2-2014

Theoretical development, factorial validity, and reliability of the online graduate mentoring scale. Mentoring and Tutoring: Partnership in Learning.

Linda Crawford
Walden University

Justus Randolph
Mercer University, randolph_jj@mercer.edu

Iris M. Yob
Walden University, iris.yob@waldenu.edu

Routledge
Taylor & Francis Group

Mentoring & Tutoring: Partnership in Learning

ISSN: 1361-1267 (Print) 1469-9745 (Online) Journal homepage: http://www.tandfonline.com/loi/cmet20

Theoretical Development, Factorial Validity, and Reliability of the Online Graduate Mentoring Scale

Linda M. Crawford, Justus J. Randolph & Iris M. Yob

To cite this article: Linda M. Crawford, Justus J. Randolph & Iris M. Yob (2014) Theoretical Development, Factorial Validity, and Reliability of the Online Graduate Mentoring Scale, Mentoring & Tutoring: Partnership in Learning, 22:1, 20-37, DOI: 10.1080/13611267.2014.882603

To link to this article: http://dx.doi.org/10.1080/13611267.2014.882603

Mentoring & Tutoring: Partnership in Learning, 2014
Vol. 22, No. 1, 20–37, http://dx.doi.org/10.1080/13611267.2014.882603

Routledge
Taylor & Francis Group

Theoretical Development, Factorial Validity, and Reliability of the Online Graduate Mentoring Scale

Linda M. Crawford
Walden University

Justus J. Randolph
Mercer University

Iris M. Yob
Walden University

In this study, we sought to confirm the theoretical framework underlying an Online Graduate Mentoring Scale by establishing the scale's factorial validity and reliability. Analysis of data received from doctoral students and alumni/ae of the College of Education of one large, online, accredited university reduced the initial theoretical framework from seven to six attributes, and resulted in a revision of the scale. Further research is needed to test the theoretical framework with other relevant populations and to refine the scale itself by reducing skewness and attaining item balance.

Keywords: mentoring, online education, graduate mentoring, graduate mentoring online, mentoring scale

Introduction

There is an abundance of research and professional literature that includes mentoring of graduate students, but this literature base has not yet coalesced into a theory of mentoring. As Forehand (2008) noted, while "the mentoring process has been viewed as critical for the development of young scholars" (p. 745), understanding and implementing that process has not been scientifically grounded. In fact, mentoring doctoral students through their program, especially in their dissertation research, which is one of the primary roles of doctoral faculty, has been largely left to the good will and good sense of the mentor (Kennedy, 1997). There is little to guide the mentor, beyond the knowledge gained from shared knowledge with other mentors and mentees, personal experience, and a growing but largely diffuse body of research literature around specific mentoring skills. Moving in the direction of theory development, Yob and Crawford (2012) created a conceptual framework, an initial and untested description of a phenomenon, for graduate mentoring

Linda M. Crawford, Richard W. Riley College of Education and Leadership, Walden University; Justus J. Randolph, Tift College of Education, Mercer University; Iris M. Yob, Center for Faculty Excellence, Walden University.

This project was funded by an Educational Leadership Research Grant from the Richard W. Riley College of Education and Leadership, Walden University.

Correspondence concerning this article should be addressed to Linda M. Crawford, Richard W. Riley College of Education and Leadership, Walden University, 100 Washington Avenue South, Suite 900, Minneapolis, MN 55401, USA. E-mail: linda.crawford@waldenu.edu

and developed an Online Graduate Mentoring Scale v1 (OGMS1) (Crawford & Yob, 2011) with two domains and seven attributes of graduate mentoring that represent that conceptual framework. Moving a conceptual framework to a theoretical framework, a tested explanation of a phenomenon that is useful for prediction, requires examining the validity and reliability of the initial framework, which is the focus of this article. In the following sections, we discuss a conceptual framework of mentoring graduate students, existing mentoring scales, initial item development of the OGMS1, the methods for investigating the scale's scores' validity and reliability, the results, and a resulting theoretical framework that underlies an OGMS2.

Conceptual Framework of Mentoring Graduate Students

Based on a review of related literature, Yob and Crawford (2012) accepted two fundamental classifications of mentoring behaviors and characteristics, labeled the academic domain and the psychosocial domain. Under these two headings, they isolated 94 mentoring behaviors and characteristics from the literature, with 39 initially associated with the academic domain and 55 initially associated with the psychosocial domain. Using an iterative process with alternating independent and cooperative classification and synthesis of the 94 behaviors and characteristics, they distilled the 94 behaviors and characteristics into seven attributes, with four attributes (competence, availability, induction, and challenge) classified under the academic domain, and three attributes (personal qualities, communication, and emotional support) classified under the psychosocial domain (Figure 1).

The domains and attributes are explicated and defined in earlier work (Crawford & Yob, 2011; Yob & Crawford, 2012). The specific behaviors and characteristics associated with each attribute provided the content for item development for the OGMS1. Kram (1985) put forth an influential theory of mentorship that served as the basis for many of

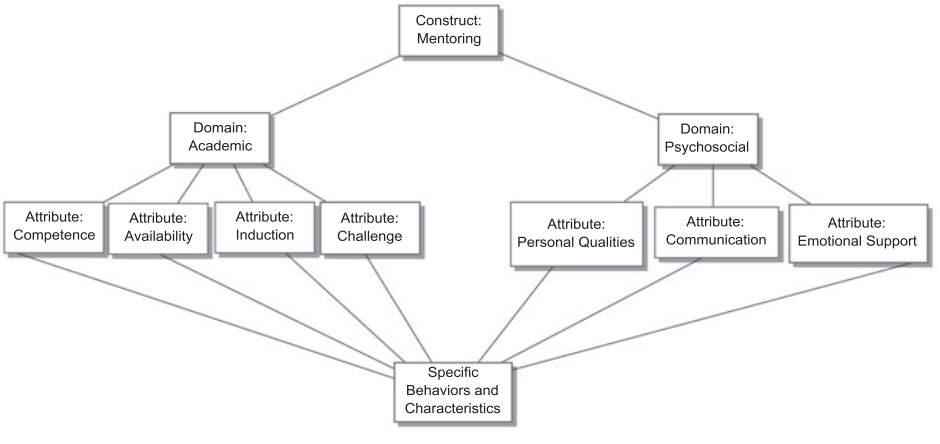

Figure 1. Initial conceptual framework for mentoring graduate students. From "Conceptual framework for mentoring doctoral students," by Yob & Crawford, 2012, *Higher Learning Research Communications, 2*, p. 39. Copyright 2012 by Higher Learning Research Communications. Reprinted with permission.

the existing mentorship scales described below. The Kram theory is similar to the Crawford and Yob framework except that Kram's career-related domain is replaced in Crawford and Yob by the academic domain.

Review of Existing Scales

A search of the EbscoHost education databases, the Internet, the ETS Test Collection, and a branching reference search revealed several existing scales meant to measure mentoring in general and a few scales concentrated on mentoring of graduate students. In this section, we begin with an overview of the existing scales meant to measure mentoring quality in general, not just for graduate students.

The major existing scales for measuring mentoring in general vary in terms of the number of factors they claim to measure. Dreher and Ash (1990) strove to create a unidimensional global measure of mentoring functions based on items from Noe's (1988) mentoring functions scale. Dreher and Ash's goal was to select a set of items that would cover the career and psychosocial constructs put forth by Kram (1985). Dreher and Ash reported Cronbach's α to be .95. Turban and Dougherty (1994) adapted Dreher and Ash's scale in a study of the role of mentor's personality in mentoring and career success. Turban and Dougherty found evidence for three factors in Dreher and Ash's scale. Turban and Dougherty called those factors (a) Psychosocial Mentoring ($\alpha = .93$), (b) Career-Related Mentoring ($\alpha = .88$), and a third factor (c) Protection and Assistance, which included the two following items ($r = .48$): "[the mentor] protected you from working with other managers or work units before you knew their likes/dislikes, opinions, on controversial topics, and the nature of the political environment" (p. 693) and "[the mentor] helped you finish assignments/tasks or meet deadlines that otherwise would have been difficult to complete" (p. 693).

While Ash and Dreher strove to create a global scale to capture Kram's (1985) psychosocial and career-related constructs, others set about to create mentoring scales that were meant to measure psychosocial and career-related constructs separately. One such instrument is Noe's (1988) two-factor mentoring functions scale. In that scale, there is a Psychosocial Factor ($\alpha = .92$) and a Career-Related factor ($\alpha = .89$). Tepper, Shaffer, and Tepper (1996) adapted Noe's (1988) scale and validated the two-factor structure (i.e. a psychosocial domain and a career-related domain) across a variety of samples and demonstrated that the scale was invariant across genders. Tepper et al. did not report internal consistency reliabilities.

All of the scales mentioned above were derived, directly or indirectly, from Kram's (1985) conceptual framework of a psychosocial mentoring domain and a career-related domain. Ensher and Murphy (2011), though, derived their items from qualitative interviews with protégés or mentors. The resulting scale (the Mentoring Relational Challenges Scale) was shown to have three factors: Requiring Commitment and Resilience ($\alpha = .91$), Measuring up to the Mentor's Standard ($\alpha = .88$), and Career Goal and Risk Orientation ($\alpha = .80$). Another three-factor mentoring scale is Scandura and Ragins' (1993) Mentor Functions Questionnaire, which consists of Instrumental, Psychosocial, and Role Modeling factors.

In addition to the several scales meant to measure mentoring functions in general, there have also been several scales created that focus on mentoring for graduate school students. One such scale was developed by Tenenbaum, Crosby, and Gliner (2001). To

create the scale, they used most of the items from the Dreher and Ash (1990) scale and added several items relevant to graduate study, for example, "[has your mentor] given you authorship on publications" (p. 331). Their scale yielded three factors. The first factor, Networking, had items that "asked about how often advisors helped student make connections within the field" (p. 332). The second and strongest factor, Psychosocial Help, had items that asked about "the social-emotional support that advisors provided for their advisees" (p. 332). The final factor, Instrumental, had items that asked about "how often advisors provided academic or job-related support" (p. 332). Cronbach's α for the Networking, Psychosocial Help, and Instrumental factors were .80, .93, and .83, respectively. A Turkish language version of this scale has been developed and validated by Buyukgoze-Kavas, Taylor, Neimeyer, and Güneri (2010).

Another scale meant to measure the mentoring of graduate students is Wrench and Punyanunt's (2004) Graduate Mentoring Scale. They developed that scale by adapting items from Hill, Bahniuk, Dobos, and Rouner's (1989) Mentoring and Communication Report Scale. They found that the revised scale had one strong factor that they deemed to be Perceived Mentoring. One item loaded on a second factor, which they deemed to be a nonapplicable item. That scale had an α of .93. Helsi, Fink, and Duffy (2003) measured mentoring of graduate students using a five-item unidimensional scale (α of .82). Through their correlational study, they examined the predictors of dissatisfaction with the graduate student experience. Of the predictors, poor mentoring was the strongest predictor of dissatisfaction with the graduate student experience.

Although there have been several scales intended to measure mentoring functions in general as well as scales meant to measure the mentoring functions of graduate students in particular, to our knowledge there are no valid and reliable measures of mentoring for online graduate students and no confirmed theoretical construct for online graduate mentoring.

Purpose

There were two purposes for this study. One was empirical; the other was theoretical. The empirical purpose of this measurement study was to refine the OGMS1 (Crawford & Yob, 2011) and to examine its reliability and factorial validity. The theoretical purpose was to determine if the empirical results supported the seven-attribute conceptual framework put forth in Yob and Crawford (2012). Establishing validity and reliability of the conceptual framework for graduate mentoring is a step in confirming the conceptual framework as a theory of graduate mentoring. If the conceptual framework is found to be theoretically valid and reliable, it may serve to assist in selecting, evaluating, and providing professional development for mentors of graduate students.

Initial Item Development

Subsequent to the identification of attributes and with reference to the 94 behaviors and characteristics as classified and synthesized, Crawford and Yob (2011) generated initial items with the intention of sufficiently assessing the mentor behaviors and characteristics related to each defined attribute. Crawford and Yob conducted an iterative process with alternating independent and cooperative review of generated items in order to distill the initial set of items to a set that was efficient and sufficient for assessing each mentoring

attribute. Iterations ceased when further work produced no changes. The result of the process was 55 content items as displayed in Appendix A. Content items were structured on a four-point scale in order to avoid a noncommittal category (DeVellis, 2003). A panel of experts examined the items for content validity, which resulted in minor changes in wording.

Methods for Investigating Scale Validity and Reliability

In this section, we describe the sample demographic characteristics, the methods used to determine the components that are congruent with the initial conceptual framework as well as revisions to the initial conceptual framework, and the criteria for selecting a smaller set of items from the larger set of initial items. For purposes of statistical analysis, the conceptual attributes are termed components below.

Data Collection and Sampling

An electronic version of the OGMS1 (Appendix A) was distributed to all students (1,312), and alumni/ae (487) in the PhD in education program of one fully online university, for a total population size of 1,799. Six hundred and two students and 90 alumni/ae responded to this solicitation, for a total sample size of 692. All student participants were currently experiencing formal mentoring and all alumni/ae participants had experienced formal mentoring as part of their doctoral program. Participants were not compensated for participating in the study. Details of the demographic characteristics of participants can be found in the results section.

Data Analyses

As described in Yob and Crawford (2012), a seven-attribute model of graduate mentoring was originally theorized and a set of 55 pilot items were written for the set of seven attributes (Appendix A). To determine the final factorial structure and select the final set of items, we conducted principal components and reliability analysis following the methods described in Field (2009) and Norušis (2006) using SPSS 19.0. Also, we conducted Rasch item analysis on the items within the components resulting from the principal components analysis. For the Rasch analysis, we used the methods described in Bond and Fox (2007) using Winsteps (3.73) software. The assumption of unidimensionality within components was verified through the principal components analysis.

In terms of selecting a number of components, we used two methods. First, we visually analyzed a scree plot to determine the number of points of inflection before leveling off. Second, we used Kaiser's criterion of accepting components with eigenvalues equal to or greater than 1.00, since the sample size was greater than 250 and the average communality is greater than or equal to .60.

The criteria we used for selecting a final set of items for each component from the larger set of items are listed below:

- The items which loaded strongly on the component on which they were intended to load and which loaded weakly on all other factors were chosen over those that did not.

- The items that were more theoretically aligned with the construct underlying the component were chosen over those that were less theoretically aligned.
- Within a component, the items with higher inter-item correlations were chosen over those with lower inter-item correlations.
- Within a component, items with less Rasch misfit were chosen over those with greater misfit.
- Within a component, items with more separation were chosen over items with less separation (i.e. we attempted to choose items in such a way that there was a large variety of item difficulties).
- We strove to have an equal number of items in each component and no fewer than three and greater than five in any component.

To check the assumptions of sufficiently related variables, we examined the overall Kaiser–Meyer–Olkin (KMO) measure and KMO for each individual variable. We also conducted Bartlett's test. Since we theoretically expected the factors to be correlated, we used direct oblimin rotation as the method of rotation. In terms of Rasch analysis, we analyzed the misfit for each item, mean square infit, and mean square outfit. We also examined variable maps for each component.

Finally, we examined the statistical goodness of fit of the Yob and Crawford's (2012) theoretical model, which is presented in Figure 1, with structural equation modeling. We followed Schumacker and Lomax's (2010) guidelines for evaluating a measurement model and used LISREL 8.80. The indices of model that we examined were weighted least squares χ^2, the root-mean-square error (RMSEA), the goodness-of-fit index (GFI), normed fit index (NFI), the standardized root-mean-square residual (standardized RMR), and the noncentrality parameter (NCP). In addition, we examined the parameter estimates to determine if the estimates were aligned with the magnitude and direction predicted theoretically by Yob and Crawford.

Results

The population size of the participant pool was 1,799, and 692 (38%) participants completed the survey in Spring 2010. The demographic characteristics of those who participated in the study can be found in Table 1. All participants were PhD students or alumni/ae who were currently receiving formal mentoring services or had received formal mentoring services in the College of Education of one large, online, accredited university.

Statistical Assumptions

In terms of sampling adequacy, the KMO for the entire model was .86, indicating meritorious sampling adequacy (Norušis, 2006). Similarly all of the KMOs for the individual items were all greater than .75, indicating adequate sampling adequacy. Finally, this model met the assumption for Barnett's test of sphericity, $\chi^2(253) = 4641.20$, $p < .001$. For the structural equation model, the model fit indices are reported later in the results section.

Table 1
Demographic Characteristics of Participants

Characteristic	Count (valid %)
Gender	
Female	522 (76%)
Male	167 (24%)
Age	
18–29	20 (3%)
30–39	150 (22%)
40–49	206 (30%)
50–59	228 (33%)
60–64	74 (11%)
65 and above	10 (2%)
Minority status	
Majority[a]	363 (54%)
Minority[b]	318 (46%)

Note. The *n* size does not always sum to 692 because of missing data within cases.
[a]White alone.
[b]Black or African–American alone, Asian alone, American Indian or Alaska Native alone, Native Hawaiian or other Pacific Islander alone, some other race/ethnicity alone, two or more races, other.

Number of Components

Through the process of component selection and item analysis discussed above, the best solution we found was one with six components and 23 items. The final scale can be found in Appendix B. In order of percentage of variance accounted for, we interpreted these components to be:

- Communication (25.32%),
- Emotional Support (10.70%),
- Induction (7.14%),
- Competence (6.23%),
- Availability (5.83%), and
- Challenge (5.18%).

One of the seven components, Personal Qualities, theorized by Yob and Crawford (2012), did not manifest itself in this analysis. The remaining six components theorized in Yob and Crawford did, however, appear in this analysis. Thus, this analysis reduces the original seven component/attribute theorization to six components/attributes, with the elimination of the attribute labeled Personal Qualities.

The scree plot for this solution is shown in Figure 2. Note that the last significant point of inflection occurred at the seventh component. The first six components cumulatively accounted for 60.61% of variance in the model. This solution also met Kaiser's criterion. The first six components had eigenvalues greater than 1.00; the seventh and later components all had eigenvalues less than 1.00.

Factorial Validity

Table 2, a pattern matrix, shows the items and factor loadings for each of the components. Table 3 shows the corresponding structure matrix. Both were extracted using

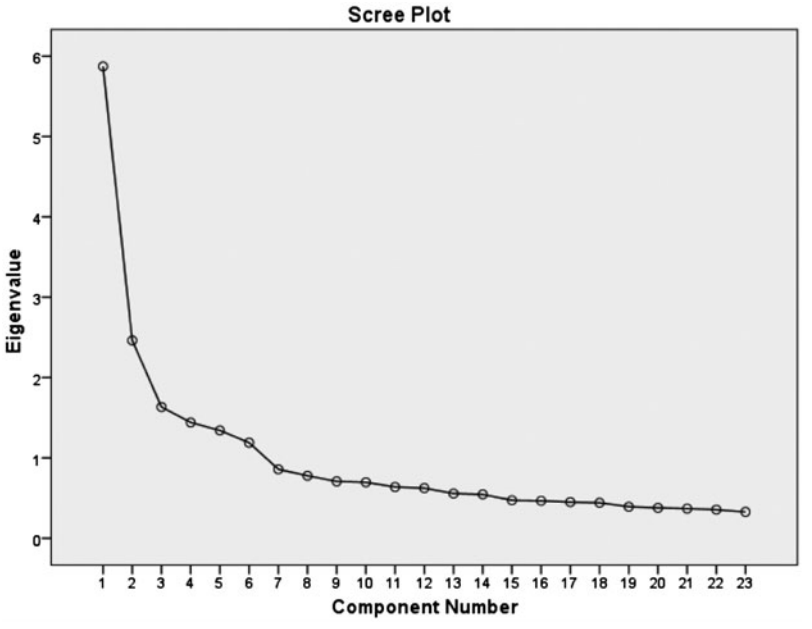

Figure 2. Scree plot for all 23 items.

principal components analysis with direct oblimin rotation with Kaiser normalization. Tables 2 and 3 show that the scale has good factorial validity. There were high loadings on the components that we intended the items to load on and low loadings (i.e. below 0.40) on almost all of the other components. These loadings illustrate unidimensionality within the components. Three of the items in the structure matrix had loadings in the .40 s on some of the other components, unlike what we predicted.

In terms of this scale's alignment with what was predicted by theory in Yob and Crawford (2012), there were just a few deviations. First, the item *EMO4: Compliments mentees on work well done* was originally meant to be in the Communication component; however, it loaded with the Emotional Support component instead. We can now see that this loading is more theoretically appropriate in the Emotional Support component than in the Communication component. Second, in the initial theory, a seventh component (Personal Qualities) was theorized. It was defined by Crawford and Yob (2011) as "a constellation of individual attributes that invites mentee confidence in the mentor and a sense of approachability to the mentor, including emotional maturity, openness, equanimity, and appropriate boundaries" (p. 25). This did indeed turn out to be a constellation of attributes which did not load together but also did not load strongly with any of the other components.

Reliability, Rasch, and Descriptive Aspects of the Scale

In Table 4, we present Cronbach's α, the mean, standard deviation, standard error of the mean, standard error of the estimate, skewness, the Rasch mean square infit for items, Rasch mean square outfit for items, and separation for items by component. The internal consistency reliabilities were good to fair for all components; the mean square infit and

Table 2
Pattern Matrix of Principal Component Loadings for the Graduate Mentoring Scale

Item	Component					
	1	2	3	4	5	6
COM1. The mentor listens carefully to mentees	*.79*	.00	.04	−.00	.01	.08
COM2. Provides clear instruction …	*.73*	−.14	.02	.02	.05	.10
COM3. Sets realistic deadlines …	*.67*	−.01	.08	.08	.01	−.01
COM4. Is easy for mentees to talk with	*.66*	.31	−.01	−.02	.05	−.02
EMO1. Provides emotional guidance	−.02	*.81*	.02	.03	.00	.05
EMO2. Advises on … personal problems	−.24	*.78*	.11	.03	.04	−.02
EMO3. Builds mentees' confidence and self-esteem	.12	*.75*	.07	.03	−.05	−.05
EMO4. Compliments mentees on work well done	.31	*.57*	−.05	−.04	.09	.09
IND1. Engages in research projects … with mentees	−.05	.03	*.81*	.05	.05	−.12
IND2. Introduces mentees to … professional networks	−.01	.05	*.81*	−.06	.02	.01
IND3. Introduces mentees to … publication venues	−.01	−.06	*.77*	.03	−.01	.10
IND4. Make connections between study and practice	.13	.07	*.60*	−.00	−.07	.09
CMP1. Holds an appropriate degree in content area	−.10	.03	−.06	*.75*	−.07	.12
CMP2. Holds … a field position in the content area	−.08	.05	.02	*.73*	−.06	.12
CMP3. Has a record of mentoring doctoral level research	.15	.03	.06	*.66*	.08	−.21
CMP4. Has … knowledge of research design …	.13	−.08	.04	*.55*	.14	−.02
AVA1. Reviews mentees' documents [promptly]	−.06	−.00	−.04	−.01	*.87*	.08
AVA2. Responds promptly to brief email inquiries …	−.02	.08	−.03	.03	*.83*	−.07
AVA3. Gives sufficient time to communication …	.08	−.06	.11	−.04	*.75*	.07
CHL1. Does not approve substandard work …	−.03	−.07	.05	−.03	.01	*.85*
CHL2. Requires professional writing	−.02	.00	.07	.06	.12	*.78*
CHL3. Encourages … alternative viewpoints	.13	.16	.01	.05	−.03	*.62*
CHL4. Provides specific feedback on mentees' work	.22	−.07	.00	.16	.21	*.46*

Note. Factor loadings greater than .40 in absolute value are in italics. $N = 636$.

outfit were almost all near the optimal value of 1.00, and the separation for items were high indicating item difficulty hierarchies. There were undesirable properties however in terms of skewness for some components. Four of the six components had skewness greater than 1.00 in absolute value.

Structural Equation Modeling Results

Because a component for personal qualities did not manifest itself in the exploratory factor analysis, we investigated the model presented in Figure 1 but without the personal qualities attribute included. In Figure 3, the observed variables communication, emotional support, competence, availability, induction, and challenge were derived from the means of the items in each subscale of the revised scale (see Appendix B). By letting the errors between some of the components correlate, we were able to refine the model such that it now has good model fit. The path diagram of the resulting model is shown in Figure 3. In that model, the variables communication and emotional support are subsumed by a latent variable we considered to be the Psychosocial Domain. Similarly, the variables competence, availability, induction, and challenge are subsumed by a latent variable we considered to be the Academic Domain. In addition, the model fit was improved when we let the errors correlate between (a) emotional support and challenge, (b) emotional support and induction, and (c) induction and competency.

Table 3
Structure Matrix of Principal Component Loadings for the Graduate Mentoring Scale

	Component					
	1	2	3	4	5	6
COM1. The mentor listens carefully to mentees	*.82*	.16	.24	.20	.31	.33
COM2. Provides clear instruction …	*.76*	.01	.18	.21	.33	.34
COM3. Sets realistic deadlines …	*.73*	*.43*	.24	.18	.30	.21
COM4. Is easy for mentees to talk with	*.71*	.16	.26	.25	.29	.24
EMO1. Provides emotional guidance	.16	*.81*	.28	.13	.09	.10
EMO2. Advises on . . . personal problems	.25	*.79*	.32	.13	.07	.04
EMO3. Builds mentees' confidence and self-esteem	−.05	*.78*	.30	.09	.05	−.01
EMO4. Compliments mentees on work well done	*.45*	*.62*	.23	.12	.25	.21
IND1. Engages in research projects … with mentees	.18	.29	*.81*	.13	.17	.19
IND2. Introduces mentees to … professional networks	.14	.27	*.80*	.21	.18	.08
IND3. Introduces mentees to … publication venues	.19	.18	*.76*	.22	.17	.28
IND4. Make connections between study and practice	.29	.27	*.66*	.18	.13	.26
CMP1. Holds an appropriate degree in content area	.12	.12	.20	*.74*	.14	.26
CMP2. Holds … a field position in the content area	.08	.08	.12	*.73*	.11	.24
CMP3. Has a record of mentoring doctoral level research	.28	.14	.22	*.68*	.25	.03
CMP4. Has … knowledge of research design …	.29	.03	.19	*.61*	.32	.19
AVA1. Reviews mentees' documents [promptly]	.26	.05	.14	.21	*.85*	.28
AVA2. Responds promptly to brief email inquiries …	.27	.14	.15	.23	*.81*	.15
AVA3. Gives sufficient time to communication …	.37	.05	.27	.21	*.81*	.31
CHL1. Does not approve substandard work …	.23	−.02	.22	.17	.21	*.85*
CHL2. Requires professional writing	.28	.07	.28	.28	.34	*.83*
CHL3. Encourages … alternative viewpoints	.35	.22	.24	.24	.21	*.68*
CHL4. Provides specific feedback on mentees' work	*.46*	.03	.22	.37	*.44*	*.62*

Note. Factor loadings greater than .40 in absolute value are in italics. $N = 636$.

The model displayed in Figure 3 is shown to have good model fit characteristics. According to Schumacker and Lomax (2010), the two most important measures of model fit are χ^2 and the RMSEA. They write that χ^2 should be not statistically significant and the upper bounds of RMSEA should be no greater than .08 in good fitting models. Our model met both of these fit criteria; the RMSEA was less than .08, RMSEA < .000, and the value of χ^2 was not statistically significant, $\chi^2(5) = 3.16$, $p = .676$.

Other models fit indices also indicated good model fit. Values of the GFI and NFI close to 1.0, values of the standardized RMS less than .05, and a NCP close to .0 are all indicators of good fit. For the model shown in Figure 3, the values of the GFI, NFI, standardized RMS, and the NCP were .999, .998, .009, and .0, all of which were indicators of good model fit. Finally, an analysis of the model parameters indicated that the model parameters were all positive, as expected, and were of the magnitudes expected.

Discussion

In terms of the empirical purpose of our scale, we refined the OGMS1 (Crawford & Yob, 2011) such that it had fewer items, and it demonstrated factorial validity as well as reliability within each component, resulting in the Online Graduate Mentoring Scale v2 (OGMS2) presented in Appendix B. In addition to showing that the items demonstrated factorial validity within components, the structural equation analysis showed that the

Table 4
Reliability, Rasch, and Descriptive Statistics for the Work Mentoring Scale

Component	α	M[a]	SD	SE	SEM	Skew	Infit[b]	Outfit[c]	Sep.[d]
Communication	.77	3.75	.34	.01	.16	−1.19	.92	.96	9.13
Emotional Support	.76	2.90	.57	.02	.28	−.11	.99	1.13	28.66
Induction	.76	3.32	.51	.02	.17	−.36	.99	1.02	12.57
Competence	.63	3.63	.37	.01	.22	−1.42	1.00	.99	10.14
Availability	.78	3.79	.34	.01	.24	−1.43	.99	.69	3.74
Challenge	.76	3.71	.36	.01	.18	−1.48	.97	1.00	9.24

[a]On a 1–4 scale where 1 = very unimportant and 4 = very important.
[b]Mean infit for items.
[c]Mean outfit for items.
[d]Separation for items.

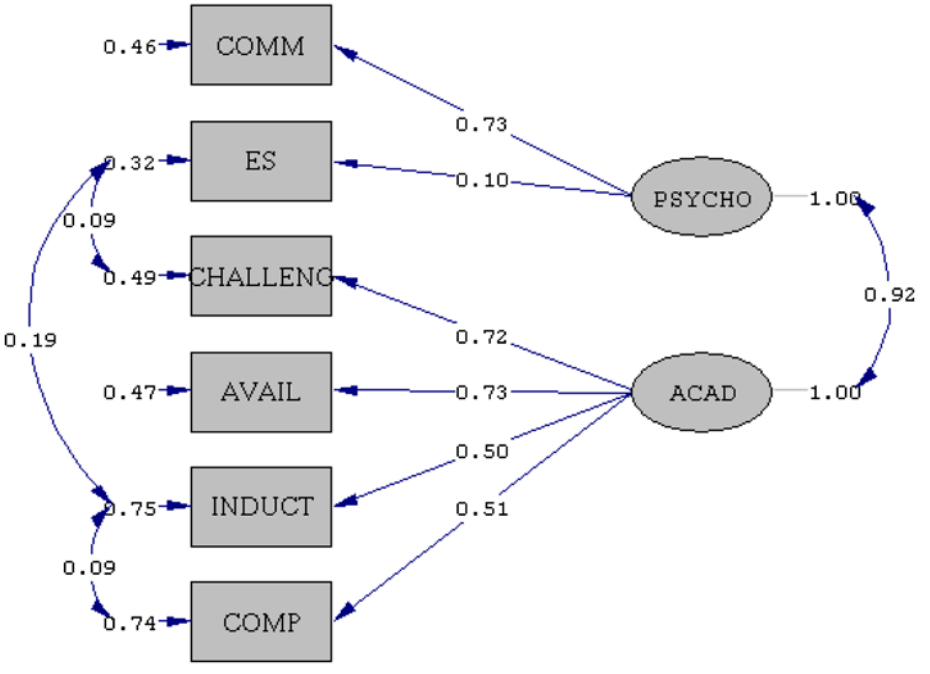

Figure 3. Path diagram for a theoretical model of online graduate student mentoring. COMM = Communication, ES = Emotional support, CHALLENG = Challenge, AVAIL = Availability, INDUCT = Induction, COMP = Competency, PSYCHO = Psychosocial domain, ACAD = Academic domain.

observed relationships between components fit the predicted theoretical model. A Rasch analysis showed that each component had desirable qualities. Namely, the components had a mean square infit and mean square outfit near to 1.0 and high degrees of separation. However, further revisions of the scale may be necessary to correct skewness in several of the components.

In terms of the theoretical purpose of our scale, our analysis indicated a need for revision of the original Conceptual Framework for Graduate Mentoring (Yob & Crawford, 2012) to reduce the number of attributes from seven to six by eliminating the attribute labeled *Personal Qualities*, and, now with the support of testing, labeling it a theoretical framework (Figure 4). We believe that the slight changes from the initial conceptual framework (Figure 1) (i.e. our hypothesis of how the variables are related) to the revised theoretical framework (Figure 4) (i.e. the empirical validation of the framework) are theoretically sound.

First, in the initial conceptual framework, we believed the Personal Qualities factor would emerge as a separate and unique factor in the psychosocial domain. However, our empirical analysis showed that the items intended to measure a Personal Quality factor were correlated across a variety of the factors. This analysis allows us to see that, conceptually, a mentor's personal qualities can be an inherent aspect of the various other factors that were measured in this study, such as, Emotional Support and Communication, or other factors not measured in this study, such as limitations of online communication, rather than a unique factor itself.

Second, the results of the structural equation model (Figure 4) indicated that Emotional Support was slightly correlated with Challenge and Induction, and that Induction was correlated with Competency. While these correlations were not hypothesized in the initial conceptual framework, we also find them to be theoretically justified. It seems that a responsible mentor needs to temper challenge and induction with emotional support; that is, the students find that quality mentors can mediate the negative emotions associated with challenge and the novelty and anxiety of induction with the positive and affirming emotions of emotional support. Similarly, it also seems logical that Induction is correlated with Competency since it would be unlikely that a mentor would not be able to successfully facilitate the induction of others into a field in which the mentors themselves were not competent. We were initially surprised that Availability and

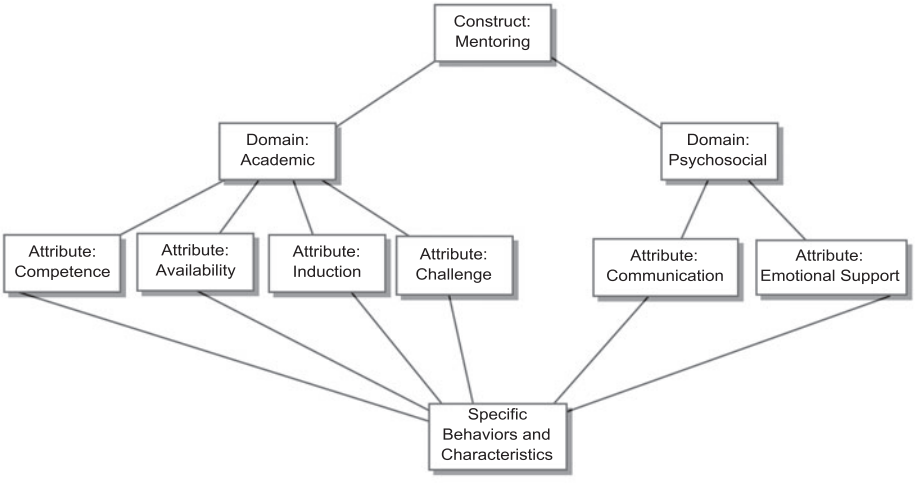

Figure 4. Theoretical framework for mentoring online graduate students.

Communication were not statistically significantly correlated, but after careful deliberation we posited that a mentor's being available for communication does not necessarily make the mentor a good communicator, and vice versa.

In summary, our initial conceptual framework (Figure 1) was very similar to the theoretical framework (Figure 4) that resulted from an empirical analysis. Where the frameworks did differ, we found those differences to be minor and theoretically justifiable.

Strengths and Limitations of the Scale

In terms of the strengths of this scale, we have shown that each component has adequate internal consistency reliability and that the scale has a six-component factorial structure, which was largely in line with what was predicted theoretically. The only difference was that the Personal Qualities attribute predicted in Yob and Crawford (2012) did not manifest itself as a separate component, thus reducing the theoretical construct from seven to six attributes. In terms of the individual items, they all loaded on the components on which they were predicted to load and did not load strongly on other components. The only exception was that the item *EMO4. Compliments mentees on work well done* loaded with the Emotional Support component instead of the Communication component as originally intended. We also strove to have an equal number of items in each component; however, we were only able to find three items that loaded highly on the Availability component and did not load highly on other components. Another strength of the scale is that the scale's theoretical model explaining the relationships among components and the academic and psychosocial domains was validated through structural equation modeling.

One of the major limitations of this scale, however, is that four out of six of the components have a negative skew greater than 1.0 (see Table 4). While approximate normality is an assumption of most parametric tests (Field, 2009), a large variety of nonparametric and robust estimation techniques are currently easily implementable on standard statistical software (see, e.g. Wilcox, 2012). Another limitation of the scale is that the population on which the factorial validity and reliability was determined was constrained to doctoral students and alumni/ae of one large online university and may not necessarily generalize to other types of students. For those interested in determining the degree to which the population in our study generalized to other populations of interest, see Shadish, Cook, and Campbell (2002). Finally, it is possible that this scale is overfit and needs to be cross-validated with other populations. We plan to validate this scale with other populations in future research.

Uses of the Scale

The theoretical basis for and the reliability and validity of the revised OGMS2 are sufficiently strong to support its use as a formative, but not yet summative, evaluation tool for mentors of online graduate students. It may be used to assist in identifying prospective mentors, as one data point in evaluating performance, and as a means of identifying professional development needs. We investigated the tool only from the perspective of those who receive mentoring services. Further research, as discussed in the next section, is needed to confirm its theoretical stability from the point of view of those who provide mentoring services.

Suggestions for Further Research

As mentioned earlier, this scale was validated for online doctoral students and alumni/ae in one social science area, education. More research is needed to validate the use of this scale with other populations, such as master's degree students, students in other program domains, and students receiving mentoring traditionally rather than online. Another area for further research is determining if the theoretical framework is the same for faculty mentors as it is for students and alumni/ae and examining the empirical and theoretical relationships between the scale's factors. We also believe that further revision of the scale is needed to reduce the amount of skew in several of the components and to add a fourth item to the availability scale so that all components have an equal number of items.

Notes on contributors

Linda M. Crawford is Director, Academic Initiatives for Laureate Education, a contributing faculty member to Walden University since 1997, and an adjunct professor at several other universities. She has been instrumental in the development of several doctoral level research programs and courses, taught the same, and mentored scores of students to successful doctoral program completion, including three awards for outstanding dissertations. Currently, she is engaged in conducting quality assurance reviews of institutions of higher education and continuing research in the area of mentoring online doctoral students.

Justus J. Randolph has a PhD in education research and program evaluation, an MEd in international education, and a certification in educational administration. Currently, he is an assistant professor of Education at Mercer University. He has developed and taught courses in quantitative and qualitative research methods, evaluation, and scholarly writing. He is the author of *Multidisciplinary Methods in Educational Technology Research and Development, Computer Science Education Research at the Crossroads,* and tens of scholarly articles.

Iris M. Yob is Director, Social Change Initiatives in the Center for Faculty Excellence at Walden University. Her research interests are in the philosophy of education, aesthetic education, spiritual education, and women's studies. Recently, she has published articles on online learning, the social responsibility of the university, and international perspectives on the role of education in social change. She has been a faculty member in the Richard W. Riley College of Education and Leadership since 1996 and served as chair and member of numerous doctoral dissertation committees.

References

Bond, G. T., & Fox, C. M. (2007). *Applying the Rasch model: Fundamental measurement in the human sciences* (2nd ed.). New York, NY: Routledge.

Buyukgoze-Kavas, A., Taylor, J. M., Neimeyer, G. J., & Güneri, O. Y. (2010). The mentoring relationship: A comparison of counselling students in the United States of America and Turkey. *Counselling Psychology Quarterly, 23*, 387–398.

Crawford, L., & Yob, I. (2011). *Importance of traditional mentoring behaviors and characteristics in an online doctoral environment*. Unpublished manuscript. Minneapolis, MN: Richard W. Riley College of Education and Leadership, Walden University.

DeVellis, R. F. (2003). *Scale development: Theory and applications* (2nd ed.). Thousand Oaks, CA: Sage.

Dreher, G. F., & Ash, R. A. (1990). A comparative study of mentoring among men and women in managerial, professional, and technical positions. *Journal of Applied Psychology, 75*, 539–546.

Ensher, E. A., & Murphy, S. E. (2011). The mentoring relationship challenges scale: The impact of mentoring stage, type, and gender. *Journal of Vocational Behavior, 79*, 253–266.

Field, A. P. (2009). *Discovering statistics using SPSS* (3rd ed.). Thousand Oaks, CA: Sage.

Forehand, R. L. (2008). The art and science of mentoring in psychology: A necessary practice to ensure our future. *American Psychologist, 63*, 744–755.

Helsi, V. L., Fink, E. C., & Duffy, D. M. (2003). Mentoring in a positive graduate student experience: Survey results from the midwest region part 1. *PS: Political Science & Politics, 36*, 457–460.

Hill, S. E. K., Bahniuk, M. H., Dobos, J., & Rouner, D. (1989). Mentoring and other communication support in the academic setting. *Group & Organization Management, 14*, 355–368.

Kennedy, D. (1997). *Academic duty*. Cambridge, MA: Harvard University Press.

Kram, K. E. (1985). *Mentoring at work: Developmental relationships in organizational life*. Glenview, IL: Foresman.

Noe, R. (1988). An investigation of the determinants of successful assigned mentoring relationships. *Personnel Psychology, 41*, 457–479.

Norušis, M. J. (2006). *SPSS 15.0: Statistical procedures companion*. Upper Saddle River, NJ: Prentice Hall.

Scandura, T. A., & Ragins, B. R. (1993). The effects of sex and gender role orientation on mentorship in male-dominated occupations. *Journal of Vocational Behavior, 43*, 251–265.

Schumacker, R. E., & Lomax, R. G. (2010). *A beginner's guide to structural equation modeling* (3rd ed.). New York, NY: Routledge.

Shadish, W. R., Cook, T. D., & Campbell, D. T. (2002). *Experimental and quasi-experimental designs for generalized causal inference*. Boston, MA: Houghton Mifflin.

Tenenbaum, H. R., Crosby, F. J., & Gliner, M. D. (2001). Mentoring relationships in graduate school. *Journal of Vocational Behavior, 59*, 326–341.

Tepper, K., Shaffer, B. C., & Tepper, B. J. (1996). Latent structure of mentoring function scales. *Educational and Psychological Measurement, 56*, 848–857.

Turban, D. B., & Dougherty, T. W. (1994). Role of protégé personality in receipt of mentoring and career success. *Academy of Management Journal, 37*, 688–702.

Wilcox, R. (2012). *Introduction to robust estimation and hypothesis testing* (3rd ed.). Amsterdam: Elsevier.

Wrench, J. S., & Punyanunt, N. M. (2004). Advisee-advisor communication: An exploratory study examining interpersonal communication variables in the graduate advisee-advisor relationship. *Communication Quarterly, 52*, 224–236.

Yob, I., & Crawford, L. (2012). Conceptual framework for mentoring doctoral students. *Higher Learning Research Communications, 2*, 37–50.

Appendix A. Online Graduate Mentoring Scale v1

The items in the OGMS1 are listed below. They are meant to be answered on a four-point scale where 1 = *very unimportant* and 4 = *very important* for successful mentoring.

Academic attributes

Competence: The expertise of a mentor that establishes credibility of and confidence in the mentor on the part of mentees, including content area knowledge, research knowledge, and recognition in the field.

C1 Publishes research and/or articles in professional journals.
C2 Presents at professional conferences.
C3 Holds an appropriate degree in the content area.
C4 Holds or has held a field position in the content area.
C5 Has a record of mentoring doctoral level research.
C6 Handles required technology effectively.
C7 Has thorough knowledge of research design and methodology.

Availability: The quality of responding to mentees in a timely and thorough fashion, including promptness, modality (such as email, phone calls, and live-chat), sufficiency, and frequency of communication.

A1 Meets face to face with mentees.
A2 Establishes expectations for communication with mentees.
A3 Is available to mentees during normal business hours.
A4 Is available to mentees evenings and weekends.
A5 Responds promptly to brief email inquiries from mentees.
A6 Reviews mentees' documents within a stated time frame.
A7 Gives sufficient time to communication with mentees.

Induction: The process of bringing mentees into the professional community of practice, including its communications, research initiatives, networks, values, ethics, and language.

I1 Advises mentees on their suitability for doctoral work.
I2 Communicates professional standards of behavior and ethics to mentees.
I3 Introduces mentees to presentation and publication venues.
I4 Engages in research projects and/or publishing with mentees.
I5 Introduces mentees to colleagues and professional networks.
I6 Helps mentees make connections between their studies and their professional practice.
I7 Confronts inappropriate professional behaviors exhibited by mentees.

Challenge: The act of requiring quality thinking and production on the part of mentees, including providing constructive feedback, stimulating critical thinking, promoting continuous improvement, and imposing quality standards.

H1 Uses questions effectively as a teaching tool.
H2 Provides specific feedback on mentees' work.
H3 Does not approve substandard work by mentees.
H4 Expects iterative improvement in mentees' submissions of documents.
H5 Requires professional writing with accurate language mechanics from mentees.
H6 Encourages mentees to consider alternative viewpoints.
H7 Expects mentees to find weaknesses and limitations in the writing of others, including experts.

(*Continued*)

Appendix A (*Continued*)

Psychosocial attributes
Personal qualities: A constellation of individual attributes that invites mentee confidence in the mentor and a sense of approachability to the mentor, including emotional maturity, openness, equanimity, and appropriate boundaries.

P1 Can be trusted.
P2 Has a sense of humor.
P3 Is patient with mentees.
P4 Sets professional boundaries with mentees.
P5 Develops a personal relationship with mentees.
P6 Develops a collegial relationship with mentees.
P7 Socializes informally with mentees.
P8 Serves as a role model for mentees.
P9 Is enthusiastic and dynamic as a scholar/teacher.

Communication: Collegial interaction between mentor and mentees that is marked by mentor's accurate delivery of information, mentor's accurate perception of mentees' communication, and receptivity to feedback from mentees.

O1 Receives compliments graciously from mentees.
O2 Takes mentees' complaints/criticisms seriously.
O3 Compliments mentees on work well done.
O4 Provides clear instruction on how mentees can improve their work.
O5 Listens carefully to mentees.
O6 Is easy for mentees to talk with.
O7 Sets realistic deadlines for mentees' work submission.

Emotional support: Facilitation of mentees' progress and growth through the doctoral program, including concern for mentees as individuals, removal of obstacles/impediments to their progress, encouragement to move forward, and assistance in dealing with setbacks.

S1 Encourages mentees to pursue their own research interests.
S2 Guides mentees to access additional expertise and resources as needed.
S3 Intervenes on the part of mentees who report unfair, hostile, or nonconstructive treatment from others.
S4 Accepts mentees as individuals.
S5 Provides emotional guidance to mentees.
S6 Advises mentees in relation to personal problems.
S7 Advises mentees on how to deal with academic stress.
S8 Builds mentees' self-confidence and self-esteem.
S9 Encourages mentees' self-awareness.
S10 Encourages mentees to express emotions.
S11 Adapts mentoring style to meet mentees' needs and interests.

Appendix B. Online Graduate Mentoring Scale v2

The items in the OGMS2, revised from the OGMS1, are listed below. They are meant to be answered on a four-point scale where 1 = *very unimportant* and 4 = *very important* for successful mentoring.

Academic attributes
Competence
1 The mentor holds an appropriate degree in the content area.
2 The mentor holds or has held a field position in the content area.
3 The mentor has a record of mentoring doctoral level research.
4 The mentor has thorough knowledge of research design and methodology.
Availability
1 The mentor reviews mentees' documents within a stated time frame.
2 The mentor responds promptly to brief email inquiries from mentees.
3 The mentor gives sufficient time to communication with mentees.
Induction
1 The mentor engages in research projects and/or publishing with mentees.
2 The mentor introduces mentees to colleagues and professional networks
3 The mentor introduces mentees to presentation and publication venues.
4 The mentor helps mentees make connections between their studies and their professional practice.
Challenge
1 The mentor does not approve substandard work by mentees.
2 The mentor requires professional writing with accurate language mechanics from mentees.
3 The mentor encourages mentees to consider alternative viewpoints.
4 The mentor provides specific feedback on mentees' work.

Psychosocial attributes
Communication
1 The mentor listens carefully to mentees.
2 The mentor provides clear instruction on how mentees can improve their work.
3 The mentor sets realistic deadlines for mentees' work submission.
4 The mentor is easy for mentees to talk with.
Emotional support
1 The mentor provides emotional guidance to mentees.
2 The mentor advises mentees in relation to personal problems.
3 The mentor builds mentees' self-confidence and self-esteem.
4 The mentor compliments mentees on work well done.