



Comradeship and Mutual Support among Female STEM Graduate Students in Taiwan

Yii-nii Lin*

Department of Educational Psychology and Counseling, National Tsing Hua University, Taiwan

*Correspondence author: E-mail: ynlin@mx.nthu.edu.tw

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ABSTRACT

The purpose of this study was to describe the comradeship among female STEM graduate students in Taiwan. Twelve participants, aged 22 to 32, from three universities, were interviewed using a qualitative phenomenological approach. Themes emerged from the data analysis include: (1) small numbers fostering close relationships and mutual support, (2) mutual support to overcome challenges, (3) collaborative learning to facilitate development, (4) mutual sharing and emotional connections to enhance life satisfaction, (5) relaxed gender norms facilitating comfortable interactions, (6) female peers serving as role models, and (7) unique shared experiences offering valuable insights. This study underscores the transformative impact of female relationships in STEM fields. Despite their underrepresentation, women in these programs foster a supportive climate through cooperative efforts and connections, enhancing belonging, engagement, and academic persistence. Friendships among female STEM students serve as critical support systems, promoting emotional intimacy, psychological well-being, and collaborative learning. These findings provide essential implications for students, educators, counselors, student affairs professionals, and policymakers in supporting the comradeship of women in STEM graduate programs.

Keywords: Comradeship, Female graduate student, STEM, Learning, Development

INTRODUCTION

Comradeship and mutual support among female stem graduate students in Taiwan

In Taiwan, there is a clear gender disparity in higher education majors, with most men pursuing STEM programs and most women opting for humanities programs (Chen, 2002; Hsieh, et al. 2011). Currently, female students comprise 47.74% of all master's students and 37.28% of all doctoral students in Taiwan (Ministry of Education [MOE], 2024). In higher education, women represent 42.81% in natural sciences, mathematics, and statistics; 29.57% in information and communication technology; and 21.24% in engineering, manufacturing, and construction (MOE, 2024), indicating severe underrepresentation, espe-

cially in mathematics, physics, computer science, information engineering, and engineering.

Women often leave STEM fields at various points from recruitment to post-graduation, akin to water leaking from a pipeline (Goulden, et al. 2011). To support women in completing their STEM degrees, it is crucial to explore factors that help anchor them within their STEM majors. Female students value relationships and emphasize relational pathways to persistence in learning (Maltese and Cooper, 2017). In a competitive academic environment, one of the most effective interventions for retaining women in STEM is peer-to-peer friendship (Maltese and Cooper; Turetsky, et al. 2020). Such friendships foster camaraderie and combat isolation, vital for women's retention in STEM. Friendships among female STEM students are essential for their

survival and success in STEM fields (Turetsky, et al. 2020).

However, little research explicitly explores the processes and effects of female student friendships and comradeships on their academic journeys. This pioneering study aims to describe the comradeship of female STEM students throughout their graduate school journey. In this study, “comradeship” includes friendship, involvement, connection, engagement, and authentic/trustful relationships. Female student comradeship is defined as female students identifying each other as good friends.

Female graduate students in Taiwan

Academic stress is widely recognized as a primary stressor among graduate students in Taiwan (Aiou, 2005; Hsieh, 2007). Several studies have explored the unique experiences of female graduate students, highlighting the complex interplay between academic and personal roles. Chen (2006) described a spectrum of emotions experienced during graduate studies, viewing pain as a transformative source of strength. Similarly, Li (2009) examined the life transformation of a female graduate student, detailing her journey from confusion to a renewed perspective on life. This study underscores the dilemmas women face in balancing academic and personal aspirations. Wu, et al. (2013) investigated the experiences of women managing multiple roles during doctoral studies, identifying strategies such as psychological resilience, time management, coping mechanisms, and self-encouragement as critical to their success.

Wu (2014) described her search for meaning during graduate studies, noting how conflicts and complaints helped improve her relationships and self-understanding. In a qualitative study, Wu, et al. (2013) interviewed three female doctoral students who were also mothers. Participants cited various motivations for pursuing a doctoral degree, including job demands, self-actualization, family expectations, and peer influence. However, they faced numerous obstacles and employed coping strategies including structured time planning, cognitive reframing, and self-encouragement. Similarly, Liao (2014) explored time management challenges among female graduate students juggling multiple roles, revealing how they prioritized tasks, utilized academic resources, and relied on family support to navigate competing demands.

Female STEM students in Taiwan

In Taiwan, STEM fields represent a significant proportion of the graduate student population, yet a gender disparity persists. Although increasing numbers of women are entering traditionally male-dominated fields, STEM remains characterized by masculine

competition and hierarchical authority. This dynamic is evident in laboratory environments, where thesis advisors, postdoctoral researchers, or senior doctoral students often establish a patriarchal culture (Han, 2009). Liu (2001) investigated career changes among female STEM bachelor's degree holders, noting that academic and career trajectories are shaped by personal interest, academic performance, family expectations, and significant life events. Women's career advancement in STEM is frequently impeded by societal biases, including gender and occupational stereotypes, which lower self-efficacy and reinforce internal barriers (Liu, 2001).

Studies have also examined non-traditional career paths among women. Wang (1990) explored the influence of familial and social support on women's pursuit of unconventional careers. Hsu (2000) highlighted the role of interest, self-cognition, and career recognition in motivating women to enter non-traditional fields, alongside external influences such as evolving societal norms, legal reforms, and teacher encouragement. Despite these positive factors, social stereotypes and inequitable promotion systems often hinder career progression for women in STEM.

Female STEM students worldwide

STEM institutions frequently exhibit an unwelcoming “chilly climate,” contributing to low rates of degree attainment among women (Bonous-Hammarth, 2000). Many female students report experiencing hostile and unwelcoming environments at departmental, college, and institutional levels, which adversely affect their sense of belonging and fit within these fields (Hill, et al., 2010; Settles, et al. 2006). Conversely, in welcoming environments, female students are exposed to more affirming messages about women in STEM, often display markers of their major, and benefit from having more peer role models. Peer mentors offering both instrumental and psychological support are especially effective in fostering the success of female STEM students (Dennehy and Dasgupta, 2017; Dajani, et al. 2021).

Turetsky, et al. (2020) demonstrated that students who participated in values-affirmation exercises reported having more friendships and showed greater persistence in STEM courses. Women tend to rely more heavily on interpersonal support, underscoring the significance of supportive relationships in STEM fields (Maltese and Cooper, 2017). Sparse representation of women in STEM courses negatively impacts academic achievement, whereas higher female representation correlates with better outcomes for female students (Bowman, et al. 2022).

Alemán (2010), in a four-year longitudinal study, examined undergraduate women's perceptions of the cogni-

tive value of their friendships. Female friendships were perceived as developmentally essential and cognitively enriching, with benefits extending into post-collegiate life. Similarly, Rieggle-Crumb, et al. (2006) found that the academic performance of same-sex friends significantly influences girls' course selections, suggesting that female friendship groups play a pivotal role in counteracting gendered stereotypes and reinforcing women's identities in STEM disciplines. Persistence in STEM fields is strongly linked to support from peer groups, advisors, and the broader campus community (Clark, et al. 2016; Pedone, 2016).

Women in STEM often face isolation due to limited access to female peers, role models, and mentors. Peer friendships foster camaraderie and mitigate the sense of isolation (Turetsky, et al. 2020). Such friendships address core psychological needs, countering the adverse effects of marginalization in workplace and academic environments (Kaepfel, et al. 2020). Raabel, et al. (2019) emphasized that peer influence is instrumental in retaining girls' interest in STEM fields.

Relationships with faculty and female role models in introductory STEM courses are significant in encouraging women to remain in these disciplines. For example, Gray, et al. (2021) found that such relationships positively influence women's retention in geology programs. Female mentors provide alternative perspectives, model academic life, and act as allies. Wu, et al. (2022) reported that female peer mentors enhance psychological well-being, aspirations, and emotional resilience among engineering students. González-Pérez, et al. (2020) further demonstrated that female role models positively impact girls' enjoyment of mathematics, expectations of success, and STEM aspirations while reducing gender stereotypes. Dennehy and Dasgupta (2017) similarly found that female peer mentors bolster belonging, motivation, confidence, retention, and career aspirations in engineering programs.

Feelings of belonging are a stronger predictor of interest in STEM than concerns about negative stereotypes, particularly among women who are not strongly identified with the field (Cheryan and Plaut, 2010). Conversely, environments perpetuating gender-normative ideas drive girls away from the STEM pipeline (Van der Vleuten, et al. 2019). Murray (2016) identified career adaptability and social support as significant factors influencing female undergraduates' commitment to STEM majors. Together, these findings underscore the critical role of institutional climate, mentorship, peer relationships, and supportive environments in fostering the persistence and success of female students in STEM fields.

Friendships among female students

Friendship, defined as a relationship based on mutual

feelings, is a fundamental need across genders and involves reliance on others (O'Connor, 1992). Unlike simple alliances, friendships are significant interpersonal connections. Gender differences in friendship dynamics are well-documented: males often engage in shared physical activities, whereas females tend to discuss personal, emotional, and intimate issues (Elkins and Peterson, 1993). For female university students, friendships play a critical role in enhancing learning, psychosocial development, and overall well-being. Women derive greater well-being benefits when they prioritize friendships (Lu, et al. 2021).

Female friendships are often characterized by emotional intensity and self-disclosure, contrasting with male friendships that focus on group activities and limited expressions of affection (Wright, 1982). This distinction explains why women tend to value friendships more highly and benefit significantly in terms of physical and psychological well-being. Studies consistently associate valuing friendships with improved health, happiness, and overall well-being (Lu, et al. 2021).

Research highlights the importance of friendships for female students in both academic and personal contexts. Alemán (2010) found that female college friendships are powerful, developmentally necessary relationships with long-term cognitive benefits. Picton, et al. (2017) identified that friendships foster a sense of belonging through shared interests, enhance well-being by reducing stress and increasing comfort, and improve learning engagement and cognitive understanding. Similarly, Felmler, et al. (2012) reported that women place higher expectations on trust and intimacy in friendships, likely due to their emphasis on emotional closeness and affiliation.

Buote, et al. (2007) demonstrated a strong positive relationship between the quality of new friendships and university adjustment among first-year students. Friendships contributed to social adjustment, institutional attachment, and academic success by providing emotional support, advice, and role modeling. Chaudhry, et al. (2017) emphasized that genuine friendships rely on mutual understanding, cooperation, and emotional connections, with friends often serving as therapists, motivators, and confidants. Takasaki (2017) noted that during the transition to adulthood, friendships offer individualized social support and help in identity development within an individualistic cultural context.

Gender and relationships in emerging adulthood

Women prioritize intimacy and emotional connection in friendships more than men, engaging in deeper self-disclosure and spending more time fostering these relationships (Galambos, 2004; De Goede, et al. 2009). Women emphasize qualities such as trust, safe-

ty, companionship, and cooperation, which are central to socially beneficial behaviors (Chen and Nakazawa, 2009). Women also exhibit greater emotional openness and communication in friendships compared to men (Johnson, 2004; Oswald, et al. 2004).

In contrast, male friendships are often governed by “male norms,” emphasizing control, dominance, and group conformity (Kindlon & Thompson, 1999; Galambos, 2004). While male friendships prioritize instrumental assistance, female friendships focus on supportive and emotionally communicative relationships that ensure long-lasting connections (Oswald, et al. 2004).

Cross-gender mentoring relationships also reflect these differences, with boundaries carefully defined to avoid romantic involvement (Dave, 2016). In Taiwanese cultural contexts, girls exhibit higher social interest, invest more time in maintaining relationships, and prioritize the intimate sharing of emotions (Chao and Wang, 2013). This contrasts with male peer groups, which center on shared activities and practical forms of support.

Relational-cultural theory

Relational-Cultural Theory (RCT) posits that individuals achieve personal growth and development through meaningful connections with others (Jordan, 2017). Emphasizing relationships and connections, RCT is particularly relevant for understanding the experiences of women from collectivist cultures and those facing oppression and marginalization (Pompeo-Fargnoli, 2017). Therefore, RCT offers a valuable framework for exploring the comradeship among female graduate students in STEM.

Jordan (2000; 2017) outlined the following principles of RCT. Individuals grow through and toward relationships throughout their lives. Mature functioning is characterized by a movement toward mutuality rather than separation. Growth involves relational differentiation and elaboration. Mutual empathy and empowerment are essential for enhancing growth-fostering relationships. Genuine engagement and therapeutic authenticity are crucial for cultivating mutual empathy.

RCT emphasizes that growth occurs through connections and that mutual empathy and empowerment are fundamental to creating growth-oriented relationships. It is particularly effective for understanding marginalized groups experiencing imbalances in power and privilege (Jordan and Hartling, 2002). This study applies RCT to examine the experiences of female STEM graduate students, focusing on how they navigate competition, autonomy, hierarchy, and authority within male-dominated STEM fields. By highlighting the importance of connections, engagement, mutuality, and

growth-oriented relationships, RCT provides insight into these students' development and coping strategies.

METHODS

Phenomenology serves as a method for exploring lived experiences, revealing the essence and meaning of individuals' subjective realities (Osborne, 1994). This approach was employed to illuminate the comradeship of female STEM graduate students in Taiwan.

Participants

The study involved 12 female graduate students from three research-oriented universities offering STEM graduate programs. The participants were selected based on the following criteria: (1) enrollment in a STEM graduate program for at least one and a half years, and (2) willingness to share their experiences of female camaraderie and interaction within the program. The participants ranged in age from 22 to 32 years, with an average age of 25.64. Eight participants were enrolled in master's programs, while four were pursuing doctoral degrees. The fields of study included science (e.g., mathematics, physics, chemistry) with three participants; engineering with five participants; life/biological sciences with two participants; and computer/information engineering with two participants. The three universities had student populations of approximately 12,000-18,000, with 6,000-9,000 being graduate students.

Interviewer

A research assistant (RA) with a master's degree in counseling conducted the interviews. The RA had completed coursework in qualitative research, interview techniques, and research methodology, and received specific training from the researcher to ensure sensitivity to the study's focus. Prior to conducting the formal interviews, the RA performed pilot interviews to refine her skills and establish trustful, egalitarian relationships with participants.

Researcher positionality

The researcher, who has advised female graduate students, has firsthand knowledge of their life experiences. Through extensive interactions with female STEM students, the researcher recognized their heightened stress levels and the essential role of peer support in fostering their learning and development. Given their similar experiences, female students are better able to empathize with and understand each other. Forming small study groups can promote female friendships and comradeships, fostering collaborative learning and helping them overcome various academic and psychosocial challenges.

Data collection

Using a snowball sampling method, the researcher identified the first participant, known for her experiences of female camaraderie in a STEM program. Subsequent participants were referred by previous interviewees. Data collection ceased after 12 interviews when saturation was achieved. Each participant completed a 90- to 120-minute interview, guided by broad, semi-structured, and open-ended questions. Sample questions included: "Please describe your camaraderie experiences with female students during your STEM graduate studies. Were there any notable events, and what impact did they have?" All interviews were audio-recorded and transcribed verbatim for analysis.

Data analysis

The researcher conducted the data analysis following Creswell's (2009) systematic approach. To minimize bias, she employed the practice of bracketing, setting aside preconceived notions about female STEM students and suspending existing attitudes toward their peer interactions. This allowed her to uncover deeper and more nuanced meanings within the data.

The analytical process consisted of the following steps. The researcher reviewed transcripts, scanned materials, typed field notes, and organized data into various information sources to facilitate analysis. She read through all collected data to gain a general understanding of the information, reflecting on its overall meaning and noting preliminary impressions. The analyst organized the data into textual segments and initiated a detailed coding process to identify patterns and key elements. Using the codes, she developed descriptions of the setting and participants, identifying categories and themes that emerged from the data. The analyst refined themes and constructed a general description of the findings, integrating various data elements to uncover deeper insights. She explored complex interconnections among the identified themes to achieve a more comprehensive understanding. Finally, the researcher synthesized the descriptions and themes to articulate the essence of the data, providing a cohesive interpretation of the findings.

To enhance the validity and reliability of the analysis, several strategies were implemented. Following Gibbs' (2007) recommendations, the researcher documented each step of the analytical procedure, creating a detailed protocol and database. Transcripts were examined for accuracy, with codes compared against the data to ensure consistency. Notes on coding decisions and definitions were maintained to support transparency. In addition, validation strategies proposed by

Creswell and Miller (2000) were also employed. The researcher ensured prolonged engagement and persistent observation, particularly in issues related to peer mentoring. Multiple sources and methods were triangulated to corroborate themes and perspectives. Rich, thick descriptions were created to vividly convey the participants and settings. To further enhance credibility, member checking was conducted. Participants were invited to review drafts of the study and provide feedback on the interpretations. Additionally, an external peer was recruited to perform an audit, examining the research process and evaluating the findings for consistency and rigor.

RESULTS

Small numbers fostering close relationships and mutual support

In male-dominated STEM fields, female students often form close-knit groups for mutual support due to their minority status. One student noted, "In school, sitting in the classroom, girls tend to sit together." Another said, "There are few girls... we get pretty familiar with each other and help one another because there's no one else who can help us (female students in STEM programs)." The small number of female STEM students leads to strong bonds and mutual support.

Mutual support to overcome challenges

While overt discrimination against women in STEM is rare, subtle discrimination persists. For example, professional personnel in internships may prefer male interns, and professors may assign more important tasks to male peers. Participants reported that sharing these experiences with female peers who understand and empathize helps them overcome subtle prejudices, discrimination, and stereotypes.

Collaborative learning to facilitate development

Female students tend to have a more serious, meticulous, and cautious attitude towards learning compared to their male peers. Participants mentioned that male peers generally do homework and prepare for exams later than females, who tend to do these tasks promptly and in advance. Female students often form study groups to discuss courses, homework, and exam preparation. One student said, "I'm taking a very difficult course right now. (Male classmates don't seem to be particularly studying the content). There's another girl in our class who studies as seriously as I do; she's my only study partner." Female students frequently take the initiative to form study groups and collaborate on learning.

Mutual sharing and emotional connections to enhance life satisfaction

Female students often discuss personal topics with their female peers, such as makeup, dressing, shopping, and food, which creates emotional connections and social support. One student stated, "There are only three girls in our lab... I'm quite happy to have girls to chat with about some women's topics... for me (having female peers in the lab) is very satisfying." These conversations provide emotional relief, interest exchange, and close relationship networks.

Relaxed Gender norms facilitating comfortable interactions

Interaction norms between the sexes are stricter, leading female students to interact more cautiously with male peers. One student noted, "When dealing with the opposite sex (males), there is a bit of a boundary. Boys and girls interacting should have some boundaries." However, interacting with female peers is more comfortable, without the need for strict physical and psychological boundaries. Female communication is perceived as more polite, gentle, and empathetic, unlike male classmates who often use foul language. This comfortable interaction helps relieve stress and negative emotions.

Female peers serving as role models

Many female peers, including seniors, juniors, and classmates, are observed studying diligently and seriously. One student stated, "Seeing girls who are strong in science and math gives me confidence. I don't feel less confident because of my gender. (Female peers provide) living proof that women can study STEM." Female students often use these well-performing peers as role models, increasing their motivation and enthusiasm for learning.

Unique shared experiences offering valuable insights

Women in STEM often face unique challenges that men may not understand, such as discomfort during menstrual periods or handling heavy equipment. One student noted, "Male teachers and classmates rarely understand the difficulties girls face, like not being able to perform experiments during painful menstrual periods." Additionally, women may experience prejudice or discrimination in learning environments. Female peers sharing their experiences in STEM studies, research, and careers often resonate with others and gain valuable support. One student said, "A male might not fully understand the pressures and frustrations of women in STEM, but a female peer can understand (another female student's state)." These unique experiences

serve as important references and offer valuable insights for female students in STEM fields.

DISCUSSION

This study highlights the critical role of female comradeships in supporting women in STEM fields. Despite their underrepresentation, female students often form cooperative groups and connections that foster belonging and engagement. These relationships are nurtured through social support and friendships, which help break isolation, enhance communication, and promote persistence in STEM programs.

Participants emphasized that having more female peers is crucial for their academic and social experiences in STEM. They underscored the importance of friendships and peer networks, noting that these connections significantly influence their learning and overall well-being. These findings align with prior research indicating that a greater number of friends improves women's persistence in STEM (Turetsky, et al. 2020) and that higher female representation positively impacts academic achievement (Bowman, et al. 2022). Female students in this study relied heavily on the support of their peers, reinforcing the importance of interpersonal relationships for women in STEM (Maltese & Cooper, 2017).

Female friendships were identified as essential for breaking isolation, fostering emotional connection, and encouraging persistence in STEM. These relationships contribute to academic success (Turetsky, et al. 2020), emotional intimacy (De Goede, et al. 2009), emotional well-being (Lu, et al. 2021; Picton, et al. 2017), and overall social and academic development (Buote, et al. 2007). Participants valued the developmental and motivational aspects of these friendships, which aligned with prior studies emphasizing the importance of relational pathways in academic persistence (Maltese and Cooper, 2017).

Female friendships provide essential support systems that help students navigate challenges, enhance life satisfaction, and encourage collaborative learning. These findings align with literature that highlights the importance of friends in fostering belonging, offering emotional support, and serving as role models (Buote, et al., 2007). Participants shared that these friendships often involved emotional bonds formed through discussing personal struggles, including navigating gender stereotypes and overcoming physical challenges. This aligns with previous research that underscores the role of emotional intimacy (De Goede, et al. 2009) and communication (Oswald, et al. 2004) in fostering strong friendships.

Diverse friend groups significantly contribute to ac-

ademic self-efficacy (Hall, et al. 2017), social adjustment, and institutional attachment (Buote, et al. 2007). In male-dominated environments, these friendships reduce stress and enhance engagement, fostering a sense of belonging essential for women's interest in STEM (Cheryan and Plaut, 2010). Participants noted that these peer networks counteract gender stereotypes, support identity development, and enhance self-efficacy (Riegle-Crumb, et al. 2006; Rosenthal, et al. 2013).

Literature suggests that women's friendships emphasize emotional depth, self-disclosure, and mutual trust (De Goede, et al. 2009; Felmlee, et al. 2012). This study supports these findings, demonstrating that female STEM students prioritize emotional communication and intimate interactions, fostering deeper connections. These relationships involve higher levels of openness and self-disclosure, which are critical for building trust and mutual support (Johnson, 2004; Oswald, et al. 2004).

The study results reinforce previous findings that several factors positively impact the learning and development of female students in STEM. These factors include the presence of female role models (González-Pérez, et al. 2020; Gray, et al. 2021), female peer mentors (Dennehy and Dasgupta, 2017; Wu et al. 2022), and female mentors (Gray, et al. 2021). These elements help counteract negative influences, fostering a more supportive and empowering environment for female STEM students.

Using RCT as a framework, this study demonstrates that growth and development among female STEM students occur through meaningful relationships, mutual empathy, and connection (Jordan, 2000; 2017). Participants reported forming close-knit groups and support networks, driven by shared experiences of marginalization and subtle discrimination. These connections enabled them to overcome academic challenges and gender-based stereotypes through mutual understanding and empowerment. RCT's principles of relational growth are evident in the participants' collaborative learning, study groups, and role-modeling relationships, which facilitate both academic and personal development.

RCT also emphasizes the role of relational differentiation and mutual contributions in fostering growth. Female STEM students in this study engaged in activities that promoted collective learning and resilience, such as forming study groups and seeking inspiration from peers. These interactions underscore the importance of connection and mutual growth, particularly in navigating systemic barriers and isolation in male-dominated STEM fields (Jordan and Hartling, 2002; Pompeo-Fargnoli, 2017).

CONCLUSION AND IMPLICATIONS

The findings of this study underscore the transformative impact of female relationships in STEM fields. Despite the small number of women in these programs, their cooperative efforts and connections foster a supportive climate that enhances belonging, engagement, and academic persistence. Friendships among female STEM students serve as critical support systems, promoting emotional intimacy, psychological well-being, and collaborative learning. Educators, leaders, and policymakers should prioritize recruiting more women into STEM programs and fostering environments that support female camaraderie. Understanding the significance of female peer networks can inform strategies to improve retention and success for women in STEM. Practical implementations could include developing mentorship programs, facilitating female-led study groups, and addressing the unique needs of women in male-dominated fields. Ultimately, female friendships and peer networks not only enhance academic and personal development during graduate studies but also prepare students for successful transitions to professional life. By fostering connection, involvement, and mutual support, these relationships play a pivotal role in advancing gender equity and inclusion in STEM fields.

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REFERENCES

- Alemán AMM. (2010). College women's female friendships: A longitudinal view. *JHE*. 81(5):553-582.
- Aiou JR. (2005). A study on graduate students' stressors and stress copings-A case study of a university in central Taiwan [Unpublished master's thesis]. National Taichung University.
- Bonous-Hammarth M. (2000). Pathways to success: Affirming opportunities for science, mathematics, and engineering majors. *JNE*. 69:92-111.
- Bowman NA, Logel C, LaCosse J, Jarratt, L, Canning EA, Emerson KTU, et al. (2022). Gender representation and academic achievement among STEM-interested students in college STEM courses. *JRST*. 59(10):1876-1990.
- Buote VM, Pancer SM, Pratt MW, Adams G, Birnie-Lefcovitch S, Polivy J, et al. (2007). The importance of friends: Friendship and adjustment among 1st-year university students. *J Adolesc Res*. 22(6):665-89.
- Chao MR, Wang SY. (2013). The confirmation of the conno-

- tation of same-sex friendship quality and analysis of the gender differences. *Bull Educ Psych.* 44(4):829-852.
- Chaudhry KA, Fida W, Amjad M. (2017). Friendship concepts among female medical students: A qualitative approach. *PJMHS.* 11(1):136-139.
- Chen CC. (2002). The change of departmental, occupational gender segregation, and earnings difference in Taiwan. *J Educ Psychol.* 23:285-312.
- Chen LH. (2006). Rinsing my soul with the dust of labor [Unpublished master's thesis]. National Hsin Chu University of Education.
- Chen YW, Nakazawa M. (2009). Influences of culture on self-disclosure as relationally situated in intercultural and interracial friendships from a social penetration perspective. *J Intercult Commun Res.* 38(2):77-98.
- Cheryan S, Plaut VC. (2010). Explaining underrepresentation: A theory of precluded interest. *Sex Roles.* 63:475-488.
- Clark SL, Dyar C, Maung N, London B. (2016). Psychosocial pathways to STEM engagement among graduate students in the life sciences. *CBE-Life Sci Educ.* 15(3):15-45.
- Connor M, Bynoe A, Redfern N, Pokora J, Clarke J. (2000). Developing senior doctors as mentors: A form of continuing professional development. Report of an initiative to develop a network of senior doctors as mentors: 1994-99. 34(9):747-53.
- Creswell JW. (2009). Research design: Qualitative, quantitative, and mixed methods approaches (3rd ed.). Sage Publications, Inc.
- Creswell JW, Miller D. (2000). Determining validity in qualitative inquiry. *TIP.* 39(3):124-130.
- Dajani R, Tabbaa Z, Al-Rawashdeh A, Gretzel U, Bowser G. (2021). Peer mentoring women in STEM: An explanatory case study on reflections from a pro-gram in Jordan. *MTPL.* 29(3):284-304.
- Dave PB. (2016). Challenges of cross gender Mentoring relationships: When it comes to mentoring, does gender matter? Macro and micro dynamics for empowering trade, industry and society.
- De Goede IH, Branje SJ, Meeus WH. (2009). Developmental changes and gender differences in adolescents' perceptions of friendships. *J Adolesc.* 32(5):1105-23.
- Dennehy TC, Dasgupta N. (2017). Female peer mentors early in college increase women's positive academic experiences and retention in engineering. *Proc Natl Acad Sci USA.* 114(23):5964-5969.
- Elkins LE, Peterson C. (1993). Gender differences in best friendships. *Sex Roles.* 29(7-8):497-508.
- Felmlee D, Sweet E, Sinclair HC. (2012). Gender rules: Same- and cross-gender friendships norms. *Sex Roles.* 66(7-8):518-529.
- Galambos NL. (2004). Gender and gender role development in adolescence. In R. M. Lerner & L. Steinberg (Eds.), *Handbook of adolescent psychology* (2nd ed., pp. 233-262). John Wiley & Sons, Inc.
- Gibbs GR. (2007). Analyzing qualitative data. In U. Flick (Ed.), *The Sage qualitative research kit*. London: Sage.
- González-Pérez S, Mateos de Cabo R, Sáinz M. (2020). Girls in STEM: Is it a female role-model thing? *Front Psychol.* 11:2204.
- Goulden M, Mason MA, Frasch K. (2011). Keeping women in the science pipeline. *Ann Am Acad Pol Soc Sci.* 638(1):141-162.
- Gray RE, Riche AT, Shinnick-Gordon IJ, Sample JC. (2021). The reasons women choose and stay in a geology major: A qualitative multi-case analysis. *Innov Educ.* 3(1):1-4.
- Hall AR, Nishina A, Lewis JA. (2017). Discrimination, friendship diversity, and STEM-related outcomes for incoming ethnic minority college students. *J Vocat Behav.* 103(B):76-87.
- Han TY. (2009). Gendered laboratory: Masculine and scientific and technological operation [Unpublished master's thesis]. National Tsing Hua University.
- Hill C, Corbett C, St Rose A. (2010). Why so few? Women in science, technology, engineering, and mathematics. American Association of University Women. 1111 Sixteenth Street NW, Washington, DC 20036.
- Hsieh HC, Lin DS, Chen PY. (2011). Crossing gender boundaries: Gender and college majors in Taiwan. *Taiwan J Sociol.* 48:95-149.
- Hsieh WL. (2007). A study of the pressure source and emotion management among graduate students, and their relationships [Unpublished master's thesis]. National Taichung University.
- Hsu IJ. (2000). The decision elements and the psychological adaptation process of Women who select non-traditional career [Unpublished master's thesis]. National ChungHua Normal University.
- Johnson HD. (2004). Gender, grade and relationship differences in emotional closeness within adolescent friendships. *Adolescence.* 39(154):243-255.
- Jordan JV. (2000). The role of mutual empathy in relational/cultural therapy. *J Clin Psychol.* 56(8):1005-1016.
- Jordan JV. (2017). Relational cultural theory: The power of connection to transform our lives. *JHC.* 56(3):228-243.

- Jordan JV, Hartling LM. (2002). New developments in relational-cultural theory. In M. Ballou & L. S. Brown (Eds.), *Rethinking mental health and disorder: Feminist perspectives* (pp. 48-70). Guilford Press.
- Kaepfel K, Grenier RS, Björngard-Basayne E. (2020). The F word: The role of women's friendships in navigating the gendered workplace of academia. *HRDR*. 19(4):362-383.
- Kindlon D, Thompson M. (1999). *Raising Cain: Protecting the emotional life of boys*. Random House Publishing Group.
- Liao SH. (2014). Tick-tock! A case study on the time management of the female, in-service-teacher graduate students in collaborative learning [Unpublished master's thesis]. National Taipei University of Education.
- Liu SL. (2001). Exploring career transformation processes among women university graduates of science and engineering majors [Unpublished master's thesis]. National Ping Tung University.
- Lu P, Oh J, Leahy KE, Chopik WJ. (2021). Friendship importance around the world: Links to cultural factors, health, and well-being. *Frontier Psychology*. 18(11):570839.
- Maltese AV, Cooper CS. (2017). STEM pathways: Do men and women differ in why they enter and exit? *AERA Open*. 3(3):1-16.
- Ministry of Education. (2024). Statistics.
- Murray MA. (2016). Identity compatibility, career adaptability, and adaptive coping as predictors of college women's commitment in STEM majors [Unpublished doctoral dissertation]. State University of New York at Albany.
- O'Connor P. (1992). *Friendships between women: A critical review*. NY: Harvester Wheatsheaf.
- Osborne JW. (1994). Some similarities and differences among phenomenological and other methods of psychological qualitative research. *Canadian Psychology/Psychologie canadienne*. 35(2):167-189.
- Oswald DL, Clark EM, Kelly C. (2004). Friendship maintenance: An analysis of individual and dyad behaviors. *J Soc Clin Psychol*. 23(3):413-441.
- Pedone MH. (2016). Persistence of undergraduate women in STEM fields [Unpublished doctoral dissertation]. Temple University.
- Picton C, Kahu ER, Nelson K. (2017). Friendship supported learning-the role of friendships in first-year students' university experiences. In *Proceedings of STARS: Students Transitions Achievement Retention and Success Conference*. Adelaide, Australia: STARS.
- Pompeo-Fagnoli AM. (2017). Women and relationships: Introduction to relational-cultural theory. In J. E. Schwarz (Ed.), *Counseling women across the life span: Empowerment, advocacy, and intervention* (pp. 57-78). Springer Publishing Company.
- Raabel IJ, Boda Z, Stadtfeld C. (2019). The social pipeline: How friend influence and peer exposure widen the STEM gender gap. *Sociol Educ*. 92(2):105-123.
- Riegle-Crumb C, Farkas G, Muller C. (2006). The role of gender and friendship in advanced course taking. *Sociol Educ*. 79(3):206-228.
- Rosenthal L, London B, Levy SR, Lobel M. (2011). The roles of perceived identity compatibility and social support for women in a single-sex STEM program at a co-educational university. *Sex Roles*. 65(9-10):725-36.
- Settles IH, Cortina LM, Malley J, Stewart AJ. (2006). The climate for women in academic science: the good, the bad, and the changeable. *Psychol Women Q*. 30:47-58.
- Takasaki K. (2017). Friends and family in relationship communities: The importance of friendship during the transition to adulthood. *MFR*. 21(1):76-94.
- Turetsky KM, Purdie-Greenaway V, Cook JP, Curley JP, Cohen GL. (2020). A psychological intervention strengthens students' peer social networks and promotes persistence in STEM. *Science Advances*. 6(45):eaba9221.
- Van der Vleuten M, Steinmetz S, van de Werfhorst H. (2018). Gender norms and STEM: The importance of friends for stopping leakage from the STEM pipeline. *Educ Res Eval*. 24(6-7):417-436.
- Wu DJ, Thiem KC, Dasgupta N. (2022). Female peer mentors early in college have lasting positive impacts on female engineering students that persist beyond graduation. *Nat Comm*. 13:6837.
- Wang LY. (1990). Factors related to selections of masculine occupations among women undergraduates majoring in science, engineering and medical colleges [Unpublished master's thesis]. National Taiwan Normal University.
- Wright PH. (1982). Men's friendships, women's friendships and the alleged inferiority of the latter. *Sex Roles*. 8(1):1-20.
- Wu PY, Wu CH, Hsia KM. (2013). The difficulties and solutions beyond the multiple roles dilemma for doctoral mom. *J Appl Psychol*. 57:31-75.
- Wu YW. (2014). Learning to love though broken relationship: A narrative inquiry [Unpublished master's thesis]. National Taipei University of Education.