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Gender differences in PERMA well-being among University students: a network analysis

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ABSTRACT

While gender differences in well-being are widely studied, the interaction of the PERMA dimensions (positive emotion, engagement, relationships, meaning, and accomplishment) across genders remains unclear, leaving gaps in understanding the psychological dynamics of flourishing. This study aims to examine gender differences in the network structure of PERMA well-being among university students, focusing on variations in global connectivity, centralities, and specific edge strengths. A total of 946 students participated in the study. The network analysis was applied to identify the network structures that determine the concentrations and interconnections of PERMA indicators in men and women. Results showed that overall network strength and structure were similar across genders. However, local differences were observed, with accomplishment more central for men and some emotional–relational connections differing between groups. These findings present a different perspective on gendered well-being patterns, emphasizing the need for developing tailored interventions in educational settings that account for these subtle differences.

Introduction

Gender differences in well-being are well studied, consistently demonstrating that men and women differ in how they perceive and experience various dimensions of mental health and psychological flourishing (Feng & Zheng, 2024; Matud et al., 2019, 2023). The gender well-being divide is a persistent phenomenon, observed across multiple well-being measurements and nations (Blanchflower & Bryson, 2024a, 2024b). This paradox indicates that, although women often report higher overall life satisfaction and happiness than men, they simultaneously experience greater negative affect (e.g. depression, loneliness, anxiety, stress), lower levels of positive affect (such as enjoyment, cheerfulness, and calmness) and higher psychological distress and diminished present well-being (Becchetti & Conzo, 2022; Blanchflower & Bryson, 2024a, 2024b; Calandri et al., 2021; Moreno-Agostino et al., 2024). This paradox has been consistently observed across countries, age groups, and socioeconomic situations (Becchetti & Conzo, 2022). Furthermore, women display greater emotional diversity, encompassing stronger experiences of both positive and negative components of well-being, suggesting that subjective well-being assessments may capture a broader range of affective and cognitive dimensions among women than men (Blanchflower & Bryson, 2024b; Matud et al., 2023). Evidence from the PERMA profile reinforces this view that although women express more general well-being, their emotional states fluctuate more, supporting the notion that short-term well-being remains lower than that of men (Ramli et al., 2024).

Through five core elements of well-being, positive emotion, engagement, relationships, meaning, and accomplishment, Martin Seligman's PERMA model provides a comprehensive framework for understanding human flourishing (Seligman, 2011, 2018). Gender differences across these dimensions are well-established, reflecting disparities in emotional regulation, social interactions, and job ambitions (Chaplin, 2015; Gülşen & Şahin, 2023; Taylor et al., 2000). Women may specifically report higher degrees of positive emotion due to

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their greater emotional expressiveness and social support systems, whereas, men tend to score higher on achievement, reflecting gendered expectations of success and self-efficacy (Chaplin, 2015). Gender differences in engagement may also arise, with men more likely to experience flow in academic or competitive activities, whereas women tend to engage more deeply in socially oriented activities (Gülşen & Şahin, 2023). Although women tend to place a higher emphasis on social bonding and interpersonal support (Taylor et al., 2000), some studies report the reverse, with male students displaying better social adjustment at the university level (Kaur & Sharma, 2022). Other evidence challenges the role of gender altogether, reporting no significant differences in students' PERMA well-being (Al-Hendawi et al., 2024). Regarding meaning, women tend to report a higher sense of purpose in life and altruistic roles, while men may derive meaning more from career-related achievements and autonomy (Hamby et al., 2017; Xi et al., 2022). These patterns, however, are shaped by cultural and societal expectations that influence how individuals find purpose (Xi et al., 2022). Gender differences in accomplishment may likewise reflect variations in assertiveness and self-esteem, with men often reporting higher levels of both than women, a disparity that may shape how they perceive and strive for success (Casale, 2020). Although gender differences in well-being have been extensively studied, the fundamental elements and their connections underlying these variations across the PERMA dimensions remain unknown. In particular, gaps persist in our knowledge of the gender-based patterns of psychological flourishing, as the ways in which these five aspects of well-being interact differently for men and women have not been fully investigated.

The ways in which these dimensions interact differently for men and women remains underexplored. Network analysis focuses on the interconnections among components rather than mean differences, offering a novel method for advancing the study of mental health (Briganti et al., 2024; Lingán-Huamán et al., 2025; McElroy et al., 2021; Pan et al., 2024). In a network model, individual variables are represented as nodes, and the connections between them (edges) indicate the strength of their interrelations (Briganti et al., 2024). This approach enables researchers to explore not only gender differences in overall levels but also differences in the structural relationships among components (Lingán-Huamán et al., 2025). Network analysis can identify patterns of connectivity among the PERMA dimensions that traditional statistical approaches may overlook (Heshmati et al., 2022). For instance, it can show whether certain domains, such as relationships and positive emotions, emerge as central to the well-being structure, suggesting their pivotal role in psychological flourishing, while other domains, such as engagement and meaning, exhibit varying degrees of interconnectedness within the network (Heshmati et al., 2022). Such an investigation can shed light on the fundamental framework of well-being and clarify how its various elements influence gendered perceptions of psychological health.

Accordingly, the first aim of this study is to compare the network structure of PERMA well-being between male and female students, and the second is to identify gender-specific differences in centrality and interconnections among PERMA elements. To achieve these aims, a network analysis will be employed to investigate gender-based disparities in PERMA well-being among college students. We hypothesise that notable gender differences exist in the PERMA well-being structures of university students. In particular, we expect to find gender differences in the relationships across the five primary areas. We predict that the global network structure and specific edge strengths will vary by gender, with men showing stronger ties in the Accomplishment domain and women in the Relationships domain This expectation aligns with cultural norms that associate success and self-efficacy more strongly with men, while women are more likely to place greater value on relationships and social support (Casale, 2020; Taylor et al., 2000). Furthermore, women may exhibit a stronger association between relationships and good mental state than men (Zhao et al., 2022). However, men may demonstrate higher levels of engagement, potentially due to stronger autonomy and a greater sense of purpose in life (Zhao et al., 2022). In addition to the overall structure of PERMA well-being, we hypothesise that there are gender differences in item-level intercorrelations within each domain. We anticipate distinct gender-specific relationships between optimism in positive emotions, life satisfaction, and happiness. Men, by contrast, may exhibit stronger relationships between Absorption, Flow Experience, and Dedication in Engagement, reflecting a more task-oriented focus. Within Relationships, women are expected to show stronger in feeling entrusted, loved, and supported, underscoring the centrality of social connection. Regarding Meaning, men may emphasise self-oriented meaning, whereas women may demonstrate stronger associations between self-esteem, value in life, and altruism, reflecting a more relational orientation. Finally, in Accomplishment, men may exhibit stronger connections

among goal progress, competence, and achievement, consistent with a more goal-directed approach. Taken together, these structural differences highlight the importance of gender-sensitive approaches to well-being interventions in academic settings. By examining these intercorrelations, we can gain deeper insight into gender-specific patterns of PERMA well-being and how men and women may experience flourishing in distinct ways.

Theoretical underpinning

Seligman (2011) introduced the PERMA model to define well-being through five key dimensions, including positive emotions, engagement, relationships, meaning, and accomplishment. Positive emotion refers to the subjective experience of happiness across past, present, and future; while engagement involves the use of one's character strengths, talents, and capacities; Meaning refers to feeling connected to a greater purpose; relationships encompass creativity and altruism in social connections; and accomplishment is the satisfaction derived from achieving goals and realising one's potential. Seligman emphasised that well-being is best achieved by integrating both hedonic (pleasure-focused) and eudemonic (purpose-driven) perspectives, and together, these five dimensions create what he describes as a 'full life' (Giangrasso, 2021).

The PERMA framework has become widely adopted in recent years. Nevertheless, alternative theories of well-being have also exerted considerable impact. Ryff's Six-Factor Model of Psychological Well-Being delineates well-being through theoretically established dimensions of self-acceptance, positive inter-personal relationships, autonomy, environmental mastery, life purpose, and personal growth, emphasising aspects of positive functioning that prior assessments, such as life satisfaction and affect balance, largely overlooked (Ryff, 1989). Diener's Subjective Well-Being model, on the other hand, focuses more on the enjoyment aspect of happiness and how happy someone is with their life as a whole (Diener, 1984). The PERMA + 4 model has recently expanded Seligman's original paradigm by integrating additional dimensions, including physical health and attitude (Donaldson et al., 2022). In the present study, we chose the PERMA model because it integrates both hedonic (e.g. positive emotions, satisfaction) and eudaimonic (e.g. meaning, accomplishment) perspectives, while remaining concise and well validated for use with university students. Moreover, the adapted PERMA scale has already been validated in the same context (Yurayat et al., 2025), making it particularly appropriate for our sample.

At the same time, understanding gender differences in PERMA requires embedding it within broader gender theories. Social Role Theory hypothesises that societal expectations shape gender differences, giving rise to stereotypes that associate men with agentic traits (e.g. independence, leadership) and women with communal traits (e.g. sociability, emotional sensitivity), with these prescriptive beliefs further influenced by age, culture, and intersectionality (Eagly & Sczesny, 2019; Eagly & Wood, 2012). Other perspectives, such as Self-Determination Theory and the Broaden-and-Build Theory, suggest that men's well-being is often reinforced by autonomy and competence, whereas women's tends to be supported by social connectedness and emotional resources that foster resilience and positive affect (Fredrickson, 2001; Ryan & Deci, 2000). Taken together, these perspectives position PERMA as both a universal model of flourishing and a framework that captures how gendered expectations and experiences shape distinct pathways to well-being.

Positive emotion

Seligman emphasises that positive emotions, such as joy, hope, and pride, can stem from past, present, or future events and are essential for well-being (Seligman, 2011, 2018). These emotions not only motivate individuals to take action but also enhance reasoning, adaptive skills, and behaviours (Lambert D'raven & Pasha-Zaidi, 2016). Positive emotions are linked to life satisfaction, improved health, resilience, and academic success (Coffey et al., 2016; Trigwell et al., 2012), as well as to creativity, social integration, and the pursuit of pleasure alongside the avoidance of discomfort (Donaldson et al., 2021). Donaldson et al. (2021) suggest that these emotions often arise as a response to overcoming challenges, contributing to long-term success. In line with broader gendered patterns, men are often encouraged to express pride and confidence, whereas women are expected to display warmth and empathy, with such differences shaping

the ways positive emotions contribute to resilience through achievement-oriented expressions for men and through relational connectedness for women (Eagly & Wood, 2012; Fredrickson, 2001).

Engagement

Engagement refers to the deep absorption in activities to the point where time seems to disappear, a concept based on Csikszentmihalyi's 'flow', where intense focus leads to the loss of self-awareness and a state of heightened performance (Csikszentmihalyi, 2014). Engagement spans across cultures, age groups, and occupations, offering enjoyment and satisfaction (El-Mawas & Heutte, 2019; Kun et al., 2017). It encompasses three key dimensions, including behavioural, psychological, and cognitive (Kern et al., 2015). In students, engagement has been linked to higher academic performance and life satisfaction, while for working adults and older individuals, it relates to work commitment and social involvement (Seligman, 2018). Studies consistently show that engagement promotes positive emotions and well-being, and is a predictor of academic success (Tansey et al., 2018; Umucu et al., 2024). Gendered patterns indicate that men tend to emphasise autonomy and mastery, whereas women more often engage through collaboration and relationships, reflecting how social expectations create different routes to deep involvement (Eagly & Sczesny, 2019; Ryan & Deci, 2000).

Relationships

Relationships are a key element of the PERMA model, essential for well-being (Butler & Kern, 2016; Kern, 2022; Tansey et al., 2018). Humans are naturally social and gain a sense of belonging and support from relationships with family, friends, and colleagues. Positive relationships enhance well-being by providing emotional support, purpose, and connection during both successes and challenges (García-Alandete, 2015; Norrish et al., 2013). These connections are not solely about dependency but involve being present and accessible when needed (Kern, 2022). Social bonds thrive on openness, active listening, and unconditional acceptance. Relationships also encompass feelings of value, inclusion, and emotional exchange, promoting a sense of safety and stability (Seligman, 2011). Maintaining meaningful connections is essential for leading a purposeful life, with positive relationships closely linked to happiness and social support, both of which improve general well-being (Benţea, 2019; Foo & Prihadi, 2021). Gender expectations shape this area as well, with women often socialised to value care, support, and emotional exchange, which can enhance the benefits they gain from close relationships compared to men (Eagly & Sczesny, 2019; Ryan & Deci, 2000).

Meaning

Meaning is the fourth element of the PERMA model, encompassing individuals' introspective processes for understanding events in their lives across the past, present, and future (Rahmadani et al., 2019; Schnell, 2014). It is tied to personal identity and is about giving rather than taking, integrating different timeframes to create a coherent sense of self (Khaw & Kern, 2014; Tansey et al., 2018). A strong sense of meaning is linked to life satisfaction, positive emotions, and academic success, particularly in college students (Tansey et al., 2018). Individuals often find meaning through participation in groups, philanthropic efforts, and volunteer work, which foster purpose, value, and fulfilment in their lives (Lambert D'raven & Pasha-Zaidi, 2016). Meaning involves an association with something larger than oneself, offering a sense of satisfaction and value (Butler & Kern, 2016; Seligman, 2011). This connection boosts purposeful living and helps individuals feel that their lives hold significance (Benţea, 2019). Gendered pathways appear in this domain too: women often find meaning through caregiving and relationships, whereas men are more likely to highlight achievement and leadership in shaping purposeful life stories (Eagly & Sczesny, 2019; Fredrickson, 2001; Ryan & Deci, 2000).

Accomplishment

Accomplishment is often linked to a persevering attitude rather than just tangible outcomes (Seligman, 2018). It represents mastery and competence in living a meaningful life, contributing to happiness (Kun et al., 2017).

While accomplishments may include victories and awards, they also stem from individual skills and efforts aligned with life goals. Achievement enhances well-being, even when not directly tied to positive emotions or engagement (Lambert D'raven & Pasha-Zaidi, 2016). Research shows that accomplishment correlates with social standing, health, and academic success, making it a strong predictor of GPA among college students (Kern et al., 2015; Tansey et al., 2018). Accomplishment also involves intrinsic motivation, where persistence towards personal goals leads to fulfilment (Butler & Kern, 2016; Seligman, 2011). Self-determination theory suggests that competence is a fundamental human need, and success motivates people to live happy, fulfilled lives (Benţea, 2019; Ryan & Deci, 2000). Gender differences remain visible in this domain, as men are often encouraged to pursue agentic goals tied to achievement, status, and competition, whereas women may find accomplishment more strongly in socially or relationally meaningful achievements (Eagly & Sczesny, 2019; Ryan & Deci, 2000).

Methodology

This study used a cross-sectional correlational survey design to explore gender differences in PERMA well-being networks among university students.

Participants

A total of 946 undergraduate students were selected from a university in Thailand, with an equal number of men and women (men $N = 473$, 50%). The sample comprised 603 second-year students (64%), 29 third-year students (3%), 24 fourth-year students (3%), and 290 first-year students (31%), drawn from groups of faculties in science and technology (18%; e.g. engineering, computer science, biology), health Science (12%; e.g. medicine, nursing, pharmacy, public health), and humanities and social sciences (71%; e.g. education, language, business, political science). The distribution of men and women was fairly balanced across academic years and areas of study. Although the data were collected from a single university, which limits generalisability, the institution enrols students from diverse regions and disciplines, adding variability to the sample.

Instruments

Well-being was assessed using the 15-item PERMA scale developed and validated by Yurayat et al. (2025) for use with university students. Their study confirmed the construct validity of the five-factor PERMA model through confirmatory factor analysis (CFA) and demonstrated strong reliability (Yurayat et al., 2025). Each of the five PERMA domains—positive emotion, engagement, relationships, meaning, and accomplishment—was represented by three items. The positive emotion domain included happiness (PE1), life satisfaction (PE2), and optimism (PE3); the engagement domain consisted of absorption (EN1), flow experience (EN2), and dedication (EN3); the relationships domain measured being entrusted (RL1), being loved (RL2), and being supported (RL3); the meaning domain evaluated self-esteem (MN1), value in life (MN2), and altruism (MN3); and the accomplishment domain included goal progress (AC1), a sense of competence (AC2), and goal achievement (AC3). Participants responded to each item using a Likert scale rating from 1 (strongly disagree) to 5 (strongly agree). In the present study, the adapted PERMA scale again demonstrated good internal consistency across its dimensions (Cronbach's α: .78–.85). Given that CFA results were previously established by Yurayat et al. (2025), the scale appeared to function reliably and demonstrated acceptable validity.

Data analysis

To investigate gender differences in PERMA well-being, we employed a network analysis approach, similar to the methodology outlined in previous studies (Heshmati et al., 2022; Merritt et al., 2024). Our analysis proceeded in several steps (Borsboom & Cramer, 2013). First, we calculated descriptive statistics for each of the 15 PERMA items separately for male and female participants, including means and standard deviations among the items. We also conducted independent samples t-tests using the t.test() function from the stats

package in R (version 4.4.2), a traditional method for group-level comparisons, to examine mean differences between men and women across PERMA items (Fried et al., 2017).

Following the group-level analysis, we estimated the network using the EBICglasso procedure (Extended Bayesian Information Criterion Graphical Least Absolute Shrinkage and Selection Operator) to estimate a Gaussian graphical model (GGM) for each gender group separately. This method allows for the estimation of partial correlations between items while controlling for all other items in the network (Epskamp & Fried, 2018; Epskamp et al., 2012). The Glasso algorithm is particularly suitable for psychological data, as it regularises the network by shrinking small correlations to zero, resulting in a more interpretable and sparse network structure (Friedman et al., 2014). The networks were estimated using the R package (Epskamp & Fried, 2018; van Borkulo et al., 2015). Each node in the network represented a PERMA item, and the edges (connections) between nodes represented the partial correlations between items (Epskamp et al., 2012). Thicker edges indicated stronger relationships between items, while the absence of an edge between two nodes indicated no direct relationship between them after controlling for other variables in the network (Epskamp et al., 2012). To ensure the reliability of our findings, we applied community detection analysis using the exploratory graph analysis (EGA) to identify clusters of highly interconnected items within the network, providing insight into the principal structure of PERMA well-being in each gender group (Golino & Epskamp, 2017).

The stability of centrality indices was assessed using a case-dropping subset bootstrap, where the correlation stability (CS) coefficient quantified how consistently centrality rankings remained after re-estimating the network with reduced cases or nodes (Epskamp et al., 2018). The CS-coefficient (correlation = .7) indicates the maximum proportion of cases that can be removed while maintaining a correlation of at least 0.7 with 95% probability (Hevey, 2018). A CS-coefficient above 0.5 is preferred, while values below 0.25 are considered inadequate (Epskamp et al., 2018; Hevey, 2018). Furthermore, the robustness of edge weights was evaluated using bootstrapped confidence intervals (CIs) to assess their variability. Narrow CIs indicate more stable edges, while wider CIs suggest greater uncertainty. Edges with CIs that include zero should be interpreted with caution, as they may not be reliably different from zero (Hevey, 2018).

Then, we compared the estimated networks for men and women participants using the Network Comparison Test (NCT), a permutation-based hypothesis test available in the R package NetworkComparisonTest (van Borkulo et al., 2015; Van Borkulo et al., 2023). The NCT assesses whether two networks differ in terms of three key aspects, including global network strength (i.e. the overall level of connectivity in the network), network structure (i.e. the pattern of connections between nodes), and specific edge weights (i.e. whether particular item-to-item relationships differ between the networks) (van Borkulo et al., 2015, 2023). We conducted 1,000 permutations in the NCT to determine the statistical significance of these differences (Van Borkulo et al., 2023).

To further explore the role of specific PERMA domains in the well-being networks, we conducted a centrality analysis. Centrality and edge measures were calculated for each item in the network. Centrality provides insight into the importance of each item within the overall well-being structure (Bringmann et al., 2019). Items with higher centrality scores are more interconnected with other items and may play a more pivotal role in the network. Centrality differences were also examined using the NCT to assess their significance across genders (Bringmann et al., 2019). Edge measures were calculated for each item in the PERMA well-being network, providing insight into the strength of associations between variables for men and women (Van Borkulo et al., 2023). The edge strength invariance test was conducted to compare specific connections between nodes, revealing differences in item relationships between the two gender groups (Van Borkulo et al., 2023).

Results

Comparing group means

Independent sample t-tests were conducted to compare the mean scores of men ($n = 473$) and women ($n = 473$) across the PERMA well-being domains. As shown in Table 1, no significant differences were observed between genders for any of the variables. For the positive emotion (PE) subscale, men and women had comparable scores on PE1, PE2, and PE3, with no statistically significant differences, $t(944) = 0.49$, $p = .63$; $t(944) = 0.92$, $p = .36$; and $t(944) = 1.62$, $p = .11$, respectively. Similarly, scores for

Table 1. Mean, standard deviation, and the differences between the mean scores of the genders on the variables.

Variable	Men ($n = 473$)		Women ($n = 473$)		t ($df = 944$)	p
	Mean	SD	Mean	SD		
PE1	3.70	0.91	3.67	0.96	0.49	.63
PE2	3.69	0.96	3.64	0.94	0.92	.36
PE3	3.87	0.91	3.77	0.93	1.62	.11
EN1	4.11	0.95	4.10	0.87	0.32	.75
EN2	4.46	0.86	4.51	0.73	−1.06	.29
EN3	4.17	0.88	4.10	0.91	1.16	.25
RL1	3.49	0.85	3.52	0.80	−0.59	.56
RL2	3.41	0.89	3.40	0.87	0.11	.91
RL3	3.74	0.90	3.72	0.92	0.32	.75
AC1	3.77	1.02	3.80	0.97	−0.43	.67
AC2	3.88	1.02	3.78	0.97	1.47	.14
AC3	3.45	1.07	3.46	1.00	−0.13	.90
MN1	4.09	0.89	4.18	0.84	−1.62	.11
MN2	4.48	0.88	4.40	0.88	1.44	.15
MN3	4.34	0.85	4.41	0.75	−1.34	.18
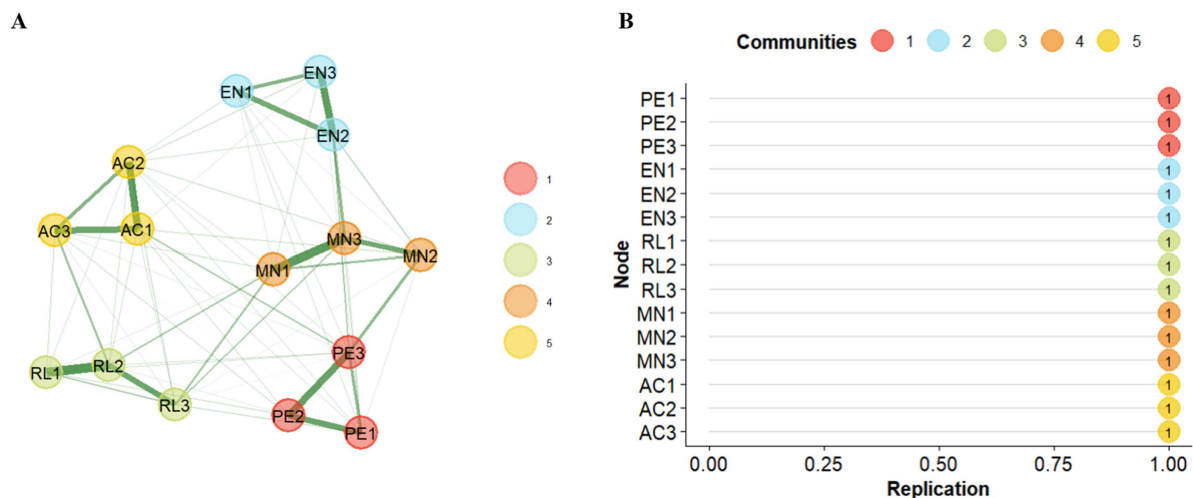
Figure 1. Ilustrates the estimated network (A) and stability of items (B) in the PERMA network model. Green lines indicate positive associations, and line thickness and boldness indicate the strength of the associations.

engagement (EN1, EN2, and EN3) did not significantly differ between men and women, $t(944) = 0.32$, $p = .75$; $t(944) = -1.06$, $p = .29$; and $t(944) = 1.16$, $p = .25$, respectively. Regarding the relationship (RL) domain, the analyses revealed no significant gender differences in RL1, RL2, or RL3, $t(944) = -0.59$, $p = .56$; $t(944) = 0.11$, $p = .91$; and $t(944) = 0.32$, $p = .75$, respectively. Similarly, no significant differences were found for accomplishment (AC1, AC2, and AC3), $t(944) = -0.43$, $p = .67$; $t(944) = 1.47$, $p = .14$; and $t(944) = -0.13$, $p = .90$, respectively. Lastly, the meaning subscale showed no statistically significant gender differences across MN1, MN2, or MN3, $t(944) = -1.62, p = .11$; $t(944) = 1.44, p = .15$; and $t(944) = -1.34, p = .18$, respectively.

Evaluating the PERMA network model

The scale was conducted to verify the number of communities and the dynamic internal structure of the PERMA scale. This procedure identified stable items in the community, suggesting their validation. Figure 1 presents the dimensionality and stability of items in a psychometric network model. In the model, we observe a network of 15 items grouped into five communities, each differentiated by colour and corresponding to the PERMA domains, including PE (red), EN (blue), RL (green), MN (orange), and AC (yellow).

The correlation stability analysis indicates that the PERMA well-being in networks remains stable even when up to 59.4% of the sample is removed, with correlation values retained at 0.7 in at least 95% of the

samples (Figure 2A). Regarding edge accuracy estimation, the graph in Figure 2B displays the 95% confidence interval band from the bootstrapped edge weights (the grey area), the edge estimate in the sample (the red line), and the mean edge estimate in the bootstrapped samples (the black line). It presented that some edge weights (having a lower band) are more accurate than others. At the same time, it illustrated how the majority of edges closer to 0 seem to be non-significant (i.e. they cross 0 in the bootstrapped samples). Our results suggest that the network structure is moderately robust, meaning the observed relationships between PERMA items are not highly dependent on both genders.

Network comparison between genders

The results of the network invariance test showed no obvious structural differences between men's and women's networks, with a test statistic of M = 0.1698 and *p*-value = 0.2328. With a test statistic of *p* = .102, the global strength invariance test also showed global strength values of 7.16 (men) and 6.80 (women), indicating that there is no significant difference in the networks' overall connectedness. These findings suggest that there are no significant differences in the overall network architecture across the sexes and that the basic structure of PERMA well-being is generally the same. The network across genders is presented in Figure 3.

The centrality invariance test assessed whether the importance of specific nodes (items) differed by gender. The measured strength of the central node is presented in Figure 4. The results showed no significant differences in strength and expected influence for most nodes, except for goal achievement (AC3) (*p* = .008 for strength), suggesting that accomplishment-related items may play a more prominent role in one gender over the other. Other items, such as Flow experience (EN2) and Being entrusted (RL1), showed moderate variations but did not reach strong significance.

The edge invariance test examined pairwise differences in edge weights between men and women networks. While most edges showed non-significant differences, a few connections, such as Optimism - Flow experience (PE3-EN2) (*p* = .002) and Flow experience - Being loved (EN2-RL2) (*p* = .0050), indicated
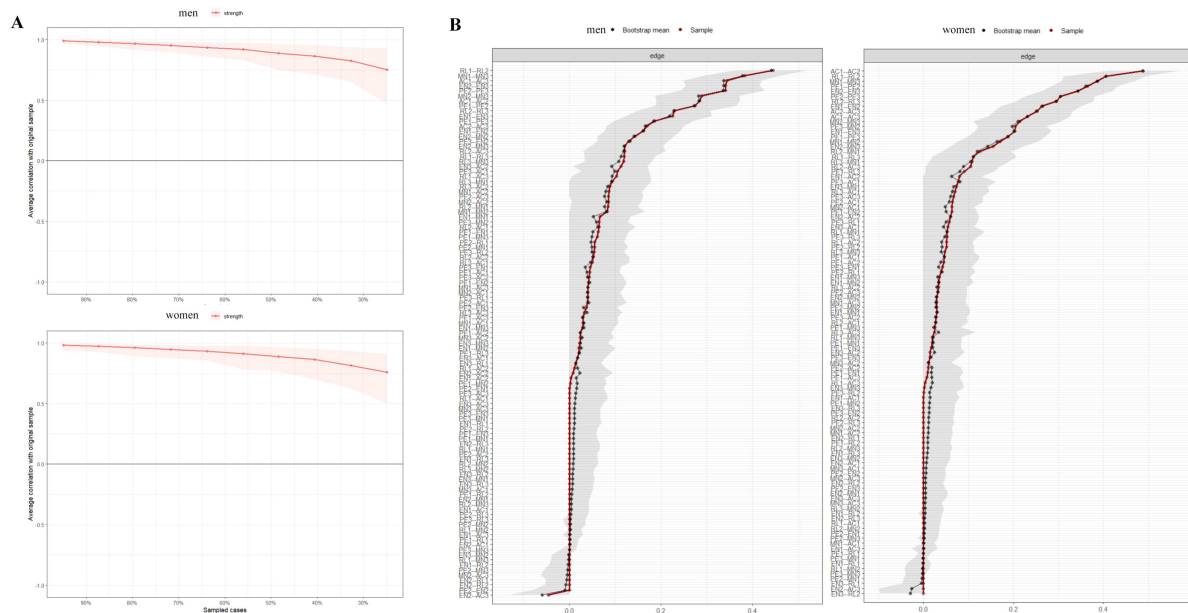

Figure 2. Illustrates the stability of correlation (A) for men (top) and women (bottom). The x-axis represents the percentage of cases removed from the original sample, and the y-axis shows the average correlation between the remaining sample and the original sample. The red lines indicate the mean values, while the shaded areas represent the 95% confidence interval. The accuracy of edge-weight estimates (B) by gender, for men (left) and women (right). The red point represents the sample value for each edge, while the black point indicates the bootstrap mean. The grey shaded areas represent the bootstrapped confidence intervals.
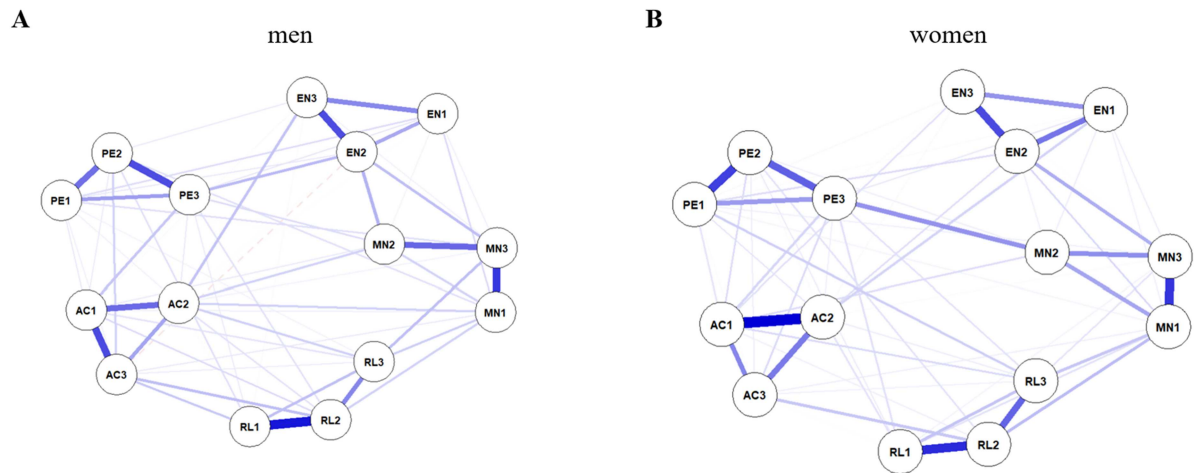
Figure 3. Illustrates networks by gender, men (A) and women (B). Line thickness and boldness indicate the strength of the associations.
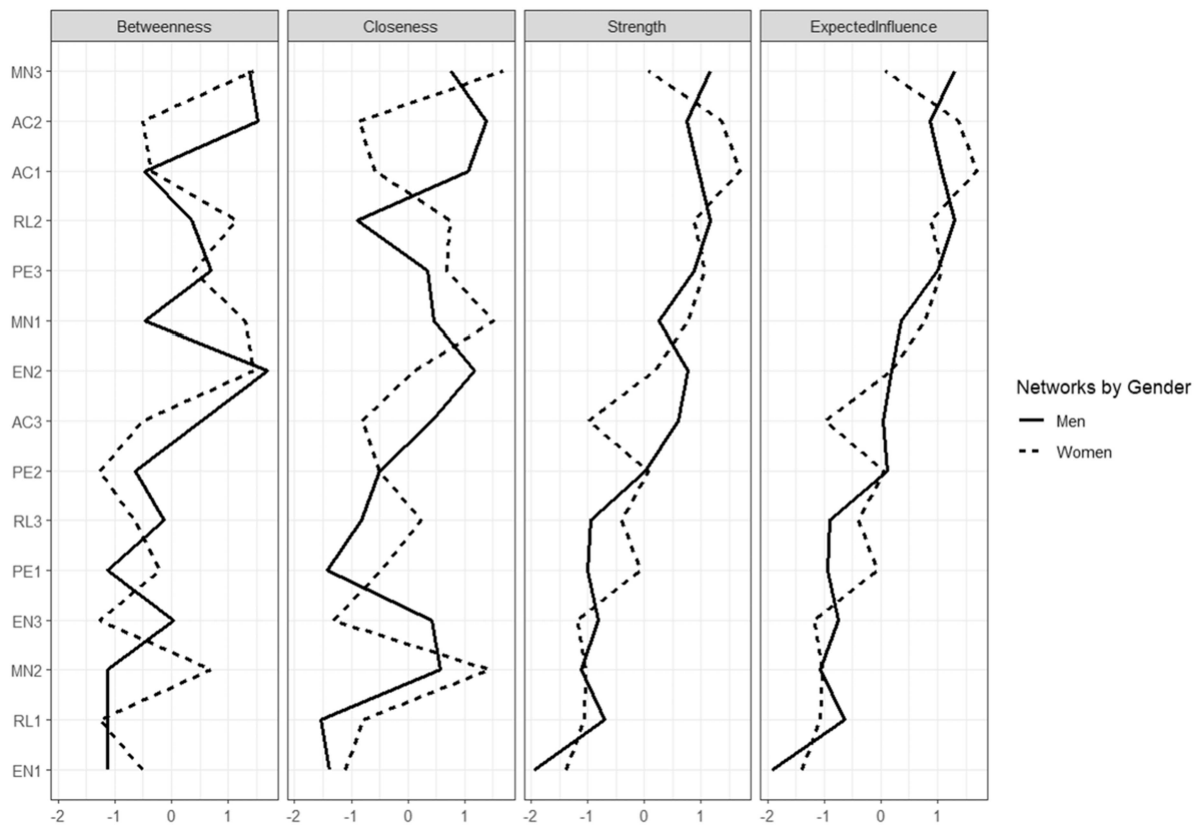

Figure 4. Illustrates centrality measures according to gender.

potential variations in how these well-being dimensions interact across genders. However, the majority of edges did not reach statistical significance, suggesting that although some local variations occur, the core relationships between PERMA items remain similar between men and women. This analysis indicates that while minor differences in edge intensity and centrality exist, the general PERMA network structure and item importance are largely stable across genders.

Discussion

The aim of the current study was to investigate gender differences in the network structure of PERMA well-being among university students. We hypothesised that men and women would differ in global network architecture and edge strengths. Specifically, we expected women to place greater value on relationships, reflecting their emphasis on social support, whereas men would place greater value on accomplishment, consistent with societal expectations of success. Additionally, we expected positive emotion to be more strongly linked to relationships among women and engagement to be higher in men, reflecting autonomy and purpose. Contrary to expectation, the network model revealed no significant global structural differences. Gender differences appeared mainly in local variations of centrality and edge connections. This indicates that men and women may share a similar overall framework of well-being, but differ in how particular elements are emphasised and linked. The following sections address the global network comparison first, followed by a discussion of how these local variations may reflect broader cultural and psychological processes shaping gendered experiences of well-being.

Our results indicate that men and women share a similar PERMA network structure, suggesting that flourishing is robust across gender. This finding contrasts with studies reporting that gender moderates the association between well-being domains, specifically regarding social connectedness and life satisfaction (Huang, 2021; Jiang et al., 2022). While previous research has shown that women tend to report higher social support and emotional dependence on relationships, whereas men emphasise achievement and autonomy (Chaplin, 2015; Zhao et al., 2022). Our findings suggest that these differences may not be structurally embedded within the well-being network itself. Instead, gender differences may manifest in how individuals prioritise and experience these domains rather than their connectivity. Similarly, previous research using traditional methods, such as confirmatory factor analysis for invariance testing, has shown that the factor structure and factor loadings of the PERMA model are the same across genders in younger adolescents (11–15 years old), older adolescents (16–19 years old), young adults (18–30 years old), and wide adult age range (18–74 years old), indicating that both the number of factors and the strength of the relationship between each item and its underlying factor are equivalent (Fernandes et al., 2024; Martín-Díaz & Fernández-Abascal, 2024; Ramli et al., 2024).

Our centrality analysis showed that goal achievement was more central for men, reflecting cultural expectations that link masculinity with autonomy and success (Brandts et al., 2021; Feng & Zheng, 2024; Ružić & Štefanec, 2016). This pattern is consistent with Social Role Theory, which suggests that gender differences arise from culturally prescribed expectations, in which men are socialised toward agentic goals such as autonomy and achievement, whereas women are encouraged to prioritise communal goals such as relatedness and support (Eagly & Sczesny, 2019; Eagly & Wood, 2012). These results corresponded to the Self-Determination Theory and the Broaden-and-Build Theory as they show that whilst men's well-being is largely driven by autonomy and competency, women's well-being is strongly linked to social support and relatedness. This is because women's interpersonal ties often promote positive emotions. (Fredrickson, 2001; Ryan & Deci, 2000). Prior research further shows that accomplishment is closely linked to life satisfaction and academic involvement, particularly through self-efficacy and goal orientation (Hidayat et al., 2020; Kun et al., 2017; Yousefi Afrashteh & Janjani, 2024), which ultimately enhances academic involvement (Lambert D'raven & Pasha-Zaidi, 2016). This suggests that men's higher centrality in accomplishment may stem from both cultural norms of success as well as individual self-belief. While self-efficacy was the only significant predictor of accomplishment for women, men's accomplishment was predicted by a combination of active learning strategies, performance goals, and self-efficacy (Pirmohamed et al., 2017). Similarly, male students' higher expectations of learning explain gender differences in the performance-approach goal (Huikku et al., 2022). At the same time, research indicates that undergraduate women rely more on emotion-oriented coping strategies than men and typically experience more stress. Their greater apparent need for social and emotional support may influence both overall well-being and academic performance (Graves et al., 2021; Vicary et al., 2024). Since most PERMA nodes did not differ significantly by gender, our findings suggest that well-being is broadly similar in importance for both men and women and is best understood as an interconnected whole rather than something divided along gendered lines. Nevertheless, prior studies have shown that women express more overall life satisfaction and happiness than men; however, they also experience lower levels of immediate positive affect, greater negative affect,

greater emotional fluctuation, and more psychological distress (Blanchflower & Bryson, 2024a, 2024b; Matud et al., 2023; Moreno-Agostino et al., 2024).

Our edge analysis revealed gender-specific interconnections, particularly between optimism-flow and flow-being loved. It seems that gender differences in well-being are shaped more by emotional and relational processes than by the broader structure. For women, lower optimism and fewer flow experiences (Dawson, 2023; Kim, 2018) may contribute to higher stress and reduced risk-taking, whereas for men, flow is more closely linked to motivation and academic outcomes (Nurttila et al., 2015; Scholten et al., 2022). In the educational context, optimism enhances academic flow by promoting confidence, engagement, and motivation, leading to improved academic performance and well-being. It acts as a psychological resource that supports stress management, sustained focus, and immersion in learning activities. Although a previous study found no significant gender differences in engagement, men were more likely to show disengagement and lower academic achievement compared to women (King, 2016). A key mediator in these differences is peer attitudes toward learning, men are more likely to perceive their peers, which in turn negatively influences their motivation, engagement, and academic outcomes (King, 2016). Moreover, flow experiences were shown to moderate this relationship, students who frequently engage in flow states during activities tend to build stronger peer relationships, which are associated with reduced social anxiety (Shang et al., 2023). Similarly, peer relationships were positively and indirectly associated with students' academic success through learning engagement and motivation (Shao et al., 2024). Overall, only a few edges differed between genders, suggesting that gender differences are more evident in emotional and relational experiences than in the overall well-being network. The recurring role of optimism and peer connections reinforces earlier research showing that gender norms shape how well-being is perceived and reported, with men encouraged toward independence and achievement, and women toward closeness and caregiving roles (Eagly & Sczesny, 2019; Fredrickson, 2001; Ryan & Deci, 2000).

It is important to note that our analysis relied on binary gender categories, which simplifies a more complex spectrum of gender identities. Non-binary and gender-diverse individuals may experience well-being differently, shaped by unique challenges such as stigma, discrimination, and minority stress (Gajek, 2025; Suksakulwat et al., 2025). From an intersectional perspective, gendered well-being is also influenced by cultural, social, and economic contexts (Livingston et al., 2022), suggesting that the patterns observed here may not generalise to all identity groups. Expanding future research to include gender diversity would provide a more nuanced understanding of how autonomy, relatedness, and accomplishment function across the full spectrum of student experiences.

In higher education settings, where relationships, achievement, and life satisfaction are very prominent (Kim, 2018; King, 2016; Nurttila et al., 2015; Scholten et al., 2022; Shang et al., 2023), our findings highlight the value of gender-sensitive well-being programs. Interventions emphasising social support and emotional control may be more beneficial for women, whereas treatments that encourage self-efficacy, goal-setting, and goal-monitoring may be more effective for men (Sagar-Ouriaghli et al., 2023). Recognising that gender differences in well-being manifest at a local rather than structural level, universities and counselling centres can tailor well-being interventions to individual needs rather than depend on fixed gender-based approaches (Esposito et al., 2024; Joshi, 2015; Lindsay et al., 2019).

Conclusion and limitations

This study examined gender differences in the network structure of PERMA well-being among university students. Our findings showed that global strength and overall network structure were the same across genders, suggesting that the core framework of flourishing is robust. However, local variations emerged, particularly in accomplishment and in emotional-relational links such as optimism-flow and flow-being loved. These results indicate that gender distinctions may manifest more in the weighting of specific well-being components than in the overall structure. These distinctions underline the importance of recognising that gender differences are subtle and contextual rather than fundamental, and that tailored interventions should consider the relative salience of accomplishment for men and relational-emotional processes for women. These findings can guide well-being initiatives within higher education. Programs that emphasise accomplishment, goal-setting, and self-efficacy may be particularly beneficial for male students, whereas those that foster emotional connection, peer support, and belonging may better support female students.

By incorporating gender-sensitive strategies, university counselling services and student affairs offices can promote a more inclusive and effective approach to student well-being and flourishing.

Despite these contributions, this study has several limitations. The analysis's cross-sectional design precludes causal interpretations, leaving open the possibility that sociocultural influences (Tesch-Römer et al., 2008; Zuckerman et al., 2017) may have an impact on the observed gender inequalities in centrality and edge strength. Another limitation is the reliance on binary gender categories. Future studies should include non-binary and gender-diverse identities, whose distinct experiences may reshape well-being networks and provide a more inclusive understanding of flourishing in higher education. Furthermore, the study's exclusive emphasis on college students limited the findings' applicability to larger groups, such as senior citizens or people from diverse cultural backgrounds shown in previous studies (Fernandes et al., 2024; Martín-Díaz & Fernández-Abascal, 2024; Ramli et al., 2024). Longitudinal designs are needed to capture how life events, stressors, and interventions shape gender-specific well-being dynamics over time (Ebling et al., 2024). A more thorough knowledge of well-being across many groups may also be possible by extending the PERMA model to incorporate extra cultural or psychological factors (Donaldson et al., 2023). Extending the PERMA framework to include additional cultural or psychological factors (Donaldson et al., 2023) and exploring the influence of digital and social media engagement on PERMA dimensions (Cemiloglu et al., 2025), may further enrich our understanding of student well-being.

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Author contributions

PY: Writing—review & editing, Writing—original draft, Investigation, Data curation. PAG: Writing—review & editing, Writing—original draft. KJ: Writing—review & editing, Writing—original draft, Investigation, Formal analysis, Visualisation, Software, Methodology, Conceptualisation.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work, the authors used Grammarly (version 1.2) and QuillBot in order to verify our work for grammar and to improve reading and writing. After using this tool/service, the authors reviewed and edited the content as needed and took full responsibility for the content of the publication.

Ethics approval statement

This study was conducted in accordance with the Declaration of Helsinki and approved by the institutional Review Board (IRB) in the Mahasarakham University Ethics Committee, Thailand (Approval number: 231-249-2567). Furthermore, informed consent was obtained from all participants involved in this study. Data were collected online, and participants were allowed to contribute their information voluntarily and anonymously.

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Data availability statement

All data and the code behind the analysis have been made publicly available at the Open Science Framework (https://osf.io/jvc47/).

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