

Validation of the Service Leadership Knowledge Scale: Factorial and convergent validity

**Daniel TL Shek^{1-6,*}, PhD, FHKPS, BBS,
SBS, JP, Lawrence K Ma¹, PhD, Lu Yu¹,
PhD and Loretta MK Leung⁷, MEd, BA**

¹Department of Applied Social Sciences, The Hong Kong Polytechnic University, Hong Kong, PR China

²Centre for Innovative Programmes for Adolescents and Families, The Hong Kong Polytechnic University, Hong Kong, PR China

³Department of Social Work, East China Normal University, Shanghai, PR China

⁴Kiang Wu Nursing College of Macau, Macau, PR China

⁵Hong Kong Institute of Service Leadership and Management Limited, Hong Kong, PR China

⁶Division of Adolescent Medicine, Department of Pediatrics, Kentucky Children's Hospital, University of Kentucky School of Medicine, Lexington, Kentucky, USA

⁷Student Affairs Office, The Education University of Hong Kong, Hong Kong, PR China.

Abstract

Building on the previous work regarding the assessment tools developed based on the Service Leadership Education model, this paper reports a large-scale validation study on the Service Leadership Knowledge Scale. A total of 4,486 Hong Kong undergraduates recruited from eight universities funded by the government were administered the Service Leadership Knowledge Scale (Short-Form) with 50 items (SLK-SF-50). After the initial internal consistency assessment, 40 items were retained to form the trimmed version (SLK-SF-40). Confirmatory factor analysis provided support for the hypothesized one-factor structure of the SLK-SF-40 and correlation analyses showed that the scale score was significantly related to different theoretically relevant constructs. The findings demonstrated that the trimmed Service Leadership Knowledge Scale (SLK-SF-40) is an objective measure in gauging individuals' knowledge about Service Leadership.

Keywords: Service Leadership Knowledge Scale, confirmatory factor analysis, convergent validity, service leadership education, scale validation

Introduction

As a result of the structural shifts in the global economic makeup over the past few decades, Hong Kong has transitioned from a manufacturing-based economy to a service-oriented economy (1). Not only is such a transition characterized by the *production* aspects such as variability of the production process and GDP compositions and share of employment (1), the *people* aspects such as leaders' and organizations' perceptions of human nature and knowledge or competencies needed to excel also constitute the defining attributes of this transformation (2). Owing to the evolution from an *Industrial* to a *Service Age* mentality (3), Chung (4,5) argued passionately for the need of undergraduates in Hong Kong to learn effective leadership in a service economy, which is

* **Correspondence:** Daniel TL Shek, PhD, FHKPS, BBS, SBS, JP, Associate Vice President (Undergraduate Programme), Chair Professor of Applied Social Sciences and Li and Fung Professor in Service Leadership Education, Department of Applied Social Sciences, The Hong Kong Polytechnic University, Hungghom, Hong Kong, PR China. E-mail: daniel.shek@polyu.edu.hk.

key to their survival and personal development in today's ultra-competitive business environment.

Against such a backdrop, a large-scale project entitled the "Fung Service Leadership Education Initiative," financially supported by the Victor and William Fung foundation and with the collaborative effort of the Hong Kong Institute of Service Leadership and Management Limited (HKI-SLAM) and the University Grants Committee (UGC), was implemented in eight UGC-funded universities in Hong Kong. Po Chung, Chairman of HKI-SLAM, instigated the concept of Service Leadership education targeting Hong Kong's undergraduates (i.e., SLAM framework). Specifically, the SLAM framework maintains that effective Service Leadership is embodied by "a leader or service provider possessing relevant situational task *competencies* plus being judged by superiors, peers, and subordinates as possessing *character* and exhibiting *care*" (6, p. 354). Accordingly, the principle "Effective leadership = Moral character * Competencies * Caring disposition", summarized by the equation $E = MC^2$, is highly emphasized within the SLAM framework (6).

As each university would devise her curriculum on the nurturance of effective leadership attributes (i.e., MC^2) (7), it is imperative that systematic evaluation research is conducted to gauge the effectiveness of these independently developed curricula (8). Particularly, Shek and Lin (9) argued that it is important to assess students' knowledge, attitudes, and behavior to assess an educational program's effectiveness. To facilitate the evaluation of Service Leadership education across universities, the research team at The Hong Kong Polytechnic University (PolyU) developed the long-form Service Leadership Knowledge Scale (SLK-LF-200; 200 items) to measure students' mastery of the fundamental knowledge points on the SLAM framework (10). The assessment tool includes 200 multiple-choice scale items in seven domains based on the SLAM framework and the relevant literature (10). These seven domains include i) the general descriptions of Service Leadership, ii) three realms of Service Leadership, iii) the belief that "Everyone can be a leader," iv) the principle " $E = MC^2$ ", v) manufacturing versus service economy, vi) distinction of Service Leadership and other leadership theories, and vii) other knowledge points in SLAM framework.

Utilizing a posttest-only control design, Shek and Lin (9) attempted to examine the criterion-related validity of the SLK-LF-200 with an undergraduate sample. The experimental group consisted of 67 students who took a three-credit "Service Leadership" course at the PolyU, whereas the control group was composed of 94 conveniently recruited PolyU students who had never taken the course. Inspection of each item revealed that the former significantly outscored the latter on 63 items. A follow-up inspection of these 63 criterion-valid items, led by the first author of this paper, resulted in a further removal of 13 items due to duplication or face validity concerns. Ultimately, 50 items were retained to form the short-form of the Service Leadership Knowledge Scale (SLK-SF-50).

While Shek and colleagues (9,10) pioneered the criterion and content validation of the initial knowledge scale (i.e., SLK-LF-200), the dimensionality and convergent validity of the short form (i.e., SLK-SF-50) remain to be ascertained. Against such a background, utilizing the responses of 4,486 undergraduates in Hong Kong, this paper is primarily concerned with the psychometric properties of the 50-item SLK-SF-50 based on a large sample of students. Despite the fact that seven dimensions were theorized to be subsumed under the original scale (SLK-LF-200), the removal of three-quarters of items suggests that a re-examination of the trimmed scale's (i.e., SLK-SF-50) dimensionality is necessary. Considering that the knowledge scale operationalizes respondents' understanding of Service Leadership as "knowledge points" they acquired, and that a composite score which denotes overall proficiency is computed (9,10), there is an implicit assumption that the knowledge scale is indeed unidimensional as the items cohere around one latent "knowledge" dimension (11,12). Hence, the proposed factor structure of the scale is a one-factor structure of the SLK-SF-50.

Convergent validity, which can be derived from "correlations with measures purporting to measure related constructs" (13), is also crucial in scale development as it informs whether the instrument can adequately probe into the target construct (14). Utilizing several validated measures of relevant constructs outlined in the SLAM framework (see 15), including i) *Servant Leadership*, ii) *moral self-concept*, iii) *leadership efficacy*, and iv) *empathy*, this

study sought to establish the convergent validity of the SLK-SF-50 via examining its correlations with these external measures.

Methods

Altogether 4,486 undergraduates (mean age: 20.47 years; SD: 1.67) from eight UGC-funded institutions completed the Short-Form Service Leadership Scale (SLS) validation study via an online platform. There were 1,517 (33.8%) male and 2,969 (66.2%) female respondents. The majority were aged 20 to 24 years (68.4%), had neither taken any credit-bearing Service Leadership (SL) subjects (74.3%) nor participated in any non-credit-bearing SL events a priori (82.0%), had previous work experience (91.4%), and had formerly served in leadership positions (61.4%). Additionally, 77.1% sat the Hong Kong Diploma of Secondary Education Examination (HKDSE). Table 1 highlights the demographic information for the present sample.

Procedures

All participants were administered the SLS online survey via the mySurvey@PolyU electronic survey system in March 2017. Students were asked to complete the survey in a self-administered fashion. Each participating university had her version of the online survey because the additional information asked is not the same. While the scale items were identical throughout, there were items probing into the respondents' demographics (e.g., faculty or school) and contact information of the person-in-charge that were unique to each university. The research objectives and guidelines on how to complete the questionnaire were detailed in the invitation emails and on the survey webpage. It was reiterated to students that it would take 45 to 60 minutes to conscientiously complete the whole survey. Each participant was given a supermarket voucher by the end of the study valued at HK\$100 or US\$12.80. Students indicated their consent or refusal to participate at the opening page.

Participants' completed electronic responses were downloaded as an EXCEL file for a preliminary data

cleaning process before being converted to an SPSS file and a DAT file for statistical analyses. Several procedures were involved regarding the 4,555 completed responses as recorded. First, six cases of which students refused to participate were removed. Thirty more cases were excluded due to ineligibility of participants. These included a) participants completing the wrong survey (i.e., University A's students completed the survey designed for University B's students), and b) participants revealing themselves to be non-undergraduates (e.g., postgraduates) in those open-ended questions. Furthermore, thirty-three cases of multiple participations—as per inspection of participants' student ID—were excluded from the main analyses. Accordingly, 4,486 cases were retained for further analyses. Table 2 features a breakdown of the number of cases retained for the present sample.

Instruments

The current questionnaire comprised items of the short-forms of the Service Leadership scales, including that of i) the Service Leadership Attitude Scale (SLA-SF-73; 73 items), ii) the Service Leadership Behavior Scale (SLB-SF-65; 65 items), and iii) the Service Leadership Knowledge Scale (SLK-SF-50; 50 items). The present paper is primarily concerned about the validation of the 50-item SLK-SF-50.

Developed based on the HKI-SLAM framework, twenty-five principles of Service Leadership (16), twelve dimensions of a Service Leader (3) and the relevant literature (e.g., 15), a 200-item Service Leadership Knowledge Scale (i.e., SLK-LF-200) was designed to “capture the essential knowledge points of Service Leadership model in the format of multiple-choice questions” (10). Fifty items were ultimately retained to form the SLK-SF-50, following Shek and Lin's (9) criterion-validation study and a follow-up item screening. Table 3 features three sample items and the model answers. Participants' responses were coded based on accuracies. Each *correct* answer would earn the participants one point, whereas an *incorrect* answer entitles them to zero point. The scale items are in English. Several well-validated inventories from the leadership and personality

literature were also utilized, with the objective to establish the convergent validity of the SLA-SF-73, the SLB-SF-65, and the SLK-SF-50. These external criterion scales included the Revised Servant Leadership Profile (RSLP; 20 items), Leadership

Efficacy Scale (LEF; 8 items), the Moral Self-Concept (MSC; 8 items), and the Interpersonal Reactivity Index (IRI; 14 items). A few forced-choice and open-ended items assessing students' background demographics were also included.

Table 1. Basic demographic information for the current working sample (N = 4,486)

Demographic Variables		N = 4,486
Valid responses from eligible participants from:	The Hong Kong Polytechnic University (PolyU)	1,000 (22.3%)
	The Chinese University of Hong Kong (CUHK)	505 (11.3%)
	The Education University of Hong Kong (EdUHK)	500 (11.1%)
	Hong Kong Baptist University (HKBU)	517 (11.5%)
	City University of Hong Kong (CityU)	464 (10.3%)
	Lingnan University (LU)	500 (11.1%)
	The University of Hong Kong (HKU)	500 (11.1%)
	Hong Kong University of Science and Technology (HKUST)	500 (11.1%)
Gender	Male	1,517 (33.8%)
	Female	2,969 (66.2%)
Age Group	15 to 19 years	1,344 (30.0%)
	20 to 24 years	3,070 (68.4%)
	25 to 29 years	69 (1.5%)
	30 years or above	3 (0.1%)
Year commencing on one's undergraduate study	2016	1,533 (34.2%)
	2015	1,164 (25.9%)
	2014	897 (20.0%)
	2013	742 (16.5%)
	2012 or before	150 (3.3%)
Number of credit-bearing Service Leadership (SL) courses taken*	0	2,962 (74.3%)
	1	951 (23.9%)
	2	71 (1.8%)
	3	2 (0.1%)
Number of non-credit-bearing SL events participated	0	3,680 (82.0%)
	1	506 (11.3%)
	2	230 (5.1%)
	3	62 (1.4%)
	4 or more	8 (0.2%)
Other leadership training taken	Yes	1,955 (43.6%)
	No	2,531 (56.4%)
Previous work experience	With work experience	4,102 (91.4%)
	Without work experience	384 (8.6%)
Self-proclaimed knowledge of Service Leadership	No knowledge	916 (20.4%)
	Little knowledge	1,590 (35.4%)
	Some knowledge	1,774 (39.5%)
	A lot of knowledge	195 (4.3%)
	All the knowledge	11 (0.2%)
Leadership position ever taken	Yes	2,753 (61.4%)
	No	1,753 (38.6%)
Entrance Exam	Hong Kong Diploma of Secondary Education Examination (HKDSE)	3,484 (77.1%)
	Hong Kong Advanced Level Examination (HKALE)	71 (1.6%)
	National College Entrance Examination (NCEE) in mainland China	221 (4.9%)
	Associate Degree/Higher Diploma in Hong Kong	495 (11.0%)
	Others (e.g., GCE A-Levels, IB, etc.)	215 (4.8%)
Grade Point Average	Mean converted Grade Point Average out of 4.00 (SD)	2.89 (0.45)
Time of completion	Average time (in minutes) taken to complete the survey (SD)	69.98 (383.13)

Note. *EdUHK does not provide any credit-bearing SL modules for her students.

Table 2. Number of cases retained in the main analyses

Participating Universities	“Completed” Cases as per Record in mySurvey	Declined	Multiple Participations	Deleted due to Ineligibility of Participants	Cases Retained for the Main Analyses
EdUHK	506	0	6	0	500
CityU	477	0	3	10	464
HKUST	514	1	12	1	500
CUHK	511	2	0	4	505
LU	509	0	6	3	500
HKU	508	1	2	5	500
HKBU	522	2	0	3	517
PolyU	1008	0	4	4	1000
Total	4555	6	33	30	4486

Table 3. Three sample items of the SLK-SF-50

Items	Options	Model Answer
8. A manager under the service economy wants to hire someone. Based on the Service Leadership model, which of the following advice would you give him/her?	A. Hire for qualifications, train for character B. Hire for character, train for skills C. Hire for attitude, train for character D. Hire for efficiency, train for mindset	B
22. In the four options below, which one belongs to an attribute of intelligence quotient (IQ)?	A. Raw power B. Attractiveness C. Sexual orientation D. Problem-solving skills	D
37. Which of the following statements is inconsistent with the concept of “respect”?	A. Showing off one’s strength B. Accepting and appreciating differences C. Accepting and appreciating oneself D. Serving as a key element in nurturing authentic relationship	A

Note. All sample items were slightly re-phrased due to copyright concern.

1. **Revised Servant Leadership Profile (RSLP):** Developed by Wong and Page (17), the RSLP measures *Servant Leadership* as a multidimensional construct. Twenty items from five factors relevant to the SLAM framework—namely, i) *Empowering and developing others* (five items), ii) *Serving others* (seven items), iii) *Open, participatory leadership* (two items), iv) *Inspiring leadership* (two items), and v) *Integrity and authenticity* (four items)—were adopted at present. Items were rated on a seven-point Likert scale, with a higher score indicating a greater alignment with a Servant Leader’s mentality. Reliability analyses showed an

excellent internal consistency of RSLP ($\alpha = 0.94$; mean inter-item correlations = 0.46).

2. **Leadership Efficacy Scale (LEF):** LEF was developed by Murphy (18) as a measure of one’s perceived “generalized capability in the leadership role” (19, p. 270). The LEF, which was utilized in the present study, entails eight items which are rated on a five-point Likert scale. Higher scores indicate one’s perceived capability that he/she could lead effectively. Reliability analyses highlighted the acceptable internal consistency of LEF on the present sample ($\alpha = 0.72$; mean inter-item correlations = 0.25).

- 3. Moral Self-Concept (MSC):** As a subscale under the Chinese Adolescent Self-Esteem Scales developed and validated by Cheng (20), the eight-item MSC measures participants' self-evaluation on facets on i) *Conduct and virtues*, ii) *Self-control and discipline*, and iii) *Altruism*. A slightly modified, English-translated version of the MSC—which operates on a seven-point Likert scale—was adopted in the present study. A higher score reflects greater perceived importance of *morality* to oneself, which is a fundamental attribute of effective Service Leadership according to the SLAM framework (21). Reliability analyses revealed a high internal consistency among the items ($\alpha = 0.83$; mean inter-item correlations = 0.44).
- 4. Interpersonal Reactivity Index (IRI):** Developed by Davis (22), the IRI constitutes the most widely adopted assessment tool of empathy. Not only was the IRI validated cross-culturally (e.g., 23,24), some suggested that it was the sole “published measure that allows a multi-dimensional assessment of empathy” (25, p. 620). Two subscales of IRI, namely i) *Perspective Taking* (PT; seven items) and ii) *Empathic Concern* (EC; seven items), were adopted for the current study. Items were rated on a five-point Likert scale, with a higher score indicating a “higher level of empathy which is an essential quality of ethical leadership” (26, p. 44). The component scores for subscales PT and EC were computed alongside a composite IRI score. Cronbach's alpha coefficients of the sub-scales PT and EC and the composite IRI score were 0.58, 0.62, and 0.74, respectively.

Data analysis plan

SPSS Statistics version 24.0 (IBM) was used for the descriptive statistical analyses (i.e., the demographics) and for the examination of internal consistency and of construct validity. Owing to the dichotomous nature (i.e., *correct* versus *incorrect*) of the coded

responses, the assessment of the factorial structure of the SLK-SF-50 (i.e., Confirmatory factor analysis [CFA]) was conducted using Mplus version 6.12 (27).

We first inspected the reliability indices of the 50-item SLK-SF-50. A Kuder-Richardson 20 coefficient of 0.93 was observed, which suggests an excellent reliability. Ten items with item-total correlations below 0.30 were excluded from the ensuing CFA. We then re-examined the reliability indices of the 40-item, trimmed SLK-SF-50 (i.e., SLK-SF-40 hereafter). Regarding CFA, the proposed one-factor structure was tested using the robust weighted least squares (WLSMV) estimator, which is appropriate for categorical items (28).

We examined the model fit using several indices including, a) Bentler-Bonett Nonnormed Fit Index (NNFI), b) comparative fit index (CFI), c) root mean square error of approximation (RMSEA; including also the 90% confidence interval [90% CI]), and d) weighted root-mean-square residual (WRMR). Based on the recommendations in the literature (29-31), a model with an NNFI exceeding 0.95, a CFI greater than 0.95, a RMSEA lower than 0.05 (with an upper CI value below 0.08), and a WRMR smaller than 0.90 would be considered an “excellent” fit. Models with a “good” fit should produce indices close to the above standards (28). We also reported the STDY metric for each item, which denotes the change in the standard deviation units of the outcomes (as per the unit change in predictor). The STDY metric represents each item's standardized factor loading (32).

Lastly, the total scale score was correlated with the different criterion measures. Considering that the knowledge preached in the Service Leadership curriculum covers domains on *Servant Leadership*, *leadership efficacy*, *morality*, and *empathy*, we would predict a positive correlation between the SLK-SF-40, with each of these external criterion scales (and subscales). Correlational analyses with other Service Leadership scales (and subscales) under validation were also administered. Data of the entire sample (N= 4,486) were utilized throughout every step of the present validation study. Specifically, we hypothesized that the SLK-SF-40 would be positively and significantly correlated with i) RSLP, ii) LEF, iii) MSC, and iv) IRI (subscales EC and PT). We expected the SLK-SF-40 to also correlate positively

with the validated versions of the SLA-SF-73 and SLB-SF-65 (and the subscales), considering that all these scales were constructed to assess the same underlying topic with different focuses (i.e., knowledge, attitude, and behavior).

Results

After removing ten items with low item-total correlations, reliability analyses revealed the excellent internal consistency of the 40 items retained ($\alpha = 0.94$, mean inter-item correlations = 0.28). All items had a corrected item-total correlation above 0.31.

Confirmatory Factor Analysis

Table 4 presents the model-fit indices of the proposed single-factor structure of SLK-SF-40, alongside the criteria for goodness-of-fit evaluation as above-mentioned. Overall, the NNFI, CFI, and RMSEA all suggested that the present proposed one-factor structure fit excellently with the current data (29-31), while the WRMR exceeded the proposed cut-off of 0.90, suggesting a model misspecification (33). Nevertheless, Newsom (34) cautioned against the sole reliance on WRMR as the only indicator of fit as it “does not always give sensible results (p. 3)”, and there is evidence (e.g., 35) that the three other metrics adopted at present (i.e., NNFI, CFI, and RMSEA) could perform well with categorical model estimations. Taken together, the examination of the goodness-of-fit indices offers preliminary support to the one-factor solution of SLK-SF-40.

We also scrutinized the individual parameter estimates of the present proposed one-factor solution. Table 5 presents every item's i) standardized factor loading (i.e. STDY estimates), ii) R-squared, iii) accuracy rate, iv) residual variance, and v) item-total correlations. As addressed in the table, the factor loadings and R-squared of all the SLK-SF-40 items were positive and significant at $p < .001$. The STDY estimates ranged from moderate to strong (0.32 to 0.90). No spurious findings were observed regarding the standard errors. These findings, in conjunction with the goodness-of-fit indices (see Table 4), again gave support to the proposed one-factor structure of the knowledge scale. Accordingly, this single-factor

model was accepted as the final factorial solution, and each respondent's SLK-SF-40 score was computed via a simple summation of their *correct* responses to the 40 items.

Validity analyses: Correlation with external criterion scales (and subscales)

Confirming our hypotheses, findings of the correlational analyses (see Table 6) indicated that the SLK-SF-40 scores correlated significantly (all $ps < .001$) and positively with all external criterion scales (and subscales). Utilizing the *cocor* statistical package (36) which allows comparisons of strengths of association across two pairs of correlation coefficients (e.g., Steiger's (37) computation of z-score using average correlations), the findings (see Table 6) indicated that amongst the significant associations, the SLK-SF-40 correlated most strongly with the *Interpersonal Reactivity Index* ($r = 0.438$, $N = 4,486$) and least with the *Leadership Efficacy* ($r = 0.125$, $N = 4,486$). These findings should give substance to the convergent validity of the SLK-SF-40 as it was demonstrated to relate positively and significantly to a myriad of well-validated measures (e.g., IRI and MSC) on constructs that were highly emphasized in the SLAM framework (e.g., empathy and morality).

Validity analyses: Correlation with other Service Leadership scales under validation

As detailed in Table 7, the SLK-SF-40 correlated significantly (all $ps < .001$) and positively with both composite scores of the six-factor, 38-item Service Leadership Behavior (i.e., SLB-SF-38) scale ($r = 0.178$, $N = 4,486$) and the eight-factor, 46-item Service Leadership Attitude (i.e., SLA-SF-46) scale ($r = 0.337$, $N = 4,486$). Discussions regarding the validations of both SLB-SF-38 and SLA-SF-46 are featured in two other papers within the current issue. The SLK-SF-40 also correlated positively with almost all the subscales of SLB-SF-38 and SLA-SF-46. These findings are consistent with our hypotheses that the three concurrently administered Service Leadership scales are positively and significantly associated with one another.

Furthermore, comparison via the *cocor* package highlighted that the strengths of correlations between SLK-SF-40 and SLA-SF-46 (and the subscales) were overall significantly greater ($ps < .05$) than those of SLK-SF-40 and SLB-SF-38 (and its subscales). These findings suggested that while individuals knowing

more about Service Leadership may be more prone to *think* or *feel* (i.e., attitude) and to *act* (i.e., behavior) as an effective Service Leader, there seems to be a weaker tie between “knowing” and “practicing what one was preached.”

Table 4. Model fit indices for the one-factor structure of SLK-SF-40

Model Tested	χ^2	Df	WRMR	NNFI	CFI	RMSEA (pclose)	RMSEA (90% C.I.)
One-factor	3,492.44	740	1.725	0.985	0.984	0.029 (1.00)	0.028/0.030
Criterion for goodness-of-fit	-	-	≤ 0.90	≥ 0.95	≥ 0.95	≤ 0.05	≤ 0.08

Note. WRMR= weighted root-mean-square residual; NNFI= Bentler-Bonett Nonnormed Fit Index; CFI= comparative fit index; RMSEA= root mean square error of approximation; pclose= probability of RMSEA ≤ 0.05 ; 90% CI= 90% Confidence Intervals (lower value/ upper value).

Table 5. Individual parameter estimates of the one-factor SLK-SF-40 (N= 4,486)

Items	Mean* (Standard Deviation)	Accuracy Rate**	Standardized Factor Loadings	R-squared	Residual Variance	Corrected Item-Total Correlations
SLK-01	0.391 (0.488)	39.12%	0.528	0.279	0.721	0.396
SLK-02	0.751 (0.433)	75.06%	0.545	0.297	0.703	0.396
SLK-03	0.830 (0.376)	83.01%	0.646	0.417	0.583	0.433
SLK-05	0.742 (0.438)	74.19%	0.537	0.289	0.711	0.391
SLK-06	0.439 (0.496)	43.87%	0.419	0.175	0.825	0.316
SLK-08	0.612 (0.487)	61.21%	0.570	0.325	0.675	0.444
SLK-10	0.447 (0.497)	44.72%	0.597	0.356	0.644	0.461
SLK-11	0.523 (0.500)	52.25%	0.522	0.272	0.728	0.399
SLK-12	0.607 (0.489)	60.65%	0.535	0.287	0.713	0.415
SLK-13	0.740 (0.439)	73.99%	0.831	0.690	0.310	0.621
SLK-14	0.592 (0.492)	59.16%	0.718	0.515	0.485	0.565
SLK-15	0.396 (0.489)	39.59%	0.676	0.456	0.544	0.509
SLK-16	0.604 (0.489)	60.43%	0.878	0.770	0.230	0.699
SLK-17	0.673 (0.469)	67.32%	0.869	0.755	0.245	0.682
SLK-18	0.597 (0.490)	59.74%	0.901	0.813	0.187	0.726
SLK-19	0.673 (0.469)	67.32%	0.558	0.311	0.689	0.422
SLK-20	0.624 (0.484)	62.44%	0.838	0.703	0.297	0.667
SLK-21	0.675 (0.468)	67.50%	0.570	0.324	0.676	0.433
SLK-22	0.685 (0.465)	68.46%	0.760	0.578	0.422	0.577
SLK-23	0.619 (0.486)	61.93%	0.819	0.672	0.328	0.652
SLK-24	0.542 (0.498)	54.19%	0.603	0.363	0.637	0.469
SLK-25	0.568 (0.495)	56.82%	0.755	0.570	0.430	0.598
SLK-26	0.594 (0.491)	59.38%	0.748	0.559	0.441	0.583
SLK-28	0.664 (0.472)	66.41%	0.316	0.100	0.900	0.653
SLK-30	0.672 (0.469)	67.23%	0.833	0.693	0.307	0.568
SLK-31	0.536 (0.499)	53.63%	0.731	0.534	0.466	0.573
SLK-32	0.552 (0.497)	55.19%	0.739	0.546	0.454	0.522
SLK-33	0.399 (0.490)	39.88%	0.662	0.438	0.562	0.494
SLK-34	0.536 (0.499)	53.59%	0.651	0.424	0.576	0.665
SLK-36	0.375 (0.484)	37.47%	0.820	0.673	0.327	0.462
SLK-38	0.429 (0.495)	42.93%	0.617	0.381	0.619	0.478
SLK-39	0.358 (0.480)	35.84%	0.618	0.382	0.618	0.318
SLK-41	0.608 (0.488)	60.81%	0.430	0.185	0.815	0.616
SLK-42	0.514 (0.500)	51.38%	0.772	0.596	0.404	0.580
SLK-44	0.343 (0.475)	34.26%	0.731	0.534	0.466	0.366
SLK-45	0.526 (0.499)	52.56%	0.497	0.247	0.753	0.591
SLK-46	0.649 (0.477)	64.87%	0.757	0.572	0.428	0.437
SLK-47	0.539 (0.499)	53.92%	0.563	0.317	0.683	0.343
SLK-48	0.363 (0.481)	36.31%	0.442	0.196	0.804	0.314
SLK-50	0.566 (0.496)	56.58%	0.421	0.177	0.823	0.575

Note. * Each correct (incorrect) response was coded “1” (“0”). ** Accuracy Rate = (Number of correct responses)/(Total responses, i.e., 4,486) *100%. All standardized factor loadings and R2 metrics were statistically significant at $p < .001$ (two-tailed).

Table 6. Correlations between SLK-SF-40 and the presently adopted external criterion scales

Correlations with the External Criterion Scales (and Subscales)			Z-Scores of Difference between r_s with SLK-SF-40 (36, 37):				
	(MITC)	r	MSC	LEF	IRI	IRI-EC	IRI-PT
1. RSLP	0.94 (0.46)	0.200***	-16.17***	4.83***	-16.92***	-14.15***	-10.09***
2. MSC	0.83 (0.44)	0.361***	—	15.11***	-6.25***	-4.31***	1.12
3. LEF	0.72 (0.25)	0.125***	—	—	-18.83***	-16.76***	-13.09***
4. IRI	0.74 (0.17)	0.438***	—	—	—	2.97**	12.91***
4a. IRI- EC	0.62 (0.19)	0.419***	—	—	—	—	5.64***
4b. IRI- PT	0.58 (0.19)	0.346***	—	—	—	—	—

Note. **p < .01 (two-tailed). ***p < .001 (two-tailed). MITC: Mean inter-item correlations. RSLP: Revised Servant Leadership Profile; MSC: Moral Self-Concept; LEF: Leadership Efficacy; IRI: Interpersonal Reactivity Index; IRI-EC: Subscale “Empathic Concern”; IRI-PT: Subscale “Perspective Taking.”

Discussion

The primary purpose of this study was to examine the factorial validity and convergent validity of the Service Leadership Knowledge Scale in a sample of Hong Kong undergraduates. Reliability analyses highlighted the excellent internal consistency amongst the 40 items which formed the SLK-SF-40. Consistent with our predictions, results of the CFA corroborated the unidimensionality of the SLK-SF-40, as both the goodness-of-fit indices and individual parameter estimates indicated that the proposed one-factor solution fits excellently with the data. Furthermore, the SLK-SF-40 correlated significantly and positively with all the external criterion scales. The SLK-SF-40 also correlated positively with the two other Service Leadership scales. Both these correlational findings offer convergent evidence for the SLK-SF-40, as instruments measuring i) the same underlying construct (i.e., SLB-SF-38 and SLA-SF-46) and ii) theoretically relevant constructs (i.e., IRI, MSC) all related consistently and positively to the SLK-SF-40. In summary, the present findings underscore the adequacy of SLK-SF-40 in measuring students’ knowledge in Service Leadership.

While the findings overall support the validity and reliability of the SLK-SF-40, there are observations worthy of attention. First, the effect sizes of the *Knowledge-Servant Leadership* correlation ($r=0.20$) and the *Knowledge-Efficacy* association ($r=0.13$) are noticeably smaller compared to that of the *Knowledge-Empathy* ($r=0.44$) and the *Knowledge-Moral Self-concept* ($r=0.36$) associations. These findings may reflect the differential coverage of the

constructs within the SLAM framework. As discussed above, *Moral character* constitutes the cornerstone of the SLAM framework (i.e., the “E = MC²” principle). Likewise, empathy is extensively covered as a fundamental attribute of *Caring Disposition* (38). *Servant Leadership* and *Leadership Efficacy*, by contrast, are not as central to the SLAM framework despite being two highly relevant constructs. In particular, the disregard of self-interest, which is a hallmark attribute in the *Servant Leadership* theory (39), is even at odds with a Core Belief of the SLAM framework (21).

Second, comparison of the correlational strengths underlined a discrepancy between the *Knowledge-Attitude* ($r = 0.34$) tie vis-à-vis the *Knowledge-Behavior* association ($r = 0.18$), implying that Service Leadership may be easier-said-than-done. However, as theorized in the Theory of Planned Behavior (TPB) (39), while *attitude* and perceived behavioral control (which involves *knowledge*) constitute two key contributors of behavioral intention (BI), BI is also determined by a perception of whether a particular behavior would lead to others’ approval (i.e., normative beliefs [NB]). In other words, although both *attitude* and *knowledge* are essential to the formation of intent to behave like a Service Leader, there is an additional element in NB (perception of whether acting as a Service Leader would be well-received by relevant others) to be taken into consideration. Hence, the current observed differential correlation strengths amongst knowledge, attitude, and behavior are actually in line with the TPB (39). This would be an interesting direction for future research.

Table 7. Correlations between SLK-SF-40 and other Service Leadership scales (and subscales) under validation

Correlations with Other Service Leadership Scales under Validation			Z-Scores of Difference between <i>r</i> s with SLK-SF-40 (36,37) ^a														
	α (MITC)	<i>r</i>	SLB-SF-38-F2	SLB-SF-38-F3	SLB-SF-38-F4	SLB-SF-38-F5	SLB-SF-38-F6	SLB-SF-38-Total	SLA-SF-46-F1	SLA-SF-46-F2	SLA-SF-46-F3	SLA-SF-46-F4	SLA-SF-46-F5	SLA-SF-46-F6	SLA-SF-46-F7	SLA-SF-46-F8	SLA-SF-46-Total
1.SLB-SF-38-F1	0.91 (0.53)	0.203***	-5.93	12.03	-0.20 ^{n.s.}	6.39	21.47	3.32	-7.57	-8.78	3.06	8.76	-11.35	-2.05	8.91	-10.53	-12.44
2.SLB-SF-38-F2	0.87 (0.42)	0.269***	—	16.39	5.56	10.44	26.85	11.54	-3.36	-5.08	8.01	13.51	-7.81	2.31	13.37	-7.42	-8.87
3.SLB-SF-38-F3	0.87 (0.50)	0.047**	—	—	-12.57	-5.26	9.64	-14.88	-16.03	-17.07	-6.42	-0.48 ^{n.s.}	-18.95	-10.93	0.53 ^{n.s.}	-17.40	-20.59
4.SLB-SF-38-F4	0.86 (0.55)	0.205***	—	—	—	6.06	20.81	2.92	-7.19	-8.71	3.18	8.77	-11.25	-1.82 ^{n.s.}	9.17	-10.59	-12.14
5.SLB-SF-38-F5	0.87 (0.56)	0.117***	—	—	—	—	13.36	-5.80	-12.20	-13.09	-2.22	3.35	-15.34	-7.05	4.06	-14.54	-16.32
6.SLB-SF-38-F6	0.85 (0.65)	-0.097***	—	—	—	—	—	-25.32	-23.05	-24.12	-15.34	-9.03	-25.78	-18.11	-7.35	-23.05	-28.03
7.SLB-SF-38-Total	0.96 (0.37)	0.178***	—	—	—	—	—	—	-9.59	-10.91	1.61 ^{n.s.}	7.67	-13.46	-3.74	7.92	-11.54	-15.12
8.SLA-SF-46-F1	0.90 (0.46)	0.315***	—	—	—	—	—	—	—	-2.35	12.83	18.20	-5.98	6.73	15.51	-4.97	-8.93
9.SLA-SF-46-F2	0.87 (0.47)	0.337***	—	—	—	—	—	—	—	—	14.30	18.90	-3.52	7.80	17.93	-3.96	-5.44
10.SLA-SF-46-F3	0.86 (0.47)	0.155***	—	—	—	—	—	—	—	—	—	8.28	-17.20	-5.85	7.01	-12.12	-24.59
11.SLA-SF-46-F4	0.85 (0.53)	0.055***	—	—	—	—	—	—	—	—	—	—	-21.46	-11.92	1.05 ^{n.s.}	-16.15	-27.97
12.SLA-SF-46-F5	0.83 (0.56)	0.373***	—	—	—	—	—	—	—	—	—	—	—	11.05	19.00	-2.09	-0.54 ^{n.s.}
13.SLA-SF-46-F6	0.82 (0.49)	0.235***	—	—	—	—	—	—	—	—	—	—	—	—	10.41	-8.53	-13.48
14.SLA-SF-46-F7	0.70 (0.54)	0.037***	—	—	—	—	—	—	—	—	—	—	—	—	—	-18.97	-22.18
15.SLA-SF-46-F8	0.79 (0.42)	0.411***	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1.92 ^{n.s.}
16.SLA-SF-46-Total	0.93 (0.28)	0.377***	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Note. . aUnless otherwise specified by the superscript “n.s.” which denotes statistical non-significance, all other Z-scores of difference were significant at $p < .05$ (two-tailed) (i.e., $|Z\text{-score}| > 1.96$). ** $p < .01$ (two-tailed). *** $p < .001$ (two-tailed). MITC: Mean inter-item correlations. SLB-SF-38-Total: Scale score of the six-factor, 38-item Service Leadership Behavior (SLB) Scale; SLA-SF-46-Total: Scale score of the eight-factor, 46-item Service Leadership Attitude (SLA) Scale; SLB-SF-38-F1: SLB Factor 1 “Self-improvement and self-reflection”; SLB-SF-38-F2: SLB Factor 2 “People and principles orientation”; SLB-SF-38-F3: SLB Factor 3 “Resilience”; SLB-SF-38-F4: SLB Factor 4 “Social competence”; SLB-SF-38-F5: SLB Factor 5 “Problem-solving”; SLB-SF-38-F6: SLB Factor 6 “Mentorship”; SLA-SF-46-F1: SLA Factor 1 “Vision and competence”; SLA-SF-46-F2: SLA Factor 2 “People orientation”; SLA-SF-46-F3: SLA Factor 3 “Caring disposition”; SLA-SF-46-F4: SLA Factor 4 “Ethical role model”; SLA-SF-46-F5: SLA Factor 5 “Social competence”; SLA-SF-46-F6: SLA Factor 6 “Self-understanding and reflection”; SLA-SF-46-F7: SLA Factor 7 “Positive view about human beings”; SLA-SF-46-F8: SLA Factor 8 “Unchangeable and dark human nature.”

As a continuation of the PolyU research team's effort, the current study marks the concluding step of the creation (plus validation) of the assessment tool aimed to measure people's understanding of Service Leadership. Specifically, the present paper came up with a much-shortened version of the knowledge scale (i.e., SLK-SF-40) which was demonstrated to be valid and reliable. Not only is a shorter survey easier to administer, crucially, meta-analytic review findings had also consistently pointed to how shorter questionnaires are linked to higher response rates and avoidance of low-quality data due to response burden (40,41). In response to Shek et al.'s (10) appeal to develop an assessment instrument which facilitates cross-institutional comparisons on students' understanding of the SLAM framework, alongside adding to the literature on systematic evaluation of Service Leadership education, the present study produced a refined, "participant-friendly," and most importantly, a psychometrically sound measurement tool in the SLK-SF-40.

All in all, in conjunction with the previous studies, there is a strong evidence base for the different versions of the Service Leadership Knowledge Scale. In future, more work could be done to further examine the criterion-related validity of the different versions of the scale. Besides, the relationship between Service Leadership knowledge and actual Service Leadership behavior deserves investigation using longitudinal research designs.

Acknowledgments

The validation project is financially supported by the Victor and William Fung Foundation. The preparation for this paper is supported by the Foundation and the Endowed Professorship in Service Leadership Education at The Hong Kong Polytechnic University.

Ethical compliance

The authors have stated all possible conflicts of interest within this work. The authors have stated all sources of funding for this work. If this work involved human participants, informed consent was received from each individual. If this work involved

human participants, it was conducted in accordance with the 1964 Declaration of Helsinki. If this work involved experiments with humans or animals, it was conducted in accordance with the related institutions' research ethics guidelines.

References

- [1] Shek DTL, Chung PPY, Leung H. Manufacturing economy vs. service economy: Implications for Service Leadership. *Int J Disabil Hum Dev* 2015;14:205-15.
- [2] Shek DTL, Leung H. Service Leadership qualities in university students through the lens of student well-being. In: Shek DTL, Chung PPY, eds. *Promoting Service Leadership qualities in university students: The case of Hong Kong*. Singapore: Springer, 2015:1-16.
- [3] Chung PPY, Elfassy R. *The 12 dimensions of a service leader*, 1st ed. New York: Lexingford, 2016.
- [4] Chung PPY. *Service reborn: The knowledge, skills, and attitudes of service companies*, 1st ed. New York: Lexingford, 2012.
- [5] Chung PPY. Where there is no vision, the people will perish. In: Shek DTL, Chung PPY, eds. *Promoting Service Leadership qualities in university students: The case of Hong Kong*. Singapore: Springer, 2015:xv-xviii.
- [6] Shek DTL, Yu L, Ma CMS, Sun RCF, Liu TT. Development of a credit-bearing Service Leadership subject for university students in Hong Kong. *Int J Adolesc Med Health* 2013;25:353-61.
- [7] Shek DTL, Chung PPY, eds. *Promoting Service Leadership qualities in university students: The case of Hong Kong*. Singapore: Springer, 2015.
- [8] Shek DTL, Lin L. Evaluating Service Leadership programs with multiple strategies. In: Shek DTL, Chung PPY, eds. *Promoting Service Leadership qualities in university students: The case of Hong Kong*. Singapore: Springer, 2015:197-211.
- [9] Shek DTL, Lin L. Validation of the Service Leadership Knowledge Scale: Criterion-related validity. In: Shek DTL, Chung PPY, Lin L, Merrick J, eds. *Service Leadership education for university students*. New York: Nova Science, 2017:189-204.
- [10] Shek DTL, Lin L, Leung H, Yu L, Ma CMS, Li X. Development and validation of the Service Leadership Knowledge Scale in a Chinese context. In: Shek DTL, Chung PPY, Lin L, Merrick J, eds. *Service Leadership education for university students*. New York: Nova Science, 2017:163-87.
- [11] DeMars CE. *Item response theory: Understanding statistics measurement*. New York: Oxford University Press, 2010.
- [12] Piedmont RL. Factorial validity. In: Michalos AC, ed. *Encyclopedia of Quality of Life and Well-being research*. Netherlands: Springer, 2014:2148-9.

- [13] Cohen RJ, Swerdlik ME. Psychological testing and assessment: An introduction to tests and measurement, 6th ed. New York: McGraw-Hill, 2005.
- [14] Goodwin CJ. Research in psychology: Methods and design, 6th ed. New York: Wiley, 2009.
- [15] Shek DTL, Chung PPY, Yu L, Merrick J, eds. Service Leadership education for university students: Experience of Hong Kong [Special issue]. *Int J Disabil Hum Dev* 2015;14:203-93.
- [16] Chung PPY, Bell AH. 25 principles of service leadership, 1st ed. New York: Lexington, 2015.
- [17] Wong PTP, Page D. *Servant Leadership: An opponent-process model and the Revised Servant Leadership Profile*. Virginia Beach, VA: Regent University, 2003.
- [18] Murphy SE. The contribution of leadership experience and self-efficacy to group performance under evaluation apprehension. Dissertation. Seattle: WA: University of Washington, 1992.
- [19] Chemers MM, Watson CB, May ST. Dispositional affect and leadership effectiveness: A comparison of self-esteem, optimism, and efficacy. *Pers Soc Psychol Bull* 2000;26:267-77.
- [20] Cheng CHK. *The Chinese Adolescent Self-Esteem Scales (CASES): A user manual*. Hong Kong: City University of Hong Kong Press, 2005.
- [21] Shek DTL, Lin L. Core beliefs in the service leadership model proposed by the Hong Kong Institute of Service Leadership and Management. *Int J Disabil Hum Dev* 2015;14:233-42.
- [22] Davis MH. Measuring individual differences in empathy: Evidence for a multidimensional approach. *J Pers Soc Psychol* 1983;44:113-26.
- [23] Albiero P, Ingoglia S, Lo Coco A. Contributo all'adattamento Italiano dell'Interpersonal Reactivity Index [A contribution to the Italian validation of the Interpersonal Reactivity Index]. *Test Psicom Methodol* 2006;13:107-25. [Italian]
- [24] Siu AMH, Shek DTL. Validation of the Interpersonal Reactivity Index in a Chinese context. *Res Soc Work* 2005;15:118-26.
- [25] Shamay-Tsoory SG, Aharon-Peretz J, Perry D. Two systems for empathy: A double dissociation between emotional and cognitive empathy in inferior frontal gyrus versus ventromedial prefrontal lesions. *Brain* 2009;132:617-27.
- [26] Shek DTL, Yu L. General university requirements and holistic development in university students in Hong Kong. *Int J Adolesc Med Health* 2017;29:41-8.
- [27] Muthén LK, Muthén BO. *Mplus user's guide*, 6th ed. Los Angeles, CA: Muthén Muthén, 2011.
- [28] Rodebaugh TL, Holaway RM, Heimberg RG. The factor structure and dimensional scoring of the Generalized Anxiety Disorder Questionnaire for DSM-IV. *Assessment* 2008;15:343-50.
- [29] Hu L-T, Bentler PM. Evaluating model fit. In: Hoyle RH, ed. *Structural equation modeling: Concepts, issues and applications*. Thousand Oaks, CA: Sage, 1995:76-99.
- [30] Hu L-T, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Struct Equ Modeling* 1999;6:1-55.
- [31] Kenny DA. Measuring model fit. 2015. URL: <http://davidakenny.net/cm/fit.htm>.
- [32] Templin J. *Confirmatory factor analysis: Introduction to structural equation modeling*. 2012. URL: https://jonthantemplin.com/files/sem/sem12ersh8750/sem12ersh8750_lecture05.pdf.
- [33] Yu CY. Evaluation of model fit indices for latent variable models with categorical and continuous outcomes. Dissertation. Los Angeles, CA: University of California, 2002.
- [34] Newsom JT. Practical approaches to dealing with non-normal and categorical variables. 2015. URL: https://pdfs.semanticscholar.org/d6f1/7c3bf7253376ac2e3098544ba18ba3c55dbd.pdf?_ga=2.137211449.804333835.1526630013-801728712.1526630013.
- [35] Beauducel A, Herzberg PY. On the performance of maximum likelihood versus means and variance adjusted weighted least squares estimation in CFA. *Struct Equ Modeling* 2006;13:186-203.
- [36] Diedenhofen B, Musch J. cocor: A comprehensive solution for the statistical comparison of correlations. *PLoS One* 2015;10:e0121945. doi:10.1371/journal.pone.0121945.
- [37] Steiger JH. Tests for comparing elements of a correlation matrix. *Psychol Bull* 1980;87:245-51.
- [38] Shek DTL, Li X. The role of a caring disposition in service leadership. *Int J Disabil Hum Dev* 2015;14:319-32.
- [39] Ajzen I. The theory of planned behavior. *Organ Behav Hum Decis Process* 1991;50:179-211.
- [40] Edwards P, Roberts I, Clarke M, DiGuseppi C, Pratap S, Wentz R, et al. Increasing response rates to postal questionnaires: Systematic review. *BMJ* 2002;324:1183-91.
- [41] Rolstad S, Adler JA, Rydén A. Response burden and questionnaire length: Is shorter better? A review and meta-analysis. *Value Health* 2011;14:1101-8.

Submitted: April 08, 2018. *Revised:* May 03, 2018.
Accepted: May 09, 2018.

Copyright of International Journal of Child & Adolescent Health is the property of Nova Science Publishers, Inc. and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.