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Psychological Coping Mechanisms of Highly Resilient Female STEM Researchers under Occupational Stress and Stereotype Internalization

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Abstract. Women's careers in science and technology are under pressure around the world. Existing studies have not examined the cases of individual women and how they cope. Although there are some highly accomplished female scholars in the same field, the psychological reasons for their ability to cope with stress and avoid internalizing gender stereotypes at a micro-level have not been explored. Our participant is a senior female researcher in a traditional engineering field and she was selected as the high-resilience sample for this study. We conducted semi-structured life-history interviews and career retrospectives to map the coping strategies in cognition, emotion and behavior of the participant. Based on our findings, our participant was able to reduce occupational stress and stereotype internalizations through the immunizing effect of early protective factors, cognitive decoupling of gender identity and professional identity, task-oriented competence construction, and proactive maintenance of emotional boundaries. This paper will address the problem of individual differences in the existing quantitative research and provide transferable theoretical support and practical guidance for cultivating career resilience among women in STEM.

Keywords: stereotype internalization, career resilience, extreme case study, female researcher

1. Introduction

Although there are increasing female enrollment in higher education, women remain underrepresented in senior STEM positions [1]. Cyr and others have shown that this persistent gap is associated with implicit gender stereotypes and informal workplace interactions that link masculinity to superior STEM abilities from an early age [1, 2]. Such bias can be seen in all parts of professional life, such as project assignment, team composition and promotions; thus, female practitioners may suffer from self-doubt and career restrictions.

Most of the existing quantitative studies cover overall STEM workplace samples and focus on the average negative effects of a group, neglecting significant individual heterogeneity. Under identical external pressures, some practitioners experience psychological exhaustion, while others mitigate

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negative effects through individual adjustment capabilities [3]. However, the question of why some individuals can block internalization remains underexplored.

Given this deficiency, this study employs an extreme case study design to examine a senior female engineering professor with over 20 years of experience [4]. By unpacking her cognitive, emotional, and behavioral coping mechanisms, we aim to extract transferable psychological "antibodies" from a "survivor" who has broken through gender-based barriers in a male-dominated environment, providing concrete references for women in similar predicament.

2. Literature review

2.1. Gender stereotypes and women's stress in STEM workplaces

Implicit gender stereotypes refer to unconscious cognitive schemas that link particular social groups with certain traits [5]. Research has found many "male-STEM" implicit associations among the general public [2]. Such biases in the workplace operate covertly through exclusive informal social circles, micro-biases in resource allocation, and unconscious deviations from evaluation standards.

Cyr and others have found that men's implicit gender bias reduces informal social interaction with female colleagues and thus lowers career belongingness and harms work engagement. This study differ in that it separates "interpersonal social exclusion" from "professional competence devaluation"; therefore, only the former has been identified as a primary reason for the "chilly climate" of STEM [2].

2.2. From external threat to internal depletion: stereotype threat and internalization

External exclusion is a distant cause; the near cause of career withdrawal is internalization, which is accepting external bias as one's own. Steele and Aronson proposed the theory of stereotype threat; they believe that anxiety over confirming a negative stereotype impairs cognitive ability and professional self-confidence without explicit discrimination [6]. STEM gradually internalizes this threat as "career self-throttling", and women begin to believe that they are not suitable for technical work, thus avoiding the main competition or leaving the industry [7]. Thus, external pressure and internalization are a dual-strike mechanism, however, there are only few studies about why some people are reluctant to internalize. Local studies similarly find that female engineering master's students universally experience decreased self-efficacy and active withdrawal in employment and academic development [8].

2.3. Career resilience and individual heterogeneity

Career resilience is the continuous ability to perform in one's work and thrive despite difficulties, but not a lack of sensitivity to stress. Masten believed that resilience is "ordinary magic", which is an all-encompassing adaptive ability, and not an extraordinary talent [9]; therefore, research began exploring how resilience functions, however rather than identifying exceptional individuals. Recently, scholars have studied various results for women facing workplace gender pressure and identified protective factors such as cognitive patterns and self-identity construction [3]. Most previous studies have used a single quantitative measure for resilience and have not described how highly resilient people cope in detail.

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2.4. Integration: the missing "antibody" mechanism

Research has established an entire chain of "external exclusion → internalized harm → career withdrawal", but has not yet conducted micro-analysis on the terminal "resilience buffering" link. Quantitative research can describe the "disease" but cannot present the generative logic of the "antibody". This study addresses the theoretical gap by exploring specific coping mechanisms at cognitive, emotional and behavioral levels in depth, and constructing a complete picture of "external exclusion →internalization risk →resilience buffering".

3. Method

This study employed an extreme case study design to examine psychological coping mechanisms in a highly resilient female STEM researcher [4]. The participant is a senior professor with over 20 years of experience at a leading engineering university in a developed city in southern China. Data were collected through a semi-structured life-history interview and career retrospective, focusing on workplace challenges, stereotype cognition, and self-regulation strategies. Data were analyzed using thematic analysis [10]: interview transcripts were first coded inductively for descriptions of external pressures and coping strategies, then organized into themes along a three-dimensional framework of external pressure, internalization risk, and resilience responses. All identifying information was anonymized, and informed consent was obtained.

4. Case analysis

4.1. Aimed workplace pressure environment

Our participate works in a male-dominated technical industry institution and the gender ratio of the workplace is very uneven. Various informal industry resources in the workplace, such as project information, technical cooperation opportunities, and intergenerational inheritance of industry seniority and resources, are mainly circulated through male social networks. The occupational field is a bit associated with stereotypes of women: they are believed to be emotionally unstable, and not physically suitable for the workplace. Therefore, more conservative acceptance of female practitioners has occurred. Such bias lacks institutionalized, explicit constraints and appears as subjective judgments in the access procedures to work, thus creating an implicit gender barrier in the industry.

After joining the work team, our participant found herself in a typical gendered division of labor: in the course of project implementation, high-intensity physical operations such as equipment handling and mechanical fastening were mainly carried out by male employees. The participant did not oppose this division of labor and believed that the reasons for such differences lay in individual physical capabilities and operational safety requirements, rather than passively accepting gender role prescriptions. Based on the above observations, it is confirmed that there is informal social exclusion and a loss of career belonging for women, aligning with the research of Cyr et al. [2]; at the same time, it is also found that gendered division exists in this situation and manifests in different forms, such as protective concessions.

4.2. Early protective factors and developmental buffering

The creation of the resilience in this case stems from a specific structure of the early-socialization environment. She is an introvert, and during her childhood, she regularly read positive and high-

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quality books to build an ideal world for herself without much contact with others. This "relatively information-enclosed" growth environment unexpectedly acted as a developmental buffer; that is, societal-level gender narratives about "women being unsuited for STEM" failed to reach her cognitive system effectively due to limited transmission paths. As the respondent said, "I have not thought about this".

In addition, a strong same-sex role model was present in the family environment: her primary caregiver was a mathematics teacher who offered an "idealized female = mathematical ability" schema during the critical period of her value formation. It should be noted that this protective factor did not work through explicit "gender equality education": the respondent explicitly stated that she was never taught confrontational discourse such as "girls can also excel in science," but rather, through daily presence alone, no association between gender and disciplinary ability was ever formed. This "conflict-free immunity" state is far from what women currently experience in an information-overloaded environment, which is the demand for "cognitive disinfection".

4.3. Core resilience mechanisms

4.3.1. Cognitive decoupling: boundary maintenance between gender identity and professional identity

The participant of this case could distinguish between gender identity and professional identity in her thoughts. When faced with experimental difficulties or career problems, her mind would automatically engage in a problem-solving mode (consulting literature, analyzing data) instead of recognizing an identity crisis. The respondent explicitly stated: "It never flashed through my mind that I couldn't do it because I'm a girl," "I generally only think about methods to solve the problem."

More importantly, our participant employed a cognitive boundary-maintenance strategy and actively disengaged from cognitive investment in uncontrollable external factors (e.g., others' biases, institutional inertia). The respondent put it as, "Don't worry about things you can't control." This is not passive avoidance; rather, it is a type of functional attention regulation that focuses limited psychological resources on the area of control for a task to avoid external bias in self-evaluation. Academically, this corresponds to the "problem-focused coping" orientation in Lazarus and Folkman's stress coping model [11].

4.3.2. Task focus and competence construction: from being tested to the core echelon

Career resilience of the participant is not an abstract personality trait; rather, it is an accumulated professional ability gained through long-term task experience and work achievements. Early in her career, the team gave some highly difficult, specialized tasks to test the abilities of the practitioners. According to the respondent's account, some male peers in the same grade had a restless mindset and lacked initiative; they often displayed buck-passing, slackness, and abandoning their work midway, but she herself was always highly motivated and responsible for her studies. Given the difficult nature of the work, she still carried herself well and carried out all the steps in the work diligently. Her diligent work ethic and high-quality work have gained the admiration of her colleagues and benefited her further studies.

Based on this early experience, she learned to manage the negative impact of being a woman in the workplace by using extreme, stable professional performance. Therefore, the participant has made consistent high-quality work output, been promoted more rapidly than others in the same period and industry, and maintained a high level of development among practitioners at the same

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level for a long time. More than ten years of continuous, stable, high-quality professional work and a high-level occupation provide an extremely strong and objective empirical foundation for her career resilience.

4.3.3. Emotion regulation: depersonalized attribution and attentional shifting

The emotion-regulation strategies of the participant has two prominent features. First, depersonalized attribution: when facing difficulties, emotions are directed at particular circumstances rather than the self. The respondent said that "Emotions should be focused on the problem, and one should not assume that this problem will involve the whole group." This attribution pattern prevents the internalization of the narrative "I am targeted because I am a woman," transforming potential identity threats into neutral task difficulties.

Second, attentional shifting and alternative safety construction: When faced with an unsolvable problem, the case subject tends to divert psychological resources to other controllable areas and engages in "doing other things to gain corresponding security and relieve anxiety". This approach corresponds to the "attentional deployment" mechanism in Gross's model of emotion regulation; that is to say, psychological homeostasis is achieved by redirecting attention rather than suppressing emotions [12].

4.3.4. Social pattern: depersonalized information collection

At the social level, the case subject neither formed an exclusive female mutual-support network nor voluntarily join the male-dominated informal workplace group. The social strategy of her workplace shows an obvious depersonalized feature: she only participates in necessary formal and semi-formal workplace communication events to obtain relevant industry information and work resources efficiently, covers career information comprehensively, and keeps a considerable distance from the private leisure social activities of male colleagues, neither actively engaging in them nor showing undue concern for them.

The first purpose of this social structure is to reduce a person's psychological need for connections among coworkers at work. The participant's workplace interactions are mainly with male colleagues, and there is frequent daily communication and cooperation, but the main reason for her social network is professional ability complementarity rather than gender circle aggregation. She thinks that the foundation of a good team is the combination of all sorts of resources and skills, and it cannot be limited to a specific gender. When people are no longer seeking career security in the acceptance and recognition of workplace circles, the negative emotions and developmental costs resulting from gender-circle social exclusion significantly decrease.

4.3.5. Mild internalization and functional resistance

The case subject is not entirely free from the stereotypes of society. She acknowledges some gendered presuppositions in certain contexts (e.g., admitting difficulties with certain physical functions). However, this cognition does not lead to career-withdrawal behavior. As the respondent put it, colleagues are "all quite nice", and gendered interactions are labelled as "interpersonal kindness" rather than "competence devaluation" in her cognition; thus, they do not become a threat to identity. The priority given to professional identity consistently outweighs that of gender identity; thus, she can maintain a functional state of "being aware yet undefined".

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The combined effect of the five above mechanisms enabled the case subject to maintain a stable and good work performance in the early days of her career at a very male-dominated occupation. After more than twenty years of continuous deep involvement, her career level and professional position have remained at the top tier of the same industry for a long time. This extended, stable high-level occupational performance serves as the fundamental operational definition of career resilience in this paper.

5. Discussion

This paper studies how women avoid internalizing bias dynamically through qualitative research, and it also addresses the shortcomings of quantitative instruments in measuring resistance mechanisms and explaining individual differences. Through a time-causal chain of early protective factors → cognitive strategy formation → sustained professional functioning presented via career retrospection, this study offers a mechanism-level theoretical explanation for the phenomenon of individual women breaking through existing limitations. The resilience pathway of this case may have considerable temporal and situational dependencies. The respondent grew up in a time when the sources of information were relatively isolated, and this "low-interference" environment for information unexpectedly served to shield her from repeated exposure to gender-stereotype narratives. The structure of the current digital media ecosystem has changed significantly from the past. Information overload has been confirmed to be significantly associated with an increase in cognitive load and workplace anxiety [13], and social media platform algorithms are not value-neutral: experimental studies on STEM fields have shown that female users are less likely to be recommended relevant disciplinary information by algorithms due to gender bias [14].

Based on the above contrast, this study puts forward an inference: the resilience path supported by the early "information-enclosure dividend" may face adaptability challenges in the current algorithm-driven fragmented media ecosystem. Contemporary female practitioners face dual pressures: traditional gender biases are precisely delivered through algorithms, while information overload constitutes a novel cognitive load. Therefore, resilience cultivation in the new era may require organized empowerment, such as fostering information discernment abilities and building a stable, de-gendered professional self-concept. For female practitioners, career resilience is not an unlearnable innate talent, but a set of psychological skills acquirable through cognitive reshaping. To constitutes the core strategy for resisting stereotype internalization, people should establish a "problem-focused" rather than "identity-focused" attribution style and concentrate attention on controllable task domains. Beyond improving the external environment of schools, Tong and others suggested we need to foster students' cognitive boundary maintenance and emotional regulation skills [15]. It should be noted that this case's philosophy for cultivating young women is not to provide formulaic standardized recipes, but to emphasize subtle demonstration effects—through observing excellent practitioners' problem-analysis frameworks, setback-response thinking, and dilemma-processing methods, to achieve subtle acquisition of cognitive patterns and behavioral strategies. Compared with institutionalized, explicit curriculum teaching, this resilience transmission pathway rooted in authentic career contexts often possesses more lasting and individually fitting educational effects.

6. Conclusion

Through extreme case analysis, this study found that the pressure on STEM women's career development is a dual mechanism of external workplace social exclusion and internal stereotype

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internalization; together, these lead most practitioners to career self-throttling. However, highly resilient individuals can mitigate the adverse effects of a harsh environment through an immune-like effect of early protective factors, cognitive decoupling of gender identity and professional identity, task-oriented competence construction, and proactive maintenance of emotional boundaries. Together, the five resilience mechanisms make up a recognizable "antibody" system.

The core value of this study lies in responding to the question of individual heterogeneity in STEM women's career development that quantitative research cannot answer from a micro-individual perspective. The outer exclusion is an ordinary structural constraint, and whether one can live well depends on how much of it is internalized. When the respondent identifies "focus, responsibility, and persistence" as the three key elements of career success, the implicit logic is: resilience is not an "anti-gender" posture against bias, but a de-identified professionalism. Through early protective factors providing cognitive immunity, through cognitive boundary maintenance blocking internalization channels, and through task focus transforming external evaluation into competence proof, the ultimate achievement is career adaptation from "passive endurance" to "functional independence." This study adds to the qualitative research on STEM women's career resilience and offers practical cognitive empowerment references for gender workplace equity and female research talent development. This research also have some limitations. The first deficiency of this study is a single-case design, and thus, the results cannot be statistically generalized. Future research can expand in two ways. First, based on the "antibody" model put forward in this study, carry out multiple case studies or quantitative empirical verification to investigate the generalizability of each mechanism across various STEM subfields. Second, the current large-scale IAT measurement tools are unidimensional and cannot distinguish among the three stereotype subtypes: "intellectual devaluation", "occupational fitness (physical/emotional)", and "historical statistical inertia" [2]. Future research should develop multidimensional implicit measurement tools to capture the distinct psychological pathways of different bias subtypes and design targeted intervention strategies.

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