

Using Parallel Analysis to Determine the Dimensionality of Students' Perspectives of Online Caring

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Abstract

There is a significant body of literature about online learning especially during COVID-19 pandemic. Caring is essential in nursing and in online nursing education. There are several nurse researchers who have studied online faculty behaviors that signal caring to nursing students. The instrument Student Perspectives of Online Caring (SPCO) was created by several leading nurse researchers whose research focuses on faculty caring behaviors. This paper used parallel analysis to determine the dimensionality of Perspectives of Faculty Caring among College of Nursing graduate students.

Parallel analysis using a SAS macro and option parallel in Proc Factor, was used to determine the dimensionality of the Perspectives of Faculty Caring. Exploratory factor analysis was conducted using maximum likelihood, squared multiple correlations, and Promax rotation. Parallel analysis using a SAS macro and option parallel in Proc Factor, was used to determine the dimensionality of the Perspectives of online Caring. Internal consistency reliability was assessed using Cronbach's alpha. Pearson's correlation assessed the association between factors and subscale items. Parallel analysis showed there are four or five meaningful underlying factors. All 24 items loaded positively on four different factors at 0.30 or above with factor loadings ranging from 0.34 to 0.84, except PERC5 which is not loaded high in any four factors. In addition, PERC23 is loaded in two factors. All 24 items loaded positively on five different factors at 0.30 or above with factor loadings ranging from 0.39 to 0.91. Parallel analysis is a valuable method for determining the dimensionality of the SPCO Scale.

Keywords: SAS, parallel analysis, exploratory factor analysis, psychometrics

Background

Caring is the essence of quality nursing practice, and thus caring behaviors are essential in online nursing education. Watson (1989), a prominent theorist on caring, wrote that nursing curricular design should reflect human caring in education and practice. Decades later, in 2017, Sitzman and Watson reflected on the current realities of our online learning environment and proposed that developing and then intentionally maintaining a priority focus on caring in course instruction from beginning to end is the key to having online learning environments that demonstrate and foster caring. The work of Kathleen Sitzman, a leading nurse researcher in caring and online nursing education, informed this study by identifying caring behaviors of nursing faculty in the online academic environment. In 2010, based on her previous research, Sitzman conducted a study asking students to prioritize faculty caring behaviors. The instrument that resulted is the Student Perspectives of Caring Online. This instrument includes 24 items in Likert scale from 1 being "not important" to 4 being "extremely important". The reliability coefficient of the instrument using Cronbach's alpha was .832²

Purpose

This study used parallel analysis to determine the dimensionality of Student Perspectives of Caring Online among College of Nursing graduate students.

Methodology

This study used the data from a sample of 141 College of Nursing graduate students' online program. This parent study aimed 1) to describe how graduate nursing students at one large university in the Southeastern part of the United States prioritized faculty behaviors that are perceived as caring in the online learning environment and 2) to identify any significant differences in perspectives related to student demographics. Inclusion criteria for the parent study were all graduate students in one college of Nursing in the Southeastern region enrolled in online nursing courses. In addition to the SPCO survey questions, student demographic information was also collected which included gender, age, ethnicity, employment, comfort level with technology, number of online courses taken, and the name of the student's graduate program and track. The survey was set up in Class Climate software and sent to all Graduate students. Factor dimensionality was assessed through parallel analysis. Parallel analysis has been demonstrated to determine factor dimensionality than the traditional Kuder-Richardson more accurately. Parallel analysis produces correlation matrices from a randomly chosen simulated dataset that has a similar number of observations as the original dataset.³ The observations in the simulated dataset have the same sampling error as observations in the original dataset.³ Eigenvalues were computed for both the simulated and original

data and compared to determine the point at which the eigenvalue in the simulated dataset was higher than in the original dataset. The number of factors before this transition point denoted the number of factors that were retained. A scree plot was also created to compare eigenvalues from simulated and original datasets to corroborate our determination of the number of factors to retain.

Data Analysis

Exploratory factor analysis was conducted using squared multiple correlations and prior communality estimates. Maximum likelihood (ML) estimation was used to extract factors followed by Promax (oblique) rotation. First, parallel analysis using a SAS macro and option parallel in Proc Factor, was used to determine the dimensionality of the Student Perspectives of Online Caring.^{4,5} Second, the Scree plot, eigenvalues, and proportion of eigenvalues were examined. An eigenvalue greater than one determined if a factor was retained in the factor structure. Third, a series of factor rotations were examined. Results of both varimax and promax rotation methods indicated an optimal factor structure of three factors. When interpreting the rotated factor pattern, an item was determined to load on a given factor if the factor loading was 0.40 or greater for that factor and was less than 0.40 for other factors.⁴ internal consistency reliability was assessed using Cronbach's alpha for the total scale and each of the three subscales. Pearson's correlation assessed the associations between factors and subscale items. PROC MEAN and PROC FREQ were used to conduct descriptive statistics. PROC CORR and PROC FACTOR were used to conduct exploratory factor analysis, compute Cronbach's alpha, and estimate correlations. We used the SAS[®] macro, %parallel, and parallel option in Proc Factor to determine the dimensionality of the SPCO among Nursing graduate online program. All data analyses were performed using SAS/STAT[®] statistical software, version 9.4.⁶

Results

Table1 displays the frequency distribution of item 1 for the SPCO, which indicates that about 86% of participants Extremely important that responds to postings and e-mails within 24-48 hours.

Table 1. Frequency distribution of item 1 of the SPCO

Responds to postings and e-mails within 24-48 hours.				
perc1	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Somewhat important	2	1.42	2	1.42
Moderately important	18	12.77	20	14.18
Extremely important	121	85.82	141	100.00

Table 2 presents the frequency and percentage of missing values for each item in the SPCO. Missing values ranged from 0 percent to 0.021 percent for SPCO items.

Table 2. Frequency and percentage of missing values for SPCO (N=141)

Items	N	%
Perc9	1	0.007
Perc10	2	0.014
Perc11	1	0.007
Perc12	1	0.007
Perc13	2	0.014
Perc18	1	0.007
Perc21	1	0.007
Perc24	3	0.021

Table 3 report frequency, means, and standard deviation of SPCO items. The mean ranged from 2.2 (PERC17) to 3.96 (PERC6).

Table 3. Frequency, means, and standard deviation for SPCO items.

Variables	n	mean	SD	min	max
1. Responds to postings and e-mails within 24-48 hours.	141	3.84	0.40	2.00	4.00
2. Responds to postings and e-mails on weekends.	141	2.91	0.95	1.00	4.00

Variables	n	mean	SD	min	max
3. Mindfully addresses student challenges as soon as they become evident, for example if a student has not been online for a week, calls to find out why and offers support help the student get back on track.	139	2.79	1.01	1.00	4.00
4. Recounts challenges experienced in the online classroom setting and shares remedies that have worked for self and other students.	141	3.20	0.79	1.00	4.00
5. Expresses the belief that students will be successful in the online setting.	141	3.30	0.83	1.00	4.00
6. Writes out and posts clear instructions regarding schedules and due dates.	141	3.96	0.24	2.00	4.00
7. Provides students with a detailed class calendar that includes all due dates for postings, papers, and projects.	141	3.93	0.35	1.00	4.00
8. Writes out and posts clear instructions regarding acceptable social behavior in the online classroom.	141	3.01	0.94	1.00	4.00
9. Writes out and posts clear instructions regarding acceptable length/quality of required online communications (postings, papers, projects, e-mails etc.)	140	3.71	0.59	1.00	4.00
10. Provides students with the opportunity for face-to-face meetings at the beginning of the semester if possible.	139	2.48	1.05	1.00	4.00
11. If face-to-face meetings are not possible, arranges for a web camera exchange between individual students and instructor so that each student has a chance to “see” and interact with the instructor in real time.	140	2.61	1.00	1.00	4.00
12. Provides scheduled telephone availability so that students know when the instructor will be available to speak to them.	140	2.94	0.94	1.00	4.00
13. Provides an e-mail address outside the course homepage.	140	2.62	1.10	1.00	4.00
14. Provides students with a discussion board thread dedicated to student questions and concerns only.	141	3.51	0.63	2.00	4.00
15. Provides virtual office hours with scheduled chats.	139	2.88	0.89	1.00	4.00
16. Posts a casual (conversational) personal introduction via the online posting forum in the first week or two of class.	141	2.82	0.91	1.00	4.00
17. Shares informal glimpses of self by posting fun/personal photographs.	141	2.20	0.97	1.00	4.00
18. Discusses hobbies or extracurricular interests.	140	2.04	0.94	1.00	4.00
19. Discusses past scholarly work and professional experiences.	141	2.79	0.84	1.00	4.00
20. Provides (at minimum) weekly praise and encouragement to individuals and/or groups for work that is well done.	141	2.70	0.92	1.00	4.00
21. Provides supportive/corrective guidance to individual students via personal e-mail or telephone rather than in any public venue i.e. chat or postings.	140	3.23	0.88	1.00	4.00
22. When responding to student work, refers to specifics so that students know their work has been thoroughly read.	141	3.48	0.66	1.00	4.00
23. Verbalizes enthusiasm for learning.	141	3.21	0.80	1.00	4.00
24. Demonstrates respect for the learning process by exhibiting excellence in creating/presenting online content.	138	3.49	0.66	2.00	4.00

Note. Items range from 1 to 4.

Figure 1 shows the plot of parallel analysis using macro which suggested four or five underlying dimensions.

Figure1. Parallel analysis plot of Eigenvalues using Macro

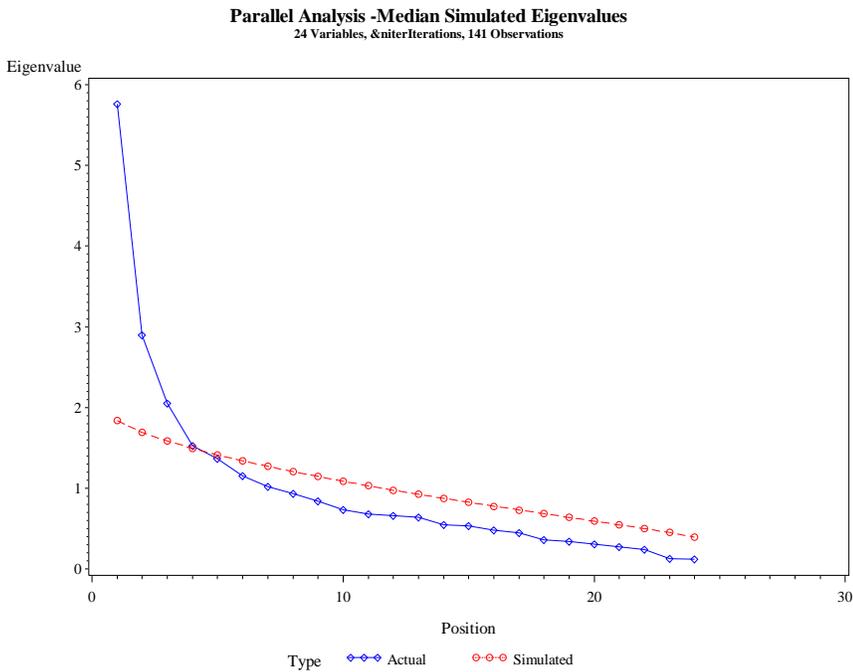


Figure 2 shows the plot of parallel analysis using parallel option in Proc Factor which suggested four or five underlying dimensions. The plot from Macro is a little different from Proc Factor.

Figure 2. Parallel analysis plot of Eigenvalues using parallel option in Proc Factor

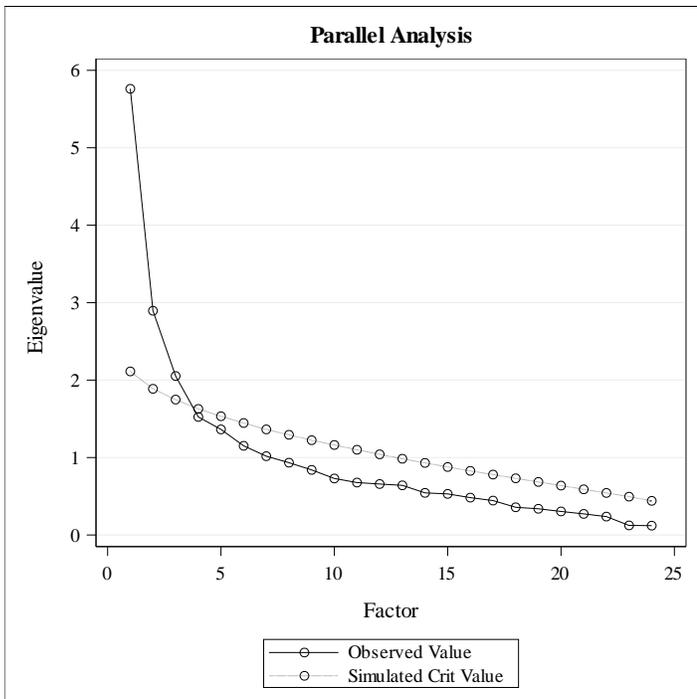


Table 4 reports eigenvalues for the SPCO scale. Eight eigenvalues are above 1. Fifty-one and 57% of the variance were explained by these four and five factors: respectively.

Table 4. Part of Eigenvalues for SPCO

Eigenvalues of the Correlation Matrix: Total = 24 Average = 1				
	Eigenvalue	Difference	Proportion	Cumulative
1	5.76119193	2.86594019	0.2400	0.2400
2	2.89525174	0.84288277	0.1206	0.3607
3	2.05236897	0.52794328	0.0855	0.4462
4	1.52442569	0.16113433	0.0635	0.5097
5	1.36329136	0.21193521	0.0568	0.5665
6	1.15135616	0.13394268	0.0480	0.6145
7	1.01741348	0.08400498	0.0424	0.6569
8	0.93340850	0.09299932	0.0389	0.6958
9	0.84040918	0.11085148	0.0350	0.7308
10	0.72955770	0.05256264	0.0304	0.7612
11	0.67699506	0.01886493	0.0282	0.7894
12	0.65813013	0.01707164	0.0274	0.8168

Figure 2 displays the scree plot of eigenvalues for the SPCO scale, which revealed that 4 or 5 factors are meaningful.

Figure 2: Scree Plot of Eigenvalues for SPCO Scale

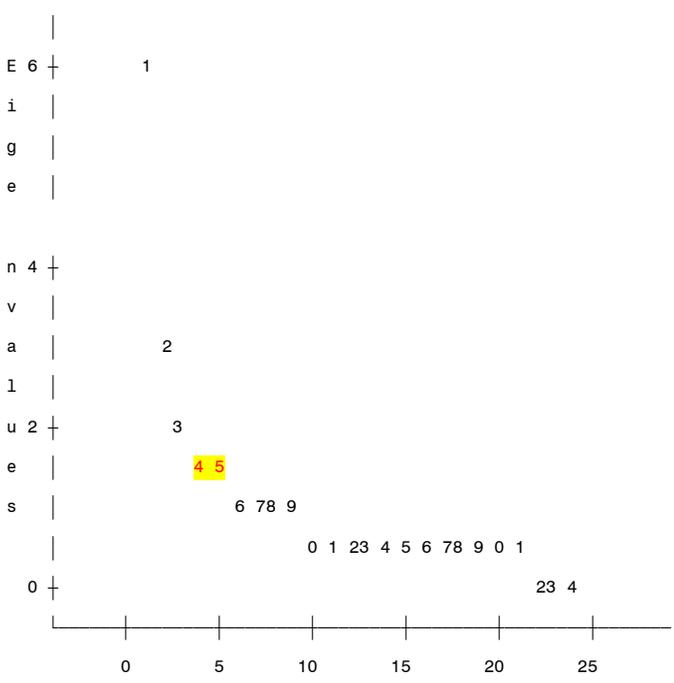


Table 5 and 6 reports the Rotated Factor Pattern (Standardized Regression Coefficients) for the PERC. Parallel analysis showed there are four or five meaningful underlying factors. Eigenvalues and the proportion of variance explained by each factor also suggested four to six meaningful factors for the 24-item scale. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy is 0.76, which is acceptable. The residuals are all small and the overall RMSR is 0.07, indicating that the factor structure explains most of the correlations.⁷ All 24 items loaded positively on four different factors at 0.30 or above with factor loadings ranging from 0.34 to 0.84, except PERC5 which is not loaded high in any four factors. In addition, PERC23 is loaded in two factors. Eight items loaded on Factor 1, six on Factor 2, and five on Factor 3 and 4. All 24 items loaded positively on five different factors at 0.30 or above with factor loadings ranging from 0.39 to 0.91. Five items loaded on Factor 1 and 4, six on Factor 2, and four on Factor 3 and 4.

Table 5. Rotated Factor Pattern (Standardized Regression Coefficients) for the SPCO Scale (four factors)

Items	Factor1	Factor2	Factor3	Factor4
perc19	85	-17	8	1
perc17	84	7	-11	-10
perc18	82	1	-7	-12
perc16	69	8	-2	9
perc20	57	7	30	1
perc23	49	-7	48	-6
perc13	37	25	0	22
perc14	37	-1	-1	33
perc11	1	90	-5	-12
perc10	-5	87	-2	-8
perc12	2	72	18	-15
perc15	3	66	1	7
perc3	-12	53	17	26
perc8	19	49	-21	39
perc22	-11	12	73	-1
perc24	24	-8	72	2
perc1	-10	-8	62	14
perc21	4	26	53	-13
perc5	16	21	28	19
perc9	15	8	-15	74
perc7	-3	-16	2	73
perc6	-10	-16	33	49
perc2	-12	12	11	43
perc4	-4	35	32	34

Note: Root Mean Square Residual (RMSR) = 0.07.

Kaiser's Measure of Sampling Adequacy = 0.76.

Item 23 loaded in two factors and item 5 did not load any factors

Table 6. Rotated Factor Pattern (Standardized Regression Coefficients) for the SPCO Scale (five factors)

Items	Factor1	Factor2	Factor3	Factor4	Factor5
perc17	91	12	-6	-13	1
perc18	89	6	-1	-15	1
perc19	78	-17	5	21	-2
perc16	61	6	-5	25	2
perc20	61	10	32	0	10
perc11	8	90	-2	-6	-10
perc10	4	88	3	-12	-2
perc12	3	70	19	5	-15
perc15	4	64	2	7	5
perc3	-19	48	12	28	15
perc8	8	42	-26	38	22
perc22	-6	14	73	-3	9
perc1	-1	-4	64	-13	29
perc24	9	-14	62	42	-8
perc21	9	28	54	-4	-5
perc23	33	-12	39	41	-17
perc5	-12	8	12	73	-11
perc14	12	-11	-14	64	6
perc4	-18	27	23	46	18
perc13	24	19	-6	39	7
perc7	1	-14	4	1	78
perc9	12	6	-16	21	68
perc6	3	-10	38	-18	65
perc2	-7	13	13	-1	47

Note: Root Mean Square Residual (RMSR) = 0.06.
 Kaiser's Measure of Sampling Adequacy = 0.76.

Table 7 and 8 reports means, standard deviations, minimums, and maximums of total scale and subscales of the PERC for four and five factors. The results showed the average of the total scale, and each subscale were 66.84, 18.65, 16.56, 14.95, and 17.68 for four factors: respectively. The results indicated the average of the total scale, and each subscale were 73.35, 12.53, 16.56, 13.95, 15.83, and 14.48 for five factors: respectively.

Table 7: Frequency, Mean, and Standard Deviation for total scale and subscales of the SPCO (Four factors n=141)

Factors	mean	std	min	max
perspective / FACTOR1 / four factor	18.65	4.33	10.00	28.00
perspective / FACTOR2 / four factor	16.56	4.27	5.00	24.00
perspective / FACTOR3 / four factor	13.95	1.98	7.00	16.00
perspective / FACTOR4 / four factor	17.68	1.95	8.00	20.00
total score for perspective / four factors	66.84	8.90	45.00	88.00

Table 8: Frequency, Mean, and Standard Deviation for total scale and subscales of the SPCO (Five factors n=141)

Factors	mean	std	min	max
perspective / FACTOR1 / five factor	12.53	3.60	5.00	20.00
perspective / FACTOR2 / five factor	16.56	4.27	5.00	24.00
perspective / FACTOR3 / five factor	13.95	1.98	7.00	16.00
perspective / FACTOR4 / five factor	15.83	2.68	8.00	20.00
perspective / FACTOR5 / five factor	14.48	1.49	7.00	16.00
total score for perspective / five factors	73.35	9.64	50.00	96.00

Table 9 and 10 reports Pearson correlations for the total scale and four/five subscales of the SPCO. There was a weak positive correlation between four factors range from .14 to .39 for four factors. A positive correlation was found between factors and the total subscale ranging from .55 to .81 for four factors. Scale reliability in this study was examined by estimating the Cronbach's alpha. The reliability coefficient for total scale was 0.81. The Cronbach's alpha for the subscales ranged from 0.65 to 0.82. There was a very weak to moderate positive correlation between five factors range from .02 to .51 for five factors. A positive correlation was found between factors and the total subscale ranging from .42 to .79 for five factors. Scale reliability in this study was examined by estimating the Cronbach's alpha. The reliability coefficient for total scale was 0.85. The Cronbach's alpha for the subscales ranged from 0.62 to 0.85.

Table 8: Pearson correlation and Cronbach's alpha for total scale and subscales PERC (four factors)

Pearson Correlation Coefficients, N = 141 Prob > r under H0: Rho=0					
	bfact1	bfact2	bfact3	bfact4	tbfact4
bfact1 perspective / FACTOR1 / four factor	0.81	0.34582 <.0001	0.25415 0.0024	0.14213 0.0927	0.74038 <.0001
bfact2 perspective / FACTOR2 / four factor		0.82	0.33771 <.0001	0.38913 <.0001	0.80843 <.0001
bfact3 perspective / FACTOR3 / four factor			0.68	0.35225 <.0001	0.58583 <.0001
bfact4 perspective / FACTOR4 / four factor				0.65	0.55358 <.0001
tbfact4 total score for perspective / four factors					0.84

Note: Cronbach's alphas are in the diagonal.

Table 9: Pearson correlation and Cronbach's alpha for total scale and subscales SPCO (five factors)

Pearson Correlation Coefficients, N = 141 Prob > r under H0: Rho=0						
	cfact1	cfact2	cfact3	cfact4	cfact5	Tcfact5
cfact1 perspective / FACTOR1 / five factor	0.85	0.27363 0.0010	0.21390 0.0109	0.39154 <.0001	0.01575 0.8530	0.64963 <.0001
cfact2 perspective / FACTOR2 / five factor		0.82	0.33771 <.0001	0.50448 <.0001	0.25712 0.0021	0.79404 <.0001
cfact3 perspective / FACTOR3 / five factor			0.68	0.42567 <.0001	0.28596 0.0006	0.59754 <.0001
cfact4 perspective / FACTOR4 / five factor				0.63	0.31916 0.0001	0.78430 <.0001
cfact5 perspective / FACTOR5 / five factor					0.62	0.42184 <.0001
Tcfact5 total score for perspective / five factors						0.85

Note: Cronbach's alphas are in the diagonal.

Conclusion

We used the SAS® macro, %parallel, and parallel option in Proc Factor to determine the dimensionality of the SPCO among Nursing graduate online program. Parallel analysis indicated four or five factors were the optimal solution for SPCO. All loading from rotated factor pattern (standardized regression coefficient) were positive for 24 items with factor loadings ranging from 0.32 to 0.94. All 24 items loaded positively on four different factors at 0.30 or above with factor loadings ranging from 0.34 to 0.84, except PERC5 which is not loaded high in any four factors. In addition, PERC23 is loaded in two factors. Eight items loaded on Factor 1, six on Factor 2, and five on Factor 3 and 4. All 24 items loaded positively on five different factors at 0.30 or above with factor loadings ranging from 0.39 to 0.91. Five items loaded on Factor 1 and 4, six on Factor 2, and four on Factor 3 and 4. There was a weak positive correlation between four factors range from .14 to .39 for four factors. The Cronbach's alpha for the subscales for four factors ranged from 0.65 to 0.82. There was a very weak to moderate positive correlation between five factors range from .02 to .51 for five factors. The Cronbach's alpha for the subscales for five factors ranged from 0.62 to 0.85. Parallel analysis is a valuable method for determining the dimensionality of the SPCO Scale.

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SAS Syntax

Part of Data steps:

```
data two; set one;
bfact1 = sum (of perc13 perc14 perc16 perc17 perc18 perc19 perc20 );
bfact2 = sum (of perc3 perc8 perc10 perc11 perc12 perc15 );
bfact3 = sum (of perc1 perc21 perc22 PERC24);
bfact4 = sum (of perc2 perc4 perc6 perc7 perc9);
tbfact4 = sum (of perc1 perc2 perc3 perc4 perc6 perc7 perc8 perc9 perc10
perc11 perc12 perc13 PERC14 perc15 perc16 perc17 perc18 perc19 perc20
perc21 perc22 perc24);
cfact1 = sum (of perc16 perc17 perc18 perc19 perc20 );
cfact2 = sum (of perc3 perc8 perc10 perc11 perc12 perc15);
cfact3 = sum (of perc1 perc21 perc22 PERC24);
cfact4 = sum (of perc4 perc5 perc13 perc14 perc23 );
cfact5 = sum (of perc2 perc6 perc7 perc9 );
Tcfact5 = sum (of perc1-perc24);
```

```
label
tbfact4="total score for perspectives / four factors"
tcfact5="total score for perspectives / five factors"
bFACT1="perspectives / FACTOR1 / four factor"
bFACT2="perspectives / FACTOR2 / four factor"
bFACT3="perspectives / FACTOR3 / four factor"
bFACT4="perspectives / FACTOR4 / four factor"
cFACT1="perspectives / FACTOR1 / five factor"
cFACT2="perspectives / FACTOR2 / five factor"
cFACT3="perspectives / FACTOR3 / five factor"
cFACT4="perspectives / FACTOR4 / five factor"
cFACT5="perspectives / FACTOR5 / five factor"
;
```

Procedures:

Parallel analysis Macro⁹:

```
ods rtf; ods listing close;
```

```

%macro parallel(data=_LAST_, var=_NUMERIC_,
niter=1000, statistic=Median);
data _temp; set &data; keep &var; run;
/* obtain number of observations and variables in dataset */
ods output Attributes=Params;
ods listing close;
proc contents data=_temp ; run;
ods listing;

data _NULL_ ; set Params;
if Label2 eq 'Observations' then call
symput('Nobs',Trim(Left(nValue2)));
else if Label2 eq 'Variables' then call
symput('NVar',Trim(Left(nValue2))); run;

/* obtain eigenvalues for actual data */
proc factor data=_temp nfact=&nvar noprint
outstat=E1(where=( _TYPE_ = 'EIGENVAL'));
var &var; run; data E1; set E1; array A1{&nvar} &var;
array A2{&nvar} X1-X&nvar;
do J = 1 to &nvar; A2{J} = A1{J}; end;
keep X1-X&nvar; run;

/* generate simulated datasets and obtain eigenvalues */
%DO K = 1 %TO &niter;
data raw;
array X {&nvar} X1-X&nvar; keep X1-X&nvar;
do N = 1 to &nobs; do I = 1 to &nvar; X{I} = rannor(-1); end; output; end; run;
proc factor data=raw nfact=&nvar noprint
outstat=E(where=( _TYPE_ ='EIGENVAL')); var X1-X&nvar;
proc append base=Eigen
data=E(keep=X1-X&nvar); run; %END;

/* summarize eigenvalues for simulated datasets */
proc means data=Eigen noprint;
var X1-X&nvar; output out=Simulated(keep=X1-X&nvar) &statistic=;
proc datasets nolist; delete Eigen;
proc transpose data=E1 out=E1; run;
proc transpose data=Simulated out=Simulated; run;

/* plot actual vs. simulated eigenvalues */
data plotdata; length Type $ 9; Position+1;
if Position eq (&nvar + 1) then Position = 1;
set E1(IN=A) Simulated(IN=B);
if A then Type = 'Actual'; if B then Type = 'Simulated';
rename Col1 = Eigenvalue; run;
title height=1.5 "Parallel Analysis - &statistic Simulated Eigenvalues";
title2 height=1 "&nvar Variables, &niter Iterations, &nobs Observations";
proc print data = plotdata ; run;
symbol1 interpol = join value=diamond height=1 line=1 color=blue;
symbol2 interpol = join value=circle height=1 line=3 color=red ;
proc gplot data = plotdata;
plot Eigenvalue * Position = Type; run;quit;
%mend parallel; run;
%parallel(data=two, var=perc1-perc24, niter=1000,
statistic=Median);
ods rtf close; ods listing; quit; run;

```

Other Procedures:

```
ods rtf; ods listing close;
```

```
%macro fact (q,n,t);
```

```

proc factor data=two rotate=promax scree reorder msa residual
parallel(alpha=0.01 nsims=10000 seed=20170229) map flag=.35 nfact=&n msa
plots=(parallel map);
var &q ;
title ' Parallel analysis ' &t;
%mend fact;
%fact (perc1-perc24,4, four factor Perceived );
%fact (perc1-perc24,5, Five factor Perceived );
run;
ods rtf close; ods listing; quit; run;

ods rtf; ods listing close;
%macro corr (q,t);

proc corr data=two pearson spearman ;
var &q;
TITLE1 'correlation'&t; run;
%mend corr;
%corr (bfact1 bfact2 bfact3 bfact4 tbfact4, four factors );
%corr (cfact1 cfact2 cfact3 cfact4 cfact5 tcfact5, five factors );
run;
ods rtf close; ods listing; quit; run;

ods rtf; ods listing close;
%macro corr (q,t);
proc corr nocorr alpha nomiss data=two;
var &q;
title ' Reliability coefficient'&t;
%mend corr;
%corr ( perc1 perc2 perc3 perc4 perc6 perc7 perc8 perc9 perc10 perc11 perc12 perc13 PERC14 perc15 perc16 perc17
perc18 perc19 perc20 perc21 perc22 perc24,total four factor);
%corr ( perc13 perc14 perc16 perc17 perc18 perc19 perc20 , four factor);
%corr ( perc3 perc8 perc10 perc11 perc12 perc15, four factor);
%corr ( perc1 perc21 perc22 PERC24, four factor);
%corr ( perc2 perc4 perc6 perc7 perc9 , four factor);
%corr ( perc1-perc24, total five factor);
%corr ( perc16 perc17 perc18 perc19 perc20, five factor );
%corr ( perc3 perc8 perc10 perc11 perc12 perc15, five factor );
%corr ( perc1 perc21 perc22 PERC24, five factor );
%corr ( perc4 perc5 perc13 perc14 perc23, five factor );
%corr ( perc2 perc6 perc7 perc9, five factor );
run;
ods rtf close; ods listing; quit; run;

```