org/10.1027/1015-5759/a000066>
- Han, J., Liu, N., & Wang, F. (2022). Graduate students' perceived supervisor support and innovative behavior in research: The mediation effect of creative self-efficacy. *Frontiers in Psychology, 13*, 875266. <https://doi.org/10.3389/fpsyg.2022.875266>
- Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. New York, NY, USA: Guilford Press.
- Heyns, M. M., McCallaghan, S., & Senne, O. W. (2021). Supervisor support and work engagement: The mediating role of psychological safety in a post-restructuring business organisation. *Journal of Psychology in Africa, 31*(2), 140–144. <https://doi.org/10.1080/14330237.2021.1903180>
- Hu, Y., & Jiang, C. (2021). The effect of major matching on the starting salary of college graduates: An empirical research based on propensity score matching method. *Journal of East China Normal University (Educational Sciences), 39*(4), 53–63. <https://doi.org/10.16382/j.cnki.1000-5560.2021.04.005>
- Hunter, A.-B., Laursen, S. L., & Seymour, E. (2007). Becoming a scientist: The role of undergraduate research in students' cognitive, personal, and professional development. *Science Education, 91*(1), 36–74. <https://doi.org/10.1002/sce.20173>
- John, O. P., Donahue, E. M., & Kentle, R. L. (1991). *The big five inventory—versions 4a and 54*. Berkeley, CA, USA: Institute of Personality and Social Research, University of California.
- John, O. P., & Srivastava, S. (1999). The big five trait taxonomy: History, measurement, and theoretical perspectives. In: Pervin, L. A., John, O. P. (Eds.), *Handbook of personality: Theory and research* (2nd ed., pp.102–138). New York, NY, USA: Guilford Press.
- Khosa, A., Wilkin, C., & Burch, S. (2024). PhD students' relatedness, motivation, and well-being with multiple supervisors. *Accounting Education, 33*(2), 131–163. <https://doi.org/10.1080/09639284.2023.2179889>
- Kim, L. E., Dar-Nimrod, I., & MacCann, C. (2018). Teacher personality and teacher effectiveness in secondary school: Personality predicts teacher support and student self-efficacy but not academic achievement. *Journal of Educational Psychology, 110*(3), 309–323. <https://doi.org/10.1037/edu0000217>
- Klassen, R. M., & Tze, V. M. C. (2014). Teachers' self-efficacy, personality, and teaching effectiveness: A meta-analysis. *Educational Research Review, 12*(4), 59–76. <https://doi.org/10.1016/j.edurev.2014.06.001>
- Körner, R., & Altmann, T. (2023). Personality is related to satisfaction in friendship dyads, but similarity is not: Understanding the links between the Big Five and friendship satisfaction using actor-partner interdependence models. *Journal of Research in Personality, 107*(1), 104436. <https://doi.org/10.1016/j.jrp.2023.104436>
- Lammers, J. C., Atouba, Y. L., & Carlson, E. J. (2013). Which identities matter? A mixed-method study of group, organizational, and professional identities and their relationship to burnout. *Management Communication Quarterly, 27*(4), 503–536. <https://doi.org/10.1177/0893318913498824>
- Lewis, A., Jamieson, J., & Smith, C. A. (2025). Professional identity formation in allied health: A systematic review with narrative synthesis. *Teaching and Learning in Medicine, 37*(1), 24–40. <https://doi.org/10.1080/10401334.2023.2290608>
- Li, C., Kong, W., & Gao, X. S. (2024). International doctoral students' academic socialisation in China: A social network analysis. *Research Papers in Education, 39*(2), 301–323. <https://doi.org/10.1080/02671522.2022.2125056>
- Liu, L., & Dong, X. (2025). Family, enterprise, academic team? The influence of Shi-men culture on the academic aspirations of postgraduates in Chinese research universities. *Higher Education Research & Development, 44*(4), 992–1007. <https://doi.org/10.1080/07294360.2025.2462027>
- Malouff, J. M., Thorsteinsson, E. B., Schutte, N. S., Bhullar, N., & Rooke, S. E. (2010). The five-factor model of personality and relationship satisfaction of intimate partners: A meta-analysis. *Journal of Research in Personality, 44*(1), 124–127. <https://doi.org/10.1016/j.jrp.2009.09.004>
- Mao, Z., & Sui, Y. (2018). An empirical study on the professional identity of interdisciplinary Master of Education students. *Academic Degrees & Graduate Education, 6*(6), 57–61. <https://doi.org/10.16750/j.adge.2018.06.011>
- Matheka, H. M., Jansen, E. P. W. A., Suhre, C. J. M., & Hofman, A. W. H. (2025). The influence of supervisors and peers on PhD students' sense of belonging and their success at Kenyan universities. *Studies in Graduate and Postdoctoral Education, 16*(1), 25–39. <https://doi.org/10.1108/SGPE-09-2022-0059>
- Melchers, M. C., Li, M., Haas, B. W., Reuter, M., Bischoff, L., et al. (2016). Similar personality patterns are associated with empathy in four different countries. *Frontiers in Psychology, 7*, e290. <https://doi.org/10.3389/fpsyg.2016.00290>
- Ministry of Education of the People's Republic of China (2023). *Number of postgraduate students by academic field (total)*. Retrieved from: http://www.moe.gov.cn/jyb_sjzl/moe_560/2021/quanguo/202301/t20230103_1037980.html.
- Ministry of Education of the People's Republic of China (2026). *Number of students of formal education by type and level*. Retrieved from: https://www.moe.gov.cn/jyb_sjzl/moe_560/2024/quanguo/202603/t20260319_1431433.html.
- Orer, H. S. (2020). IUBMB/PSBMB 2019 conference/plenary: Mentoring in postgraduate training and the role of organization for PhD education in health sciences in european system. *Biochemistry and Molecular Biology Education, 48*(6), 592–595. <https://doi.org/10.1002/bmb.21345>
- Podsakoff, P. M., & Organ, D. W. (1986). Self-reports in organizational research: Problems and prospects. *Journal of Management, 12*(4), 531–544. <https://doi.org/10.1177/014920638601200408>
- Roberts, B. W., Lejuez, C., Krueger, R. F., Richards, J. M., & Hill, P. L. (2014). What is conscientiousness and how can it be assessed? *Developmental Psychology, 50*(5), 1315–1330. <https://doi.org/10.1037/a0031109>
- Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist, 55*(1), 68–78. <https://doi.org/10.1037/0003-066X.55.1.68>
- Simmonds, A. H., & Dicks, A. P. (2018). Mentoring and professional identity formation for teaching stream faculty: A case study of a university Peer-to-Peer mentorship program. *International Journal of Mentoring and Coaching in Education, 7*(4), 282–295. <https://doi.org/10.1108/IJMCE-02-2018-0012>
- Song, Y., & Shi, M. (2017). Associations between empathy and big five personality traits among Chinese undergraduate medical students. *PLoS One, 12*(2), e0171665. <https://doi.org/10.1371/journal.pone.0171665>

- Srivastava, S., Guglielmo, S., & Beer, J. S. (2010). Perceiving others' personalities: Examining the dimensionality, assumed similarity to the self, and stability of perceiver effects. *Journal of Personality and Social Psychology*, 98(3), 520–534. <https://doi.org/10.1037/a0017057>
- Stroud, C. B., Durbin, C. E., Saigal, S. D., & Knobloch-Fedders, L. M. (2010). Normal and abnormal personality traits are associated with marital satisfaction for both men and women: An actor-partner interdependence model analysis. *Journal of Research in Personality*, 44(4), 466–477. <https://doi.org/10.1016/j.jrp.2010.05.011>
- Trede, F., Macklin, R., & Bridges, D. (2012). Professional identity development: A review of the higher education literature. *Studies in Higher Education*, 37(3), 365–384. <https://doi.org/10.1080/03075079.2010.521237>
- Wang, T., & Jiang, Y. (2025). The relationship between professional identity and academic burnout among college students majoring in physical education a chain-mediated effect. *Frontiers in Psychology*, 16, 1618909. <https://doi.org/10.3389/fpsyg.2025.1618909>
- Wang, Q., Xin, Z., Zhang, H., Du, J., & Wang, M. (2022). The effect of the supervisor-student relationship on academic procrastination: The chain-mediating role of academic self-efficacy and learning adaptation. *International Journal of Environmental Research and Public Health*, 19(5), 2621. <https://doi.org/10.3390/ijerph19052621>
- Wei, G., & Chen, X. (2015). Social interaction and professional identity of student teachers: An empirical study in seven provinces in mainland China. *Journal of Educational Studies*, 11(4), 55–66, 76. <https://doi.org/10.14082/j.cnki.1673-1298.2015.04.008>
- Wilmot, M. P., Wanberg, C. R., Kammeyer-Mueller, J. D., & Ones, D. S. (2019). Extraversion advantages at work: A quantitative review and synthesis of the meta-analytic evidence. *Journal of Applied Psychology*, 104(12), 1447–1470. <https://doi.org/10.1037/apl0000415>
- Wu, Y., Chen, Z., & Zhang, D. (2025). Supervisors' academic supervising behaviors and graduate students' academic thriving: The mediating roles of admiration and task engagement. *Behavioral Sciences*, 15(6), 754. <https://doi.org/10.3390/bs15060754>
- Yan, C., Ding, Q., Wang, Y., Wu, M., Gao, T., et al. (2022). The effect of cognitive reappraisal and expression suppression on sadness and the recognition of sad scenes: An event-related potential study. *Frontiers in Psychology*, 13, 935007. <https://doi.org/10.3389/fpsyg.2022.935007>
- Yao, R., Chen, H., & Miao, Q. (2013). An empirical analysis of the influences of personality traits on job performance for frontline staff in the public transportation industry: With work attitude acting as a moderator. *Acta Psychologica Sinica*, 45(10), 1163–1178. <https://doi.org/10.3724/SP.J.1041.2013.01163>
- Yao, Y., Dong, F., & Qiao, Z. (2023). Perceived abusive supervision and graduate students' suicidal ideation: From the perspective of interpersonal psychological theory of suicide. *BMC Psychology*, 11(1), 80. <https://doi.org/10.1186/s40359-023-01136-z>
- Yu, X., Zhao, J., & Wu, X. (2017). Empirical analysis on the status and influence of the supervisor-student relationship in universities: Evidence from three universities. *Journal of Tianjin University (Social Sciences)*, 19(2), 157–161.
- Yuan, J., Zhang, J., Zhou, X., Yang, J., Meng, X., et al. (2012). Neural mechanisms underlying the higher levels of subjective well-being in extraverts: Pleasant bias and unpleasant resistance. *Cognitive Affective & Behavioral Neuroscience*, 12(1), 175–192. <https://doi.org/10.3758/s13415-011-0064-8>
- Zhang, J., Wu, M., & Zhang, G. (2024). The influence of supervisor-postgraduate relationship on master's students' research learning engagement—the mediating effect of academic aspiration. *Behavioral Sciences*, 14(4), 334. <https://doi.org/10.3390/bs14040334>
- Zhang, J., Zhang, J., Li, Y., & Deci, E. L. (2010). An effective path for promoting work motivation: The self-determination theory perspective. *Advances in Psychological Science*, 18(5), 752–759.
- Zhu, M., Yao, X., & Talib, M. B. A. (2025). Intentional self-regulation and peer relationship in the teacher-student relationship for learning engagement: A moderation-mediation analysis. *Journal of Psychology in Africa*, 35(1), 83–90. <https://doi.org/10.32604/jpa.2025.065784>
- Zhuang, T., & Kong, X. (2023). Shaping personal worldviews when neo-liberalism meets Confucianism and patriotism: Insights from Chinese postgraduate students. *British Journal of Sociology of Education*, 44(4), 687–702. <https://doi.org/10.1080/01425692.2023.2195088>