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Confirmatory Factor Analysis of the Public Health Associate Program Service-Learning Scale: A Validation Study

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Service-learning programs play an important role in the recruitment and development of the public health workforce. Such programs serve as necessary pathways for trainees to enter public health and related fields (McClamroch & Montgomery, 2009; Horney, et al., 2014; Yeager, Beitsch, & Hasbrouch, 2016; Leider, Resnick, & Erwin, 2022; Leider et al., 2023), providing participants with hands-on career experience and supplying organizations access to a pool of early career applicants (Furco, 1996; Cashman & Seifer, 2008; Thacker et al., 2008; Meritt & Murphy, 2019; Markaki, et al., 2021). Service-learning participants offer valuable insight into program quality and effectiveness, and gathering this input through surveys is among the most widely used approaches to evaluate training and professional development programs (Gelmon, et al., 2001; Brown, 2005; Kirkpatrick & Kirkpatrick, 2006). Although certain scales designed to evaluate different components of service-learning have been examined previously (e.g., Eyler, et al., 1997; Shiarella, et al., 2000: Moely, et al., 2002; Snell & Lau, 2020; Lee et al, 2021), the overall body of evidence derived from psychometric evaluation is limited (Gelmon et al., 2001; Toncar, et al., 2006; Ma et al., 2019; Snell & Lau, 2020). This is particularly true for service-learning programs in public health and related fields and in programs sponsored by non-academic institutions.

The Public Health Associate Program (PHAP) Service-Learning Scale (PSLS) (Appendix) was first developed in 2016. It was designed to evaluate participant experience and satisfaction with PHAP, a service-learning fellowship program managed by the Centers for Disease Control and Prevention (CDC). Using an exploratory factor analysis (EFA), the initial pilot of assessment of PSLS provided evidence of validity and reliability and as an underlying factor structure for the scale (Colman et al., 2018). For the pilot study, EFA was more appropriate methodology because the scale was still in development and hypothesized factors had not been generated (Kelloway, 1995). As explained by Hurley et al., (1997), psychometric research on a particular scale can be phased, beginning with the EFA study and succeeded by a CFA study to see what can be confirmed. The current study purpose is to reexamine and confirm previous findings of the factor structure of subscales and provide evidence of its validity using a confirmatory factor analysis (CFA). While this sample for these psychometric evaluations has been limited to PHAP participants, if the instrument is validated, this scale has utility for a plethora of service-learning programs.

Pilot Study: Exploratory Factor Analysis

In 2018, authors examined psychometric properties of PSLS using exploratory factor analysis (EFA) (Colman et al., 2018). Using a systematic process, EFA with maximum likelihood extraction and orthogonal varimax rotation validated a scale on service-learning experience and program satisfaction for participants of PHAP.

PSLS consists of 22 items across five subscales (Appendix A): *Learning Outcome*s (five items), *Mentoring* (four items), *Experiential Assignment* (five items), *Self-Efficacy in Program Competency Domains* (five items) and *Program Satisfaction* (three items). Each subscale is measured on a 5-point Likert scale. All subscale items had factor loading scores from .46 to .94. Each subscale was found to have acceptable internal consistency (all subscales had $\alpha > .70$) and the overall scale's internal consistency was determined to be excellent ($\alpha = .90$).

Current Study: Confirmatory Factor Analysis

Based on the EFA findings, the model appeared to be a reliable and valid measurement of assessing participant experience and satisfaction in service-learning programs with five subscales. In this current study, the authors expanded on the EFA study, seeking to verify the previously discovered model using a CFA. The factor structure discovered in the EFA provided an a priori hypothesis that guided this CFA study.

Method

Sample

Data collected from a cross-sectional survey of 633 graduating PHAP participants (i.e., associates) were used to examine the PSLS factor structure. Participants completed the program during 2016–2021. PHAP primarily, but not exclusively, serves as a post-baccalaureate service-learning fellowship, with 61% of participants entering the program with only a bachelor's degree (386/633) and minimal work experience. Service-learning assignments in state, tribal, local, territorial, federal, and nongovernmental health agencies or organizations, referred to as host sites, varied with most of the experiential assignments being at local health departments (56%; 352/633) and state health departments (28%; 178/633). The remaining 16% of host sites consisted of federal health agencies, nongovernmental organizations, and territorial and tribal health agencies (103/633).

Data Collection

The PSLS survey was electronically sent to eligible participants within one month of program completion. Participants were considered eligible if they were enrolled in the program at the time the survey was administered. Participants who resigned from the program before survey administration were excluded from the sample. Surveys were sent using an individualized link and no participant names or identifiable characteristics were collected. Of 633 eligible persons who received the survey, 598 participated, for a total response rate of 94%.

Analysis

Analyses were conducted using SAS® Version 9.4 (SAS Institute, Incorporated, Cary, North Carolina). The CFA was performed using maximum likelihood structural equation modeling techniques (Steenkamp and van Trijp, 1991). Model fit was evaluated using the following recommended criteria (Hu & Bentler, 1999; Brown, 2015): root mean square residual (RMR), the goodness of fit index (GFI), the root mean square error of approximation (RMSEA), and the comparative fit index (CFI) (Table 1). Because of the large sample size, missing data were not imputed in the analysis (Matsunga, 2010).

Results

Researchers tested the fit of the 5-factor model discovered in the initial EFA pilot study. As shown in Table 1, the model was found to fit the data with factor loading scores ranging from .46 to .89 (Table 2). Good fit has been established for this model based on model fit indices. For this model, the RMR = .048, and the standardized RMR = .052. GFI for this model was .919. RMSEA demonstrated a good model fit at .056. CFI also indicated good model fit, CFI = 0.953. The combination of CFI above .95 and RMSEA value approximately .06 decreased the possibility of type I and type II errors (Hu & Bentler, 1999). Lastly, internal consistency reliability was determined to be good ($\alpha = .87$).

Table 1
Goodness-of-fit indices for the PSLS confirmatory factor analysis model

	χ^2	*df*	*p*-value	RMR	GFI	RMSEA	CFI
PSLS Model	265.71	125	<.01	0.048	0.919	0.056	0.953
Model Fit Recommendation				<0.05	>0.90	<.05, close fit; <.08, reasonable fit	>0.93
References				Joreskog & Sorbom, 1984; Steiger, 1990; Bentler, 1995	Joreskog & Sorbom, 1984; Byrne, 1994	Steiger & Lind, 1980; Browne & Cudeck, 1993; Steiger, 2007	Bentler & Bonett, 1980; Byrne 1994; Hu & Bentler, 1999

Table 2
Structure coefficients of the Public Health Associate Program Service-Learning Scale: Results for the confirmatory factor analysis

	Factor Loadings				
Items Grouped by Factors	1	2	3	4	5
Factor One: Learning and Development					
Associate developed new skills while in PHAP	.71				
Associate's existing skills were enhanced during PHAP	.73				
Associate experienced a change in skills during PHAP	.79				
PHAP prepared associate for next position	.73				
PHAP influenced associate's career goals	.61				
Factor Two: Mentoring					
Mentor connected associate with other professionals		.89			
Mentor was a confidential source of support		.83			
Mentor provided career guidance		.80			
Associate satisfaction with PHAP mentoring program		.88			
Factor Three: Experiential Assignment					
The degree of challenge in host site assignment			.51		
Associate developed new knowledge and skills at host site			.64		
Associate satisfaction with host site supervisor			.60		
Associate recommendation of host site			.63		
Associate satisfaction with overall host site experience			.67		
Factor Four: Self-Efficacy in Program Competencies					
Associate confidence in Public Health Program and Practice				.62	
Associate confidence in Partnership and Collaboration				.46	
Associate confidence in Cultural Competency				.59	
Associate confidence in Communications				.54	
Associate confidence in Critical Systems Thinking				.51	

Table 2 (cont.)

	Factor Loadings				
Items Grouped by Factors	1	2	3	4	5
Factor Five: Program Satisfaction					
Associate would recommend PHAP to others					.68
Overall quality of PHAP					.70
PHAP met associate's expectations					.75

Although the previously mentioned model fit tests repeatedly demonstrated good model fit, the chi-square statistic did not support this finding (χ^2 (125) = 265.71, $p < .01$). Chi-square is sensitive to larger sample sizes, and the *p*-value often decreases as the sample size increases (Babyak & Green, 2010). The study sample size is large and exceeds the recommended ratio of sample size to model variables (Myers, Ahn, & Jin, 2011). Because of this chi-square statistic, study authors concluded that the model fit was good as established by the other model fit indices.

Discussion

This study continued the examination of the psychometric properties of PSLS, a scale designed to evaluate the overall experience and satisfaction among associates participating in CDC's PHAP program. CFA study validated the 5-factor model revealed in the previous study by Colman et al. (2018), confirming a 22-item scale for a PHAP service-learning program evaluation. Both studies provide evidence of the validity and reliability of PSLS.

A mix of response options across the different items were included in this survey. Mixed-response formatting helped reduce acquiescence and central tendency biases amongst participants since patterned responding is reduced when questions use different response options. Additionally, the full range of a latent variable is better measured when using different response formats since different components of these latent variables are more accurately measured with different types of questions and responses.

Authors did not reverse score any items when completing the analyses for this study. From the implementation and practice standpoint, this was done to simplify the experience for the individuals completing the survey. Participants were able to follow a consistent direction, reducing respondent burden related to cognitive load, as well as the potential for response error due to misinterpretation of the questions. Reversed-scored items were also intentionally excluded to avoid method variance, biased parameter estimates, and the negative impacts this type of item can have on model fit.

In the present study, multiple fit indicators were used to confirm CFA: RMR, RMSEA, GFI, and CFI. The authors chose to evaluate model fit using multiple tests to increase the conservative model fit valuation (Brown, 2015; Kline, 2016). Only the chi-square statistic did not display good model fit, but model fit was supported by the other four goodness-of-fit indices.

Limitations

The primary limitation of this study is that it was confined to persons selected to be PHAP associates. In the same regard, only data from those associates who completed the program were included; persons who left the program early did not complete this survey. Additionally, the sample consisted of a single service-learning program, PHAP; therefore, findings cannot be generalized to service-learning participants outside of this fellowship program.

Conclusions

PSLS was developed to examine experience and evaluate satisfaction of PHAP among associates participating in CDC's public health service-learning program. This CFA study, along with the previous EFA study, helps fill a gap in the psychometric literature by expanding the limited research base concerning assessments designed for evaluating service-learning programs and fellowships (Toncar, et al., 2006; Snell & Lau, 2020). This manuscript highlights a novel evaluation instrument that could potentially be adapted to evaluate similar programs to PHAP. Further research examining PSLS is needed to determine if its use can extend beyond PHAP, federal government fellowships, and the field of public health.

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Appendix

Public Health Associate Program (PHAP) Service-Learning Scale: Survey Items (in the order they appear on the survey)[1]

1. I was appropriately challenged in my host site assignment.
    a. Strongly Disagree
    b. Disagree
    c. Neither Agree nor Disagree
    d. Agree
    e. Strongly Agree
2. I developed new knowledge or skills in the program focus area where I was assigned.
    a. Strongly Disagree
    b. Disagree
    c. Neither Agree nor Disagree
    d. Agree
    e. Strongly Agree
3. How satisfied have you been with the supervision provided by your host site?
    a. Very Dissatisfied
    b. Dissatisfied
    c. Neither Satisfied nor Dissatisfied
    d. Satisfied
    e. Very Satisfied
4. Based on your experience, which statement best reflects your opinions of your host site?
    a. I am not sure if I would recommend my host site.
    b. I would not recommend that my host site receive a future associate.
    c. I would recommend that my host site receive a future associate, but only with major changes.
    d. I would recommend that my host site receive a future associate, but only with minor changes.
    e. I would highly recommend that my host site receive a future associate.
5. Considering everything, how satisfied have you been with your host site experience?
    a. Very Dissatisfied
    b. Dissatisfied
    c. Neither Satisfied nor Dissatisfied
    d. Satisfied
    e. Very Satisfied
6. My official CDC mentor has been a confidential source of support for me.
    a. Strongly Disagree
    b. Disagree
    c. Neither Agree nor Disagree
    d. Agree
    e. Strongly Agree

[1] Scoring is based on letter choice of response option: a=1, b=2, c=3, d=4, and e=5.

7. My official CDC mentor connected me with public health professionals who could assist me with meeting my goals.
    a. Strongly Disagree
    b. Disagree
    c. Neither Agree nor Disagree
    d. Agree
    e. Strongly Agree
8. I am satisfied with the career guidance provided by my official CDC mentor.
    a. Strongly Disagree
    b. Disagree
    c. Neither Agree nor Disagree
    d. Agree
    e. Strongly Agree
9. Considering everything, how satisfied have you been with the mentorship provided by your official CDC mentor?
    a. Very Dissatisfied
    b. Dissatisfied
    c. Neither Satisfied nor Dissatisfied
    d. Satisfied
    e. Very Satisfied
10. I acquired new skills during PHAP.
    a. Strongly Disagree
    b. Disagree
    c. Neither Agree nor Disagree
    d. Agree
    e. Strongly Agree
11. I enhanced existing skills during PHAP.
    a. Strongly Disagree
    b. Disagree
    c. Neither Agree nor Disagree
    d. Agree
    e. Strongly Agree
12. My public health skills have increased as a result of participating in PHAP.
    a. Strongly Disagree
    b. Disagree
    c. Neither Agree nor Disagree
    d. Agree
    e. Strongly Agree
13. How confident are you in your ability to perform skills related to public health program and practice? (includes knowledge of CDC's public health program approach to address and improve the population-based health and the development and application of program skills to improve health outcome)
    a. Not at all Confident
    b. Slightly Confident
    c. Somewhat Confident
    d. Confident
    e. Very Confident

14. How confident are you in your ability to perform skills related to partnership and collaboration? (includes developing relationships to improve the community's health and implementing programmatic interventions)
    a. Not at all Confident
    b. Slightly Confident
    c. Somewhat Confident
    d. Confident
    e. Very Confident
15. How confident are you in your ability to perform skills related to cultural competency? (includes operating in different cultural contexts and integrating knowledge about individuals and groups of people into public health practice to produce better public health outcomes)
    a. Not at all Confident
    b. Slightly Confident
    c. Somewhat Confident
    d. Confident
    e. Very Confident
16. How confident are you in your ability to perform skills related to communications? (includes the ability to deliver clear and effective communication that satisfied internal and external customers)
    a. Not at all Confident
    b. Slightly Confident
    c. Somewhat Confident
    d. Confident
    e. Very Confident
17. How confident are you in your ability to perform skills related to critical systems thinking? (includes the ability to assess problems and effectively arrive at appropriate solutions, as well as the ability to self-identify the need for profession improvement)
    a. Not at all Confident
    b. Slightly Confident
    c. Somewhat Confident
    d. Confident
    e. Very Confident
18. My experience in PHAP helped clarify my career goals.
    a. Strongly Disagree
    b. Disagree
    c. Neither Agree nor Disagree
    d. Agree
    e. Strongly Agree
19. PHAP has prepared me for my next position. (Note: think about what's next for you [i.e. job, academic program, other endeavor]. If you don't know exactly what's next, please consider how PHAP has prepared you, in general, for your next position following PHAP.)
    a. Strongly Disagree
    b. Disagree
    c. Neither Agree nor Disagree
    d. Agree
    e. Strongly Agree

20. I would recommend PHAP to others considering a career in public health.
    a. Strongly Disagree
    b. Disagree
    c. Neither Agree nor Disagree
    d. Agree
    e. Strongly Agree
21. Overall, the quality of the PHAP program was:
    a. Poor
    b. Fair
    c. Good
    d. Very Good
    e. Excellent
22. Overall, the PHAP program:
    a. Did Not Meet My Expectations At All
    b. Somewhat Met My Expectations
    c. Met My Expectations
    d. Exceeded My Expectations
    e. Significantly Exceeded My Expectations