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Analyses of measurement equivalence across gender in the Mentoring Functions Questionnaire (MFQ-9)

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Abstract

The purpose of this study is to examine the measurement equivalence/invariance (ME/I) of the 9-item Mentoring Functions Questionnaire (MFQ-9) across gender. Although ME/I is a prerequisite for examining cross-group differences, this assumption is rarely examined in mentoring research, particularly for comparing gender differences in mentoring functions protégés receive. Following Vandenberg and Lance's (2000) suggestion, a series of multi-group confirmatory factor analyses (MGCFAs) were conducted to investigate ME/I of the MFQ-9 across male ($N = 201$) and female ($N = 312$) protégés. The results supported full configural invariance, full metric invariance, full scalar invariance, partial uniqueness invariance and partial factor variance–covariance matrix invariance across gender. Implications and application of the study findings are discussed.

Keywords: Mentoring; Measurement equivalence/invariance; Confirmatory factor analysis; Gender

1. Introduction

Mentoring relationships are interpersonal exchanges between an experienced colleague (mentor) and a less experienced colleague (protégé) in which the mentor helps the protégé with career advancement and personal development (Kram, 1985). Mentored protégés may attain higher personal and professional goals (Allen, Eby, Poteet, Lentz, & Lima, 2004), have stronger intentions to stay with an organization (Payne & Huffman, 2005), and feel less stressed in general (Allen et al., 2004; Noe, 1988a; Wanberg, Welsh, & Hezlett, 2003). Mentoring relationships help mentors fulfill developmental tasks in their careers (Kram, 1985; Noe, Greenberger, & Wang, 2002) and personal lives (Noe et al., 2002; Wanberg et al., 2003). Organizations that promote a mentoring culture are more likely to retain employees (Kram, 1985; Noe et al., 2002; Wanberg et al., 2003). It appears that employees and organizations can benefit from mentoring relationships.

Although mentoring research focuses on mentoring functions protégés receive, the dimensionality of mentoring functions remains an area of ambiguity (Wanberg et al., 2003). The three commonly used mentoring functions scales (i.e., Noe, 1988a; Ragins & McFarlin, 1990; Scandura, 1992) are based on Kram (1985) pioneering work, which outlined two mentoring functions provided by mentors: career functions (sponsorship, coaching, exposure and visibility, protection, and challenging work assignments) and psychosocial functions (acceptance and confirmation, counseling, role modeling and friendship). Recently, some scholars argue that role modeling is a third dimension of mentoring functions, rather than an aspect of the psychosocial function because several factor analyses result in a three-factor solution rather than a two-factor model (Castro & Scandura, 2004, November; Pellegrini & Scandura, 2005; Scandura, 1992; Scandura & Ragins, 1993). Role modeling refers to the extent to which a protégé respects and admires the mentor and perceives the mentor as an identified example of behavior modeling (Scandura & Ragins, 1993).

Among the several measures of mentoring functions, the 9-item Mentoring Functions Questionnaire (MFQ-9) is

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used for the current study. The MFQ-9 is a shortened version of the 20-item MFQ (Scandura, 1992) and each of the mentoring functions (vocational support, psychosocial support, and role modeling) is measured by three items. The choice of the MFQ-9 is based on the following two reasons. First, the psychometric properties of the MFQ-9 have been validated by both exploratory and confirmatory factor analyses (Castro & Scandura, 2004, November; Pellegrini & Scandura, 2005; Scandura & Pellegrini, 2007; Wanberg et al., 2003), whereas most evidence supporting Noe (1988a) or Ragins and McFarlin (1990) measure were based on exploratory factor analyses (Wanberg et al., 2003). Second, the other two measures contain more than 20 items, which can often cause the problem of careless responding in industry (Gosling, Rentfrow, & Swann, 2003). Therefore, the examination of the psychometric properties of a shorter measure can provide greater practical implications.

Gender and mentoring has been an important issue of mentoring research (Noe et al., 2002; O'Neill, 2002; Ragins, 1989; Ragins, 1999; Wanberg et al., 2003; Young, Cady, & Foxon, 2006). Owing to gender differences in perceptions of social stereotypes, competencies, work outcomes, and work roles, mentoring researchers argue that men and women differ in their expectations of mentoring and mentoring experiences (Bierema & D'Abundo, 2004; Hezlett & Gibson, 2005; Noe, 1988b; Ragins, 1989; Ragins, 1997; Ragins, 1999; Reciniello, 1999; Russell & Adams, 1997; Young et al., 2006). However, empirical studies reveal mixed findings on gender differences in the amount of mentoring protégés received, mentoring benefits, and quality of the relationship (Noe et al., 2002; O'Neill, 2002; Wanberg et al., 2003). For example, some empirical studies found that protégé gender related to mentoring functions received (Baugh, Lankau, & Scandura, 1996; Burke, McKeen, & McKenna, 1990; Noe, 1988a; Ragins, 1999; Ragins & McFarlin, 1990; Ragins & Scandura, 1997; Scandura & Williams, 2001), whereas others did not (Ensher & Murphy, 1997; Kurowski, 1996; Ragins & Scandura, 1997; Scandura & Ragins, 1993). Therefore, more research is needed to clarify whether gender differences in mentoring exists (Noe et al., 2002; O'Neill, 2002; Young et al., 2006).

One way to reply to this research call is to examine whether male and female protégés conceptualize mentoring similarly. That is, to examine whether measurement equivalence/invariance (ME/I) can be established across genders. Because female and male protégés may have different perceptions and expectations and face different barriers to mentoring (Bierema & D'Abundo, 2004; Hezlett & Gibson, 2005; Noe, 1988b; Ragins, 1989; Ragins, 1997; Ragins, 1999; Reciniello, 1999; Russell & Adams, 1997; Young et al., 2006), gender differences in mentoring may be quantitative (e.g., the amount of mentoring received) or qualitative (e.g., different calibration of mentoring items). When the between-group differences are qualitative, it is possible that no quantitative differences can be detected because of different calibrations toward items. Therefore, before investigating any potential between-group differences, it is necessary to ensure that groups compared share similar conceptualizations of the latent construct of interest (Cheung & Rensvold, 2002; Drasgow & Kanfer, 1985; Meredith, 1993; Steenkamp & Baumgartner, 1998; Vandenberg & Lance, 2000). By doing so, researchers can determine whether the significant quantitative differences are interpretable without biases or lack of between-group quantitative difference is a result of qualitative differences.

Statistically speaking, ME/I examines the extent to which a given measurement demonstrates similar factor structures and similar calibrations of the observed item with regards to a measured latent construct across groups (Drasgow & Kanfer, 1985; Vandenberg & Lance, 2000). For a measure to be equivalent across groups, individuals with identical levels of endorsement on the measured latent construct have the same observed score (Drasgow & Kanfer, 1985). Without ME/I, the relationships between the latent constructs and the items are different across diverse groups, and interpreting between-group differences at the item or the construct levels can be erroneous or biased (Cheung & Rensvold, 2002; Drasgow & Kanfer, 1985; Meredith, 1993; Steenkamp & Baumgartner, 1998; Vandenberg & Lance, 2000). Therefore, ME/I may be particularly relevant in examining gender differences in mentoring functions protégés receive because many scholars suggest potential gender differences in mentoring may be quantitative and qualitative. Furthermore, only when ME/I across gender is established can researchers appropriately interpret observed differences in mentoring across gender. To date, only one study has examined whether ME/I can be established on a 16-item scale adapted from Noe (1988a) Mentoring Functions Scale (Tepper, Shaffer, & Tepper, 1996). Given that the MFQ-9 is a shorter version of a widely used measure of mentoring functions and has excellent psychometric properties (Castro & Scandura, 2004, November; Scandura & Pellegrini, 2007), it is worthwhile to investigate the ME/I of the MFQ-9 across genders.

In short, this study investigates ME/I of the MFQ-9 across gender. Following Vandenberg and Lance's (2000) suggestion, a series of MGCFAs are conducted to evaluate ME/I of the MFQ-9 across male and female protégés.

2. Method

2.1. Participants

Data were collected from mentor-protégé dyads from companies in Taiwan through personal contact. Questionnaires were completed anonymously and mailed directly to the researcher through a postage-prepaid return envelope. Participants answered questions concerning an ongoing mentoring relationship. Among the 652 distributed questionnaires, 515 questionnaires were returned, resulting in a response rate of 79%. After excluding two incomplete

questionnaires, the sample size for analyses was 513 (male = 201; female = 312).

The average length of the mentoring relationships was 21.81 months (SD = 32.29), and 67% ($n = 342$) of the participants reported that their mentoring relationships were assigned by the company. The average age of protégés was 27.97 years (SD = 5.16) and protégés' average tenure in the current organization was 30.27 months (SD = 41.85). The industries for which the participants worked included information (29%), other (20%), traditional (12%), service (15%), financial (14%), and sales (9%).

3. Measures

3.1. Mentoring functions

I used the MFQ-9 (Castro & Scandura, 2004, November) to measure the mentoring functions protégés received. Items 1–3 measure vocational support (e.g., "My mentor takes a personal interest in my career"), Items 4–6 measure psychosocial support (e.g., "I share personal problems with my mentor"), and Items 7–9 measure role modeling (e.g., "I try to model my behavior after my mentor"). Participants responded to all items using a 6-point Likert-type scale ranging from strongly disagree (1) to strongly agree (6). Because Traditional Chinese was the native language for all respondents, all items were translated from English into Traditional Chinese with the back-translation approach suggested by Brislin (1980). The Cronbach's alpha coefficients for the whole scale, vocational support, psychosocial support, and role modeling were .86, .84, .77, and .80, respectively for male protégés and .93, .88, .90, and .89, respectively for female protégés.

3.2. Analysis

A series of nested MGCFAs were conducted to investigate ME/I across gender with LISREL 8.71 (Jöreskog & Sorbom, 1997). A series of chi-square difference tests (CDTs, Anderson & Gerbing, 1988) among pairs of nested MGCFA models were used to examine whether a specific type of ME/I was achieved. In addition to the CDTs, the combinational rule that TLI and CFI be larger than .95 and SRMR be smaller than .09 suggested by Hu and Bentler (1999) was used to evaluate the overall model fit because the combination resulted in least sum of Type I and Type II error rates.

4. Results

4.1. Descriptive statistics

Table 1 presents descriptive statistics for each item by gender. Except for Item 1, all the other items' standard deviations were unequal across gender at the .05 level. All items' means exceeded 3, indicating participants

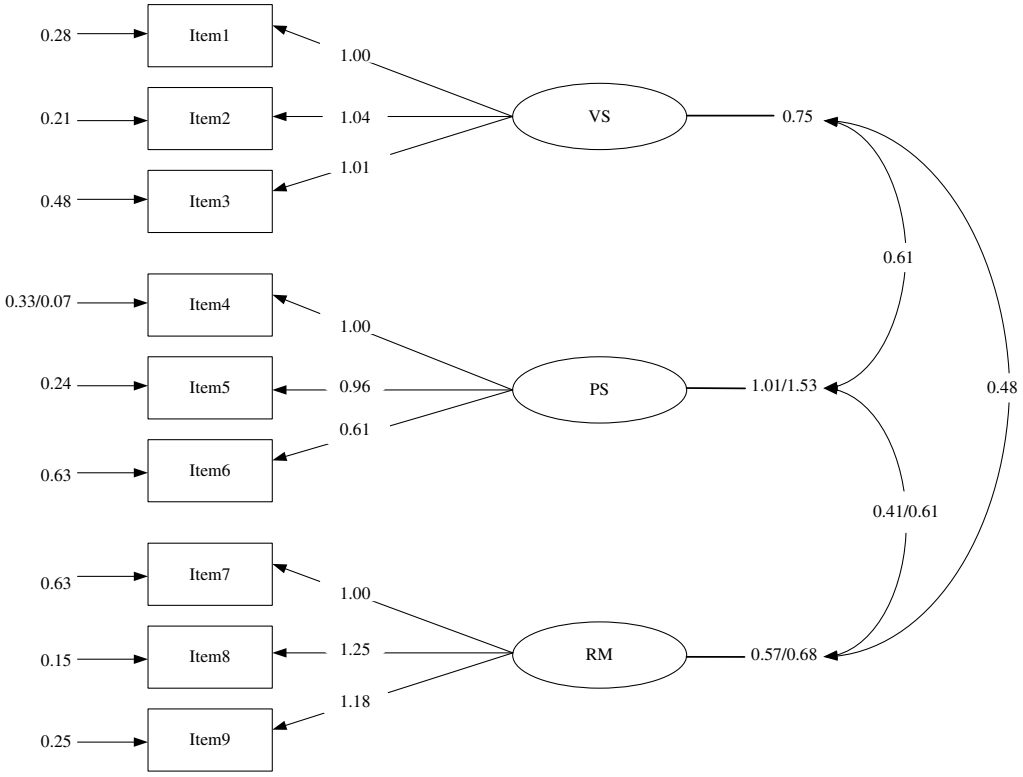

Fig. 1. Path diagram for the multi-group confirmatory factor analysis (Model 5a). Note: Values on the left side present unstandardized coefficients for male protégés and values on the right side present unstandardized coefficients for female protégés. VS, PS, and RM present vocational support, psychosocial support and role modeling, respectively.

Table 1
Descriptive statistics for MFQ-9 items by gender

Gender	Male ($N = 201$)				Female ($N = 312$)			
	Mean	Std.	Skewness	Kurtosis	Mean	Std	Skewness	Kurtosis
Item1	4.33*	.87	−.25	−.12	4.12*	1.07	−.12	−.31
Item2	4.38*	.85	−.17	.18	4.05*	1.07	−.28	−.20
Item3	3.91*	.96	−.23	.27	3.55*	1.19	.14	−.40
Item4	3.86	1.02	−.34	−.04	4.06	1.33	−.40	−.33
Item5	3.82	1.00	.10	−.28	3.89	1.34	−.21	−.62
Item6	4.64	.90	−.47	.04	4.57	1.13	−.55	−.13
Item7	4.13*	.96	−.30	−.29	3.85*	1.21	−.41	−.14
Item8	4.36	.91	−.42	−.01	4.25	1.15	−.37	−.06
Item9	4.54	.85	−.28	−.56	4.41	1.17	−.55	−.01

Note. *t-test significant at the .05 level.

generally perceived that they received more than average mentoring functions. Items 1, 2, 3, and 7 showed significant differences across gender at the .05 level. Skewness and kurtosis for each item were all within the range of −1 to +1.

4.2. Single group confirmatory factor analyses

Single-group CFAs were first conducted to examine the construct validity of the MFQ-9 within each gender group. For male protégés, the three-factor model demonstrated marginally acceptable model fit ($\chi^2_{(24)} = 102.52$, $p < .01$, TLI = .93, CFI = .95, SRMR = .10). All factor loadings were significant at a .01 level (t values ranged from 7.93 to 15.50), providing evidence for convergent validity (Anderson & Gerbing, 1988). Discriminant validity was examined by three CDTs (each with 1 degree of freedom) and each nested model fixed one pair of latent constructs' correlation to 1. The results support the discriminant validity of the 3-factor model as all CDTs were significant at the .01 level ($\chi^2_{(1)}$ ranged from 112.69 to 145.20) and none of the confidence intervals of the latent variable's correlation included 1 (Anderson & Gerbing, 1988; Bagozzi, Yi, & Phillips, 1991). For female protégés, the three-factor model demonstrated acceptable fit ($\chi^2_{(24)} = 135.10$, $p < .01$, TLI = .96, CFI = .97, SRMR = .06). Convergent and discriminant validities were supported because all factor loadings were significant at the .01 level (t values ranged from 14.18 to 23.56), all CDTs were significant at the .01 level ($\chi^2_{(1)}$ ranged from 216.15 to 452.54), and none of the confidence intervals of the latent variable's correlation included 1. Table 2 shows the maximum likelihood (ML) estimates of intercorrelations between the three mentoring functions. Because the intercorrelations were moderate to high, I further examined whether the one-factor model fit the data better than the three-factor model. The one-factor models were not acceptable for both groups (Male: $\chi^2_{(27)} = 307.47$, $p < .01$, TLI = .76, CFI = .82, SRMR = .11; Female: $\chi^2_{(27)} = 705.47$, $p < .01$, TLI = .75, CFI = .81, SRMR = .09) and results of CDTs suggested that the one-factor model fitted the data significantly worse than the three-factor model (Male: $\Delta\chi^2_{(3)} = 204.95$, $p < .01$; Female: $\Delta\chi^2_{(3)} = 570.37$, $p < .01$). Consequently, I retained the three-factor model for both groups in ME/I tests.

Table 2
Factor correlation for male and female participants (ML estimates)

Variable name	1	2	3
1. Vocational support	–	.58**	.65**
2. Psychosocial support	.63**	–	.40**
3. Role modeling	.73**	.64**	–

Note. Correlations for male protégés ($N = 201$) are listed above the diagonal, and correlations for female protégés ($N = 312$) are listed below the diagonal.
** $p < .01$.

4.3. Multi-group confirmatory factor analyses

A test of configural invariance was first conducted by investigating a baseline model with no constrained parameters across two groups (M1). The model showed acceptable model fit ($\chi^2_{(48)} = 225.04$, $p < .01$, TLI = .95, CFI = .97, SRMR = .06). As configural invariance has been established, subsequent ME/I tests can be conducted (Vandenberg & Lance, 2000).

Second, to test metric invariance, corresponding factor loadings were set to be equal across two groups (M2). The constrained model showed acceptable model fit ($\chi^2_{(54)} = 238.20$, $p < .01$, TLI = .95, CFI = .96, SRMR = .07). The CDT result (M1 vs. M2) suggested that factor loadings were invariant across gender ($\chi^2_{(6)} = 13.16$, $p > .01$).

Third, scalar invariance was tested by further constraining like items' intercepts on the latent construct to be invariant across gender (M3). The constrained model showed acceptable model fit ($\chi^2_{(60)} = 238.20$, $p < .01$, TLI = .96, CFI = .97, SRMR = .07). The CDT result (M2 vs. M3) suggested that like items' intercepts on the latent constructs were invariant across gender ($\chi^2_{(6)} = 0$, $p > .01$).

Fourth, uniqueness invariance was tested by further constraining the uniqueness of like items to be invariant across gender (M4). The constrained model showed acceptable model fit ($\chi^2_{(69)} = 276.20$, $p < .01$, TLI = .96, CFI = .96, SRMR = .07). However, the CDT result (M3 vs. M4)

suggested that item uniqueness was not invariant across gender ($\chi^2_{(9)} = 38, p < .01$). To identify the sources of non-invariance, I examined the modification indices and estimates of item uniquenesses in the less constrained model in a sequential model-fitting procedure (Byrne, Shavelson, & Muthen, 1989). After releasing the constraint on Item 4, the modified model (M4a) showed acceptable model fit ($\chi^2_{(68)} = 247.43$, $p < .01$, TLI = .96, CFI = .97, SRMR = .07). The CDT result (M3 vs. M4a) suggested that like items' uniquenesses were partially invariant across gender at a .01 level ($\chi^2_{(8)} = 9.23, p > .01$).

Finally, I tested factor covariance–variance invariance by further constraining latent concepts' covariance–variance matrices to be equal across gender (M5). The constrained model showed acceptable model fit, except for SRMR ($\chi^2_{(74)} = 276.64$, $p < .01$, TLI = .96, CFI = .96, SRMR = .15). The CDT result (M4a vs. M5) suggested that factor covariance–variance matrices were not invariant across gender ($\chi^2_{(6)} = 29.21, p < .01$). To identify the sources of non-invariance, I examined the modification indices and parameter estimates of the covariance–variance matrices of a less constrained model. The factor variance of psychosocial support, the factor variance of role modeling, and the covariance between psychosocial support and role modeling were not invariant across gender. After releasing the equality constraint on the above three non-invariant elements, the modified model (M5a) showed acceptable model fit, except for SRMR ($\chi^2_{(71)} = 258.64$, $p < .01$, TLI = .96, CFI = .97, SRMR = .14). However, the CDT result (M4a vs. M5a) suggested the factor variances-covariance matrices of the three mentoring functions were partially invariant across gender ($\chi^2_{(3)} = 11.21$, $p > .01$). Fig. 1 shows the unstandardized coefficients of the final ME/I model (5a).

In summary, MGCFAs results revealed that the factor structure (configural invariance), factor loadings (metric invariance), and item intercepts (scalar invariance) were fully equivalent across gender. That is, male protégés and female protégés have similar conceptualizations of mentoring, use equal scale intervals while responding to items, and have same item values corresponding to the zero point of the three mentoring functions. However, item uniquenesses and factor variances-covariance matrices only demonstrated partial invariance across gender. Specifically, the measurement error associated with Item 4 and the within-group variability and covariances of the latent constructs were not the same across gender.

5. Discussion

This study investigates ME/I of the MFQ-9 across gender. Factor structure invariance indicates both genders perceive mentoring functions as consisting of vocational support, psychosocial support, and role modeling. Equivalence in factor loadings and item intercepts indicate both groups respond to the MFQ-9 in the same manner such that the strength of the relationship between each item and the underlying construct and the baseline level of mentoring functions are the same across gender. Therefore, differences in the means of the observed items are reflective of differences in the means of the latent constructs (Cheung & Rensvold, 2002; Meredith, 1993; Steenkamp & Baumgartner, 1998; Vandenberg & Lance, 2000). Accordingly, mixed findings in gender differences on mentoring functions may not be a result of lack of ME/I across gender.

The partial item uniqueness invariance suggests the measurement errors associated with Item 4 "I share personal problems with my mentor," were different across gender. The ML estimates of the uniqueness of Item 4 were .32 for male protégés and .07 for female protégés, suggesting that Item 4's measurement error was larger for male protégés than female protégés. Furthermore, female protégés ($M = 4.06$) scored higher than male protégés ($M = 3.84$) on Item 4. Although the difference is not significant ($t_{(496.62)} = 1.94$, $p = .053$), the findings that females share more personal problems with their mentors and that this pattern is more consistent for women are not surprising as women tend to disclose more than men (Dindia & Allen, 1992) and men may be viewed as maladjusted if they disclose too much (Chelune, 1976).

The partial factor covariance–variance matrix invariance suggests the within-group variability of mentoring experiences was not the same across gender. ML estimates of the factor variance of psychosocial support (Male = .83, Female = 1.70), the factor variance of role modeling (Male = .46, Female = .78) and factor covariance between psychosocial support and role modeling (Male = .27, Female = .74) were all larger for female protégés than male protégés, which are consistent with the differences in item standard deviations shown in Table 1. In other words, female protégés' psychosocial and role modeling mentoring experiences may be more dispersed than those of male protégés' and the association between psychosocial support and role modeling is stronger for female protégés. The finding that the covariance between vocational support and role modeling were similar across gender may imply that female protégés tend to view mentors who provide both vocational and psychosocial support as role models to imitate whereas male protégés relate role modeling mainly with mentors' vocational support.

The present study has two noteworthy limitations. First, this study only addressed one aspect of diversity, gender difference. Future studies may attempt to investigate whether other demographic attributes such as race, age, and culture result in differences in ME/I. Furthermore, this study only examined one type of gender difference: protégés' gender. As cross-gender mentoring can be associated with higher cost, risks, and barriers for both mentors and protégés (Clawson & Kram, 1984; Feldman, Folks, & Turnley, 1999; Noe, 1988b; Ragins, 1997; Thomas, 1993), the gender composition of mentoring dyads may impact the mentoring functions realized by protégés. Future studies may examine whether gender composition of the mentoring dyads affects conceptualizations, experiences, and expectations of mentoring because the risks, taboos, and

barriers associated with male-mentor-female-protégé dyads are different from those associated with female-mentor-male-protégé dyads, or same-gender mentoring dyads (Thomas, 1993).

A second limitation is that the current study relied on Taiwanese employees who are from a more collectivistic culture that emphasizes group norms (Hofstede, 2001). Therefore, readers should be cautious while generalizing the findings to individuals from a more individualistic culture. However, the sample used in the current study should not posit a major threat to the validity of the study, as the participants are employees undergoing actual mentoring relationships (Highhouse & Gillespie, in press). Furthermore, as the MFQ-9 was developed through a deductive approach (literature review) rather than an inductive approach (interview), it is more likely to demonstrate ME/I across culture because the items tend to be more general and less culture specific (Riordan & Vandenberg, 1994). In fact, both workers from Taiwan in the current study and from the US (Pellegrini & Scandura, 2005) perceived MFQ-9 as a three-factor measure. Furthermore, the estimated factor correlations of the current study ranged from .40 to .73, which is similar to the correlations (.48–.78) reported by Pellegrini and Scandura (2005). The above findings provide preliminary evidence that individuals from both high and low collectivistic cultures may share similar conceptualizations of mentoring. However, whether gender differences in mentoring did not emerge in the current study is because that females and males in a more collectivistic culture tend to obey norms and appreciate similarity over individuality will require further investigation by comparing protégés from different countries.

In light of the study findings, the MFQ-9 demonstrates good psychometric properties across male and female protégés and is appropriate for studying gender differences in mentoring functions protégés receive. The finding that female protégés' mentoring experiences are more diverse than those of male protégés' suggest that mentoring researchers should not only focus on between-gender differences but also on the role that within-gender variability plays in mentoring.

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