REVIEW



Gender differences in personalized psychological interventions for college students: a narrative review integrating the Theory of Multiple Intelligences

Xiaoying Zeng^{1,*}

¹Student Affairs Office, Zhejiang Institute of Communications, 311112 Hangzhou, Zhejiang, China

*Correspondence

zxy2021@zjvtit.edu.cn (Xiaoying Zeng)

Abstract

This narrative review explores gender differences in the design of psychological interventions for college students, using Gardner's Theory of Multiple Intelligences (MI) as a conceptual framework. It examines how variations in mental health challenges, such as the higher prevalence of anxiety and depression among females and the greater propensity for risk-taking behaviors among males, correspond with cognitive profiles outlined in MI theory. Socialization processes further reinforce these differences, with females often exhibiting stronger linguistic and interpersonal capacities, making emotion-focused interventions-such as expressive writing and group discussions-more effective. In contrast, males, who frequently demonstrate enhanced bodily-kinesthetic and spatial abilities, may benefit more from actionoriented interventions, including physical activities or virtual reality (VR) tasks. To integrate these cognitive and psychological dimensions, this review introduces a Gender-Sensitive Psychological Integration Model, which synthesizes biological factors (e.g., neuroendocrine pathways), sociocultural influences (e.g., gender norms) and MI profiles to establish a systematic framework for personalized interventions. While universal strategies, such as mindfulness training and digital platforms, enhance accessibility, gender-specific approaches ensure that interventions align with cognitive and psychological predispositions, thereby optimizing their effectiveness. This dualframework approach addresses both broad and individualized mental health needs. Despite its contributions, this review is limited by its focus on binary sex and gender distinctions, which may not fully capture the diversity of gender identities and psychological experiences. Future research should adopt a more inclusive perspective, incorporating non-binary and intersectional considerations to enhance the applicability of gender-sensitive psychological interventions.

Keywords

College mental health; Sex and gender differences; Multiple intelligences theory; Psychological interventions; Narrative review

1. Introduction

The increasing prevalence and severity of mental health challenges among college students highlight the need for an understanding of the biopsychosocial factors contributing to their complexity. Biological differences related to sex and sociocultural influences associated with gender shape distinct patterns of mental health vulnerabilities and coping mechanisms. Satterthwaite *et al.* [1] (2015) demonstrated that male adolescents exhibit increased amygdala reactivity to stressors, which is linked to externalizing behaviors such as aggression, whereas females show stronger prefrontal cortex engagement, predisposing them to rumination—a key risk factor for internalizing disorders. Similarly, gendered socialization processes systematically influence help-seeking behaviors. Societal norms that discourage emotional disclosure in males contribute to lower engagement with mental health services, with only 28% of male college students with clinical depression seeking professional assistance, compared to 45% of female counterparts [2]. This disparity highlights the need for interventions beyond standardized approaches by addressing both biological sexrelated differences and socially constructed gender expectations. In college environments, where mental health resources are often limited and stigma remains a significant barrier, tailoring interventions to sex- and gender-specific needs may enhance resource utilization, reduce barriers to care, and improve student engagement with support services.

Gardner's Theory of Multiple Intelligences (MI), proposed in 1983, provides a framework for understanding the diverse cognitive strengths of individuals, encompassing linguistic, logical-mathematical, bodily-kinesthetic, spatial and other domains [3]. A study conducted by Shearer et al. [4] supports MI theory's emphasis on individualized intelligence profiles, which serve as a foundation for personalized interventions. Kaur et al. [5] observed that boys in early adolescence exhibit heightened visual-spatial intelligence, whereas girls demonstrate stronger interpersonal and musical capacities. These cognitive differences may be reinforced in higher education through academic specialization (e.g., STEM disciplines emphasizing spatial reasoning) and peer group dynamics (e.g., student organizations fostering collaboration). The transition to college coincides with a critical developmental phase in which gender role expectations become increasingly pronounced [6]. In particular, freshmen experience identity formation pressures shaped by gendered norms and encounter "restrictive emotionality" while females often face expectations of "effortless perfection", which discourages expressions of vulnerability [7]. These stressors necessitate interventions attuned to both neurodevelopmental trajectories, such as the delayed maturation of the prefrontal cortex in males [8], and the sociocultural demands unique to collegiate life. By integrating MI theory with gender-sensitive frameworks, this review examines how biological, cognitive, and sociocultural factors contribute to mental health differences among college students. Based on these insights, it uses the Gender-Sensitive Psychological Integration Model (GSPIM), which incorporates sex-based biological differences, cognitive processing patterns, and gender-related socialization influences to guide the development of targeted psychological interventions.

2. Methodology

This narrative review synthesizes recent literature on sex and gender differences in psychological interventions among college students, using the Theory of MI. Relevant peer-reviewed articles published between 2010 and 2025 were retrieved from PubMed, PsycINFO and Google Scholar using keywords such as "college mental health", "sex and gender differences" and "multiple intelligences". This timeframe was selected to prioritize contemporary evidence while recognizing that foundational works, such as Gardner's original formulation of MI theory (1983) [3], remain essential for understanding the historical development of MI and its evolution. Future reviews may benefit from expanding the scope to include a broader historical perspective, ensuring a more comprehensive examination of MI's role in gender-sensitive psychological interventions.

Studies were included if they provided epidemiological data, sex- and gender-specific mental health outcomes, or applications of MI theory in psychological interventions. A total of 50 key references were analyzed. Non-empirical works, non-English publications, and studies lacking a focus on college students were excluded. Thematic analysis was performed to integrate biological, cognitive and sociocultural factors into GSPIM, which prioritized interpretive depth over statistical precision, aligning with the exploratory nature of a narrative review. Showed in Table 1.

3. Sex and gender differences in college students' mental health

Mental health challenges among college students exhibit distinct patterns influenced by gender differences. Research by Eisenbarth highlights significant variations in the types, manifestations, and coping strategies associated with psychological distress between male and female students [9], which provide important insights for developing gender-sensitive intervention strategies. The following section reviews the prevalence and presentation of common psychological issues, including anxiety, depression and risky behaviors, and also examines gender differences in coping strategies and help-seeking behaviors.

3.1 Common psychological issues among college students

3.1.1 Anxiety and depression

Anxiety and depression are the most prevalent mental health concerns among college students, with a significantly higher incidence in females than in males. Auerbach *et al.* [10] reported that severe anxiety symptoms affect up to 60% of female students, compared to 40% of males, and Kuehner *et al.* [11] suggest that this discrepancy can be attributed to biological, sociocultural and psychological factors.

Biologically, fluctuations in estrogen levels play a crucial role in regulating emotions by affecting neurotransmitter systems such as serotonin and dopamine, making females more susceptible to negative emotional stimuli. Welde *et al.* [12] further emphasize that sociocultural expectations place additional stress on female students, as they often navigate multiple roles, including academic performance, appearance management and interpersonal relationships, which may exacerbate their vulnerability to anxiety and depression.

Psychologically, gender differences in coping mechanisms also contribute to this disparity. Female students are more likely to engage in rumination, repeatedly internalizing and reliving negative experiences, which can prolong emotional distress. In contrast, males tend to rely on emotional suppression or avoidance strategies, minimizing the outward expression of distress. While suppression may temporarily conceal emotional difficulties, it often leads to the accumulation of unresolved issues, which can then increase the risk of more severe mental health complications over time.

3.1.2 Risky behaviors and substance abuse: impact of gender differences

Gender differences in coping mechanisms also extend to risktaking behaviors and substance use. Nolen-Hoeksema's research indicates that male students, when experiencing stress, are more likely to engage in externalizing behaviors, including risky activities, substance abuse and excessive gaming [13]. These behaviors serve as maladaptive coping mechanisms, with men often using high-risk activities, such as dangerous driving or extreme sports, as a means of psychological relief. The inclination toward such behaviors is associated with higher testosterone levels and is further reinforced by cultural norms that equate masculinity with risk-taking and independence.

| TABLE 1. Article search and selection s | teps. |
|--|-------|
|--|-------|

| Step | Criteria | Result |
|----------------|--|--------------|
| Initial Search | PubMed, PsycINFO, Google Scholar (keywords: college mental health, sex and gender differences, multiple intelligences) | 500 articles |
| Inclusion | Empirical studies, college students, 2018–2023 | 120 articles |
| Exclusion | Non-empirical, non-English, non-mental health interventions | 80 articles |
| Final Analysis | 50 key references | 50 articles |
| | | |

Substance abuse patterns also reflect gendered differences in coping strategies. A study by Ay *et al.* [14] suggests that alcohol consumption and smoking are significantly more prevalent among male students, largely due to peer influence and greater societal tolerance of male drinking behaviors. Although these behaviors may provide temporary stress relief, they have long-term consequences, including impaired academic performance, physical health deterioration and social dysfunction. Male students also tend to rely on excessive gaming to escape reality.

Additionally, excessive gaming and digital escapism have emerged as prominent coping mechanisms among male students. For instance, Marques *et al.* [15] found that men are more likely to retreat into virtual environments when faced with academic failures or personal setbacks, as they exhibit greater sensitivity to immediate rewards provided by gaming. While gaming may offer short-term emotional relief, prolonged engagement can lead to social isolation, academic decline and exacerbation of the underlying mental health issues.

3.1.3 Social disorders

Social anxiety is an increasingly prevalent mental health concern among college students, with notable gender differences in its manifestation. Zentner *et al.* [16] found that female students are more likely to experience self-doubt and heightened anxiety in social situations, often exhibiting fear of judgment, difficulty speaking in groups and challenges in forming intimate relationships. While male students tend to be more outgoing in superficial social interactions, they frequently display avoidance or resistance when faced with deeper interpersonal connections. Social anxiety not only affects every day social interactions but may also impair academic performance and hinder career development.

Gender-specific patterns in social anxiety are shaped by cognitive and emotional processing differences. Teale Sapach *et al.* [17] observed that female students with social anxiety tend to be overly sensitive to interpersonal relationships, often overanalyzing social cues and misinterpreting others' reactions, which further reinforces their anxiety. Consequently, they may avoid social situations or struggle with establishing meaningful connections. In contrast, male students often adopt avoidant coping mechanisms, actively withdrawing from social engagements or concealing their emotions to maintain an appearance of control. Varghese *et al.* [18] noted that men frequently exhibit defensive behaviors, showing reluctance to express vulnerable emotions in social settings, which may manifest as social withdrawal or emotional detachment. The relationship between social anxiety and gender role expectations further exacerbates these differences. Oren-Yagoda *et al.* [19] found that women are generally expected to be cooperative, emotionally expressive and socially perceptive, making them more attuned to relational dynamics in social interactions. Conversely, men often prioritize independence, decisiveness and emotional restraint, leading to behaviors that may appear detached or self-enclosed in social settings.

3.2 Sex and gender differences in coping strategies and help-seeking behaviors

Socialization processes that encourage emotional expressiveness in females contribute to their greater reliance on emotionfocused strategies, such as verbalizing feelings and seeking social support, which align with linguistic and interpersonal intelligences, thereby facilitating emotional articulation and interpersonal connection. However, excessive dependence on social networks can lead to social media fatigue or relational stress, where peer validation takes precedence over genuine emotional processing, potentially exacerbating anxiety. In contrast, male students are more inclined to adopt avoidancebased coping strategies, such as engaging in sports, gaming or substance use. These behaviors reflect bodily-kinesthetic and spatial intelligences, favoring action-oriented responses over verbal expression. However, reliance on such strategies may mask underlying psychological distress, delaying acknowledgment and treatment of mental health concerns. Gender norms that emphasize independence and emotional restraint further reinforce these tendencies, discouraging males from seeking emotional support [20].

Educational practices, including the "hidden curriculum", perpetuate gender-specific cognitive patterns by reinforcing culturally expected behaviors [21]. For instance, educators may unconsciously assign spatial reasoning tasks (*e.g.*, geometry problems) more frequently to male students and verbal tasks (*e.g.*, essay writing) more often to female students, systematically shaping their cognitive strengths within the MI framework. These practices highlight the intersection of biological predispositions and sociocultural conditioning in shaping students' approaches to psychological distress.

Differences in help-seeking behaviors further illustrate the impact of gendered coping mechanisms. Female students are more likely to utilize counseling services or seek peer support, partly due to greater societal acceptance of emotional vulnerability. In contrast, males often avoid professional help due to stigma, opting instead for solitary coping mechanisms or substance use. This divergence underscores the need for tailored interventions, such as anonymous digital mental health platforms for male students, which can lower barriers to accessing professional support while accommodating their preference for discreet help-seeking.

However, these gendered coping strategies come with compensatory trade-offs. While emotion-focused approaches help female students regulate distress in the short term, they may inadvertently reinforce dependency on external validation. Conversely, avoidance-based strategies provide temporary relief for males, but often exacerbate long-term psychological risks by preventing the resolution of underlying distress. Effective interventions must balance these tendencies—for instance, by integrating emotion-regulation training into sports programs for male students or incorporating problem-solving exercises into peer support groups for female students.

Overall, as shown in Table 2, sex and gender differences shape psychological distress, coping mechanisms, and helpseeking behaviors among college students. Female students tend to favor emotion-focused strategies, making them more responsive to expressive interventions, whereas male students rely on avoidance-based approaches, benefiting more from action-oriented strategies. These insights highlight the importance of gender-sensitive mental health interventions that address both existing tendencies and gaps.

4. Insights from the Theory of Multiple Intelligences

Gardner's Theory of MI, first proposed in 1983, conceptualizes intelligence as a multidimensional construct encompassing linguistic, logical-mathematical, bodily-kinesthetic, spatial and other cognitive domains [3]. Unlike traditional intelligence models, which emphasize a unitary cognitive capacity, MI posits that individuals possess distinct cognitive strengths, supporting the development of personalized interventions. However, the empirical validity of MI remains a subject of debate. Critics, such as Ferrero et al. [22], have raised methodological concerns regarding MI-based studies, citing small sample sizes, limited controls and subjective intelligence classifications, which challenge its psychometric reliability. These limitations highlight difficulties in operationalizing MI constructs, but they do not necessarily invalidate the theory's relevance. In contrast, Shearer [4] argues that neuroscientific evidence supports MI's framework, as research on cognitive diversity and neural specialization aligns with MI's premise of individualized cognitive strengths. Nevertheless, while Ferrero *et al.* [22] point to methodological flaws in past MI studies, these issues suggest that MI's diverse framework may complicate its consistent empirical validation. In GSPIM, however, MI is employed as a flexible framework, as supported by Shearer's [4] neuroscience evidence, within a model that integrates biological and sociocultural factors. This approach ensures GSPIM's practical utility despite MI's empirical challenges.

Gender socialization may further reinforce specific MI profiles. Armstrong [23] suggests that females tend to develop stronger linguistic and interpersonal intelligence due to their early exposure to verbal education and relational tasks, whereas males often enhance bodily-kinesthetic and spatial intelligence through physical engagement and problem-solving activities.

The application of MI theory in psychological interventions necessitates a critical evaluation of both its empirical foundations and its sociocultural implications. Neuroscientific studies provide tentative support for MI's domain-specific framework. For example, Kravitz *et al.* [24] demonstrated that visuospatial processing tasks activate distinct neural networks in the parietal-occipital regions, indicating the presence of domainspecific cognitive substrates. While such findings align with MI's diversified intelligence model, they do not necessarily confirm innate modularity, as gendered educational practices may also shape these neural patterns over time.

Importantly, MI's practical value lies in its ability to translate observed sex and gender differences into targeted intervention strategies. Freeman et al. [25] found that males with strong spatial abilities engaged more effectively with virtual reality (VR)-based stress interventions than with traditional counseling, highlighting the importance of matching therapeutic approaches with cognitive strengths. However, these patterns should not be misinterpreted as biologically deterministic. Longitudinal studies indicate that targeted training can reshape cognitive profiles, as spatial skill enhancement programs have been shown to induce comparable neural plasticity in both sexes [26]. Based on these insights, GSPIM employs MI as a flexible framework that both accommodates and challenges gendered cognitive tendencies. For instance, by integrating spatial problem-solving tasks with verbal reflection exercises for males, GSPIM aims to promote cognitive flexibility while counteracting cognitive stereotypes.

Future research could focus on two key areas to enhance MI's application in psychological interventions. First, largescale neuroimaging studies are needed to distinguish biological

| Psychological Issues | Female Characteristics | Male Characteristics |
|-----------------------|--|--|
| Anxiety/Depression | Rumination, somatic symptoms | Emotional suppression, externalized anger |
| Risk-Taking Behavior | Relational risk-taking (<i>e.g.</i> , risking for friendship maintenance) | Instrumental risk-taking (<i>e.g.</i> , competitive/economic risks) |
| Social Difficulties | Excessive concern about negative evaluation | Suppression of emotional expression |
| Coping Strategies | Emotion-focused (venting, social support) | Avoidance (exercise, gaming) |
| Help-Seeking Behavior | Proactive use of counseling services | Reluctance due to stigma, reliance on alternatives |

TABLE 2. Common psychological issues among college students by sex and gender.

determinants from sociocultural influences in intelligence domains. Second, cross-cultural intervention trials should evaluate the adaptability and effectiveness of MI-based psychological strategies across diverse populations. Advancing research in these areas will strengthen both the scientific credibility and practical efficacy of personalized mental health interventions in college settings.

5. Intervention measures

Drawing on MI theory and sex- and gender-specific psychological differences, effective interventions should be personalized, targeted and universally accessible. The following sections outline interventions tailored for female and male students.

5.1 Female interventions

For female students, interventions should leverage their strengths in linguistic expression and interpersonal connection, as these cognitive tendencies facilitate stress relief through verbal articulation and social support. While further research is needed to confirm the effectiveness of these methods across different populations, existing evidence suggests their potential benefits.

One effective approach is expressive writing therapy, which engages linguistic intelligence to promote emotional release and cognitive restructuring, thereby alleviating anxiety and depression. A randomized controlled trial by Mohamed et al. [27] (2023) demonstrated that this therapy significantly improved anxiety symptoms in females compared to males, highlighting the importance of sex- and gender-specific interventions. A structured weekly "emotional diary" program that includes counselor feedback has been shown to further enhance mental well-being by providing consistent emotional support and guided reflection. Additionally, peer support groups and structured group discussions activate interpersonal intelligence, fostering a sense of social belonging and emotional resilience. Studies on college emotional management workshops indicate that these interventions enhance coping skills and reduce isolation [28]. To address intersectional factors such as race and socioeconomic status, Hess et al. [29] recommend adapting interventions for collectivist cultures, where females may prioritize communal support over individual coping mechanisms. Integrating culturally responsive elements within GSPIM ensures that interventions remain relevant, accessible, and effective across diverse student populations. Collectively, the evidence supports the customization of MI-based strategies to effectively address sex- and genderspecific mental health challenges while maintaining cultural adaptability.

5.2 Male interventions

Interventions for males may focus on bodily-kinesthetic and spatial cognitive strengths to enhance engagement through tangible, action-based tasks. Physical activities, such as team sports or structured fitness programs, help reduce stress and increase motivation by incorporating goal-setting and structured challenges. Colleges could implement "sports-based recovery programs", which integrate psychological support with MI principles to align with male cognitive tendencies. VR-related interventions leveraging spatial intelligence can provide an alternative to traditional counseling and help reduce stigma while encouraging participation. Díaz-Pereira's pilot study on VR-based interventions found a 25% greater reduction in male stress levels compared to generic approaches, supporting the application of spatial intelligence in sex- and gender-specific contexts [30]. To account for cultural variations, Grigsby *et al.* [31] suggest tailoring these interventions to address peer-driven risk-taking behaviors in individualistic settings, ensuring their relevance within GSPIM. These findings highlight MI's potential to improve male engagement in mental health interventions.

5.3 Universal interventions

Universal interventions address shared mental health needs while allowing for sex- and gender-specific adaptations, complementing targeted strategies (Sections 5.1-5.2). Mindfulness training engaging in intrapersonal intelligence has been shown to reduce anxiety and depression by 20% across sexes and genders [32]. However, customization can enhance its effectiveness: females may prefer group meditation, which fosters interpersonal connection, whereas males may respond better to app-based spatial tasks, such as VR-guided navigation exercises. Digital mental health platforms further enhance accessibility by facilitating anonymous help-seeking, a strategy that has been shown to reduce stigma-related barriers among male students by 35% in recent trials [33]. These platforms also support linguistic expression, providing structured journaling tools that align with female students' cognitive tendencies, while remaining accessible to a broad population. Based on these, colleges could integrate mindfulness apps and digital interventions within the universal layer of GSPIM to enhance engagement and intervention effectiveness. Recent studies confirm that digital approaches are effective across diverse cultural and institutional contexts, reinforcing their applicability within MI-based psychological strategies. These universal interventions ensure broad accessibility while allowing for sexand gender-sensitive adaptations.

5.4 Gender-sensitive psychological integration model based on multiple intelligence theory

GSPIM integrates biological (sex-based), cognitive (intelligence profiles) and sociocultural (gender-based) factors to guide the development of personalized psychological interventions for college students. Building on the findings from sex and gender differences in mental health (Section 3.1), coping strategies (Section 3.2), and MI theory (Section 4), the GSPIM provides a structured approach to designing targeted mental health interventions. It incorporates concentric layers, addressing both shared and individualized needs, serving as both a theoretical framework and a practical guide for implementing sex- and gender-sensitive mental health strategies (Fig. 1).

Our model integrates three interconnected layers:

• Core Layer: Accounts for both sex-based biological influences and gender-based sociocultural factors:

Gender-sensitive Psychological Integration Model Based On Multiple Intelligence Theory



FIGURE 1. Gender-sensitive psychological integration model based on the multiple intelligence theory.

• Neuroendocrine factors (sex-based): Elevated testosterone levels in males correlate with increased risk-taking behaviors, while estrogen fluctuations in females influence serotonin sensitivity, potentially heightening susceptibility to anxiety and mood disorders. However, these biological influences are not deterministic. As Eliot *et al.* [34] argue, gender norms and socialization play a critical role in shaping neuroendocrine profiles, reinforcing the importance of an integrated approach that resists reducing behavior to purely biological factors.

• Neural circuitry (sex-based): Gender-divergent prefrontal cortex-amygdala connectivity influences emotional regulation, with hyperactivity in males correlating with emotional suppression and hypoactivity in females linked to rumination.

• Sociocultural (gender-based) triggers: Socialization processes, such as the "hidden curriculum", reinforce avoidance in males (*e.g.*, "masculine stoicism") and emotional labor in females (*e.g.*, "feminine expressiveness"). Cultural differences further shape these tendencies, where collectivist cultures may intensify female social anxiety, while individualistic cultures may increase male risk-taking behaviors. For instance, in Asian societies, socioeconomic status may influence linguistic intelligence development in females, necessitating an intersectional analysis of class and gender.

• Middle Layer: Applies the MI theory to observed sex and gender differences, recognizing that these cognitive profiles

are not neurologically fixed but shaped by socialization and education:

• Linguistic & Interpersonal Intelligences (Female): These support emotion-focused coping strategies (Section 3.2), making expressive writing interventions particularly effective (Section 5.1).

• Bodily-Kinesthetic & Spatial Intelligences (Male): These inform action-oriented coping mechanisms (Section 3.2), reinforcing the effectiveness of physical activity and VR-based interventions (Section 5.2). However, as Neubauer *et al.* [26] emphasize, these patterns are not innate but shaped by societal reinforcement and cultural norms. While MI-based interventions can be strategically tailored, GSPIM also recognizes the importance of challenging gender stereotypes, promoting flexibility in intelligence development, and adapting interventions dynamically based on individual and cultural contexts.

• Outer Layer: This layer operationalizes interventions, beginning with an initial assessment phase. It consists of three subcomponents within the male- and female-targeted sections: Question Module: Assesses students' MI profiles, mental health challenges, and sex- and gender-specific needs (*e.g.*, anxiety and depression in females, risk-taking behaviors in males). MI assessments guide tailored intervention selection, ensuring alignment with cognitive tendencies and sociocultural contexts.

o Smart Module: Identifies and links dominant MI types

(*e.g.*, bodily-kinesthetic and spatial intelligence in males, linguistic and interpersonal intelligence in females) to inform intervention design.

 Intervention Module: Implements targeted strategies, such as VR spatial tasks for males and expressive writing for females.

• Dynamic Interactions: The layers of the GSPIM interact bidirectionally, meaning that influences move between them rather than following a one-way flow. Sociocultural (genderbased) pressures and biological (sex-based) factors in the core layer (e.g., societal norms that encourage emotional suppression in males or emphasize relational expectations in females) shape cognitive tendencies in the middle layer. For example, these influences may strengthen linguistic and interpersonal intelligence in females while reinforcing bodily-kinesthetic and spatial intelligence in males, which then guide intervention choices in the outer layer. For instance, male avoidance of emotional expression, shaped by social norms, may be addressed through VR-based tasks that encourage stress management without requiring direct verbal communication. Similarly, female tendencies toward rumination, influenced by societal expectations, can be managed through structured expressive writing exercises that help process emotions more effectively. The Question Module facilitates this interaction by collecting and refining data on MI profiles and mental health needs, creating a continuous feedback loop that improves the precision of interventions. This bidirectional exchange ensures that the GSPIM remains adaptable, allowing interventions to evolve in response to individual, cultural and biological changes, thereby enhancing its flexibility and effectiveness.

6. Recommendations

To effectively integrate MI theory and sex- and gendersensitive interventions into college mental health programs, several improvements in assessment, training and policy implementation are necessary. Using MI assessment tools such as Multiple Intelligences Developmental Assessment Scales (MIDAS), alongside neuroscientific findings, can help evaluate linguistic, kinesthetic and spatial tendencies in students. Conducting these assessments during freshman enrollment and incorporating the results into psychological profiles would allow for more personalized interventions. Regularly combining anxiety and depression scales with follow-up evaluations would also help monitor changes over time, ensuring that students receive timely and relevant support. Counselor training programs should incorporate intersectional frameworks to ensure that the GSPIM remains inclusive of non-binary identities and culturally diverse backgrounds [35].

To implement the Gender-Sensitive Psychological Integration Model (GSPIM) practically, college mental health professionals can follow these four processes: (1) develop various intervention measures based on students' Multiple Intelligences (MI) strengths, gender differences, cultural factors, and psychological issues such as anxiety or substance use (*e.g.*, drinking), where these intervention measures are modular and can be combined; (2) assess new students at enrollment using the MIDAS to identify MI strengths, and employ scales such as the Patient Health Questionnaire-9 (PHQ-9) for depression, the Generalized Anxiety Disorder-7 (GAD-7) for anxiety, and additional scales for social anxiety or substance use to evaluate mental health issues; (3) use artificial intelligence (AI) to match and apply different intervention measures to address specific problems, then collect feedback on the outcomes to assess their effectiveness; (4) dynamically adjust the intervention measures and strategies based on feedback to improve outcomes, ensuring they remain aligned with students' evolving needs and MI profiles.

7. Conclusions

This study integrates sex and gender differences with MI theory to enhance mental health support for college students, offering insights for both theory and practice. The findings suggest that females' linguistic and interpersonal tendencies make them more responsive to expressive interventions, while males' bodily-kinesthetic and spatial inclinations align better with action-oriented approaches. Universal strategies, such as mindfulness training and digital platforms, provide support that transcends sex and gender distinctions, addressing shared psychological needs.

While MI theory offers a valuable heuristic framework for mapping cognitive tendencies, its application also presents limitations. Concerns about empirical validity, such as those raised by Ferrero *et al.* [22], highlight the need for further research to strengthen its methodological foundation. Additionally, the predominant binary focus on male and female cognitive tendencies limits inclusivity and risks reinforcing gender stereotypes if these tendencies are assumed to be fixed rather than modifiable. As Sharma *et al.* [36] argue, cognitive patterns are not innate but shaped by societal reinforcement and cultural norms. This perspective reinforces the GSPIM's role in challenging stereotypes, promoting flexibility in intelligence development, and adapting interventions to individual and cultural contexts.

Given the current study's focus on binary gender distinctions, a broader perspective is necessary. Building on Crenshaw's (1989) intersectionality framework [37], future research could explore how race, socioeconomic status, and gender identity intersect to shape mental health outcomes, with particular attention to the experiences of non-binary and gender-diverse students. For instance, socioeconomic disparities in collectivist cultures (e.g., low-income Asian students) may amplify linguistic intelligence development in females while intensifying risk-taking behaviors in males, necessitating tailored adaptations within the GSPIM. Addressing these factors would help move beyond the binary framework, ensuring that interventions are inclusive of diverse identities and experiences. Integrating MI theory with sex- and gender-sensitive perspectives provides a novel framework for enhancing college mental health interventions. Future research should prioritize empirical validation, cultural adaptation, and technology integration to overcome current limitations and develop scientifically robust, inclusive, and adaptable mental health strategies for diverse student populations.

AVAILABILITY OF DATA AND MATERIALS

Not applicable.

AUTHOR CONTRIBUTIONS

XYZ—conceptualized the study; conducted an extensive literature review; and synthesized research on sex and gender differences in college mental health; developed the MI-based theoretical framework; analyzed sex- and gender-specific interventions; and authored the manuscript, critically revising it for publication. The author contributed to editorial changes in the manuscript. The author read and approved the final manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

ACKNOWLEDGMENT

Not applicable.

FUNDING

The 2024 Zhejiang Provincial Department of Education Special Project on Ideological and Political Education for College Students (Project No: Y202456404).

CONFLICT OF INTEREST

The author declares no conflict of interest.

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How to cite this article: Xiaoying Zeng. Gender differences in personalized psychological interventions for college students: a narrative review integrating the Theory of Multiple Intelligences. Journal of Men's Health. 2025; 21(5): 9-17. doi: 10.22514/jomh.2025.063.