Confirmatory Factor Analysis of the BCSSE Scales

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INTRODUCTION

The Beginning College Survey of Student Engagement (BCSSE, pronounced “bessie”) measures entering first-year students’ high school academic and co-curricular experiences as well as their expectations for participating in educationally purposeful activities during the first year of college. BCSSE administration takes place prior to the start of fall classes and is designed to be paired with the administration of the National Survey of Student Engagement (NSSE, pronounced “Nessie”) in the spring. BCSSE results can aid the design of orientation programs, student service initiatives, and other programmatic efforts aimed at improving the learning experiences of first-year students. Since its launch in 2007, more than 430,000 first-year students at 373 higher education institutions across the US and Canada have completed the BCSSE survey.

BCSSE was updated in 2013 to align with the updated version of NSSE. The new version maintains BCSSE’s focus on gathering information from entering first-year students regarding their high school experiences and their expectations for engagement during their first year in college. It also includes new items to increase alignment with NSSE, improved clarity and applicability of survey language, and refinements of existing measures. The revision also included new items and scales. The BCSSE scales (nine altogether) are called BCSSE Scales. One of the goals during the revision process was to assure that these scales have strong psychometric properties. Much of the development work was completed during the NSSE update process and included extensive student cognitive interviews, literature reviews, expert consultations, pilot testing, statistical analysis of pilot data, and interviews with administrators responsible for use of the BCSSE data on their campuses. Information regarding the NSSE and BCSSE update process can be found at nsse.iu.edu.

These nine scales include two that refer to the students’ academic engagement in high school quantitative reasoning and learning strategies. Three of the scales include students’ first year expectations to engage in collaborative learning with other students, interactions with faculty, and interactions with a diverse student body. The other four scales ask students to report on their expected academic perseverance, expected academic difficulty, perceived academic preparation, and importance of the campus to support their academic efforts. Years of prior research and student development theory provide evidence for the importance of these scales for first-year student success (Pascarella, & Terenzini, 2005; Upcraft, Gardner, Barefoot, & Associates, 2005)

Two statistical techniques were used to examine the psychometric properties of the BCSSE Scales. First, item- and scale-level descriptive statistics were computed to show response patterns, measures of central tendency, and data distribution (e.g., skewness). The second technique used confirmatory factor analysis (CFA) to examine the construct validity for the scales. Acceptable construct validity indicates that the data adequately represent the constructs being

investigated and allows researchers to make valid inferences and use of the data (Brown, 2006; Messick, 1995).

METHOD

Data Source and Characteristics

This report used data from the 2013 administration of BCSSE. A total of 71,413 entering first-year students enrolled at 120 institutions across the United States (and one in Canada), completed BCSSE during summer/early fall of 2013. Approximately 47% of these students were first-generation college students and 59% were female. Regarding the students' race/ethnicity, 3% identified as American Indian/Alaskan Native, 8% as Asian, 13% as Black/African American, 9% as Hispanic, 74% as White, and 2% as other (percentages sum to more than 100% because students could select more than one category). Of the 120 participating institutions, 35% were public and 65% private, with 45% classified as baccalaureate level, 43% masters, and 12% doctoral.

BCSSE Scales

A total of 42 items were categorized into nine BCSSE Scales (Table 1). The total number of items in each scale ranged from 3 to 7 (see Appendix A for complete list of items). Scale values ranged from 0 to 60. These scales were developed using exploratory and confirmatory factor analysis from pilot data from NSSE (2011-2012) and during the initial pilot testing of BCSSE (2004-2006).

Table 1. BCSSE Scales

High School Quantitative Reasoning (HS_QR)
High School Learning Strategies (HS_LS)
Expected Collaborative Learning (EXP_CL)
Expected Student-Faculty Interaction (EXP_SFI)
Expected Interactions with Diverse Others (EXP_DD)
Expected Academic Perseverance (EXP_PER)
Expected Academic Difficulty (EXP_DIF)
Perceived Academic Preparation (EXP_PREP)
Importance of Campus Environment (EXP_CAMP)

Analytic Approach

This study used descriptive, reliability, and confirmatory factor analyses. The descriptive analysis includes item- and scale-level means, standard deviations, standard error of the means, skewness, kurtosis, and an inter-item correlation matrix. Given that the survey items use a vague response set (e.g., “often”) and that these items are similar to Likert items, polychoric correlations were used so to not underestimate the degree of association between observed variables (Saris, Van Wijk, & Scherpenzeel, 1998; Olsson, 1979). Similar to Pearson’s correlations, polychoric correlations range from zero to 1. Polychoric correlations were calculated using the R package *polycor*.

Reliability analysis was performed for each BCSSE Scale. Given that the item-level data used to create the BCSSE Scale can be treated as ordinal or interval data, Cronbach’s alphas were calculated based on the Pearson’s correlations, whereas the ordinal alphas were calculated based on polychoric correlations. Though polychoric correlations are preferred when using ordinal data, Pearson’s correlations are preferred when using interval data (Gadermann, Guhn, & Zumbo, 2012). The Ordinal alpha were calculated using the R package *psych* with the polychoric correlation matrix as input data. SPSS (v21) was used to calculate the Cronbach’s alphas.

The confirmatory factor analyses (CFA) were carried out for each BCSSE Scale in a separate model and again with the scales together in a single model (the overall model). In the overall model, BCSSE Scales were allowed to correlate with each other. Holgado–Tello, Chacón–Moscoso, Barbero–García, and Vila–Abad (2010) reported in their simulation study that when dealing with ordinal data, CFA based on polychoric correlations provided more accurate reproduction of the underlying theoretical model than CFA based on Pearson correlations. Further, studies have shown that the usual Maximum Likelihood (ML) estimation method of CFA is not suitable when the polychoric correlation matrix is used as input and will produce biased test statistics and standard error estimates (Babakus, Ferguson Jr, & Jöreskog, 1987; Dolan, 1994; Rigdon, & Ferguson, 1991). In this situation, the robust weighted least squares (WLS) estimation method is often recommended for CFA with ordinal data since it can yield asymptotically efficient parameter estimates and correct standard errors (Flora, & Curran, 2004; Muthén, & Muthén, 1998). For this study, CFA models were fitted to the polychoric correlation matrix using the robust WLS method. Mplus 6 was used for model fitting (Muthén & Muthén, 1998).

Each CFA model was evaluated according to four fit indices: the Chi-square statistic and degrees of freedom, the Root Mean Square Error Approximate (RMSEA), the Tucker-Lewis Index (TLI), and the Comparative Fit Index (CFI). Those four indices are recommended for use by Jackson, Gillaspy, and Purc-Stephenson (2009). According to Browne and

Cudeck(1993), when RMSEA is smaller than .08, and TLI/CFI above .90, the model is regarded as an acceptable fit. When RMSEA is smaller than .05 and TLI/CFI greater than .94, the model is regarded as a good fit. A measurement model with independent residual terms was first fitted to each BCSSE Scale. If the model fit was not acceptable, residual terms were allowed to be correlated according to the modification index and the substantive meaning of the items. Model modification stopped when the fit index reached acceptable range or when degrees of freedom were no longer available.

RESULTS

Descriptive Analysis

Of the 42 items, 18 have response ranges from 1 to 4. These 18 items comprise the following BCSSE Scales: HS_QR, HS_LS, EXP_CL, EXP_SFI, and EXP_DD. The means for these items ranged from 2.4 (skewness=.18) to 3.3 (skewness=-.64). The response categories for the other 24 items that comprise the scales EXP_PER, EXP_DIF, EXP_PREP, and EXP_CAMP ranged from 1 to 6. The means for these items ranged from 2.7 (skewness=.48) to 5.4 (skewness=-1.51). Appendix B includes the descriptive statistics for all 42 items. Descriptive analyses for each scale are presented in Table 2.

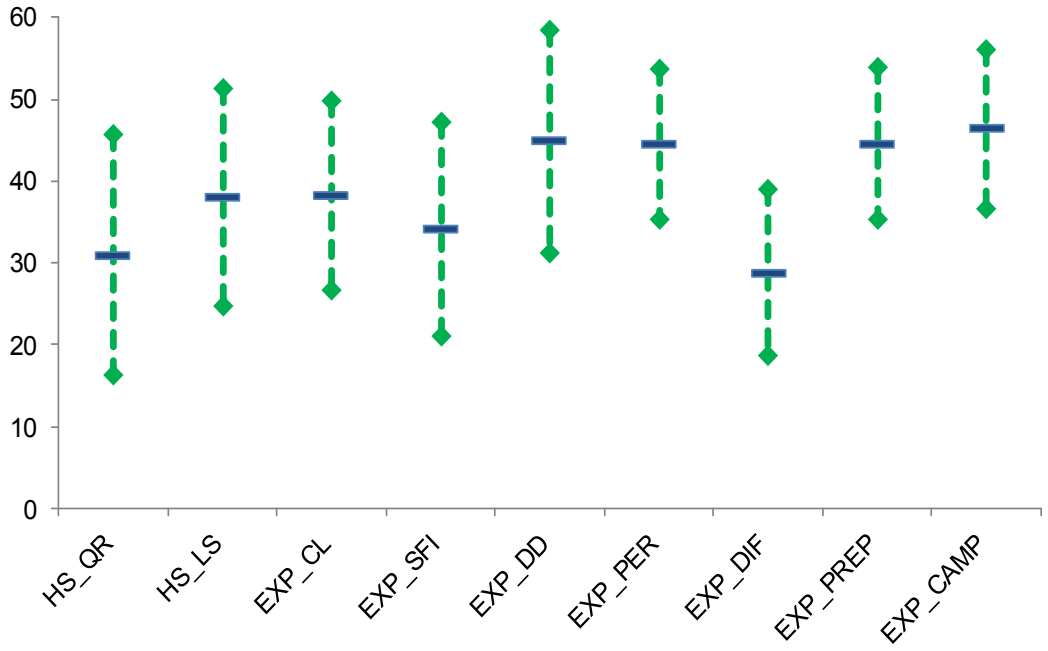
Scales HS_QR, HS_LS, EXP_CL, EXP_SFI, and EXP_DIF all have means within 10 points of the mid-point 30. Though the other four (EXP_DD, EXP_PER, EXP_PREP, and EXP_CAMP) all have means that are skewed more than 10 points beyond the scale mid-point, three of them (EXP_PER, EXP_PREP, and EXP_CAMP) have the smallest standard deviations. The scale EXP_DD has the highest mean (44.9) and second largest standard deviation. Overall, these scales have adequate distributional properties with the possible exception of EXP_DD, which tends to be skewed toward the upper end of the range with a larger standard deviation (See Figure 1).

Table 2. Descriptive statistics for each BCSSE Scale

	N	Mean	SD	SE of Mean	Skewness	Kurtosis
HS_QR	68,770	31.0	14.71	.056	.099	-.509
HS_LS	68,438	38.0	13.21	.050	-.107	-.567
EXP_CL	68,389	38.3	11.55	.044	.088	-.557
EXP_SFI	68,274	34.2	13.13	.050	.320	-.564
EXP_DD	67,893	44.9	13.59	.052	-.498	-.471
EXP_PER	67,932	44.5	9.22	.035	-.628	.895
EXP_DIF	67,745	28.9	10.10	.039	.065	.157
EXP_PREP	67,811	44.6	9.28	.036	-.443	.327
EXP_CAMP	67,904	46.4	9.64	.037	-.671	.363

Note: Standard error of skewness and kurtosis for all scales was .009 and .019, respectively.

Figure 1. BCSSE Scales means plus/minus one standard deviation



Confirmatory Factor Analysis

Given the skewness present for many of these ordinal/Likert-scaled responses, polychoric correlations are preferred over the use of Pearson correlations when estimating the correlations between latent variables in CFA (Jöreskog & Sörbom, 1988; Thompson, 2004).

Overall polychoric correlations within each scale ranged from .22 (EXP_DIF) to .88 (EXP_DD) (see Table 3). Eight of the scales exhibited adequate internal consistency ($\alpha \geq .70$), with the possible exception of EXP_DIF (.66). The table included in Appendix C contains the item-level polychoric correlations for all 42 items.

Since two of the scales (HS_QR and HS_LS) only have three items and thus zero degrees of freedom, model fit statistics could not be produced for these scales as separate models. For the other scales, fit scales are adequate with the possible exception of EXP_SFI. The RMSEA of .128 for EXP_SFI exceeds the criteria for adequate model fit, but the TLI and CFI both indicate "good" model fit (Browne & Cudeck, 1993; Hu & Bentler, 1999). Appendix D includes the parameter estimates and residuals for the nine BCSSE Scales. Overall model fit was adequate based on criteria set forth by Browne and Cudeck (1993). Appendix E contains the parameter estimates and residual variances for the nine factor model.

Correlations between the scales as estimated by the overall nine-factor model was also examined. As expected, small to moderate positive correlations were found for all scales with the exception of EXP_DIF. Correlations with that scale were all negative, given that the higher the score on EXP_DIF the more difficulty the student anticipated having in the first year of

college. These expected negative correlations between EXP_DIF and the other scales provided additional validity evidence for these scales. For instance, the correlation between expected perseverance (EXP_PER) and expected academic difficulty (EXP_DIF) was -.24, indicating that the higher the score on perseverance, the lower the score on difficulty. A positive correlation (even one small in magnitude) would be illogical.

Table 3. Item level polychoric correlations within each BCSSE Scale

	Range of inter-item polychoric correlations	Average poly-choric correlation	Cronbach's Alpha	Ordinal Alpha
HS_QR	.56 to .69	.61	.78	.83
HS_LS	.39 to .63	.48	.68	.74
EXP_CL	.45 to .73	.55	.78	.83
EXP_SFI	.59 to .72	.64	.84	.88
EXP_DD	.77 to .88	.82	.92	.95
EXP_PER	.28 to .61	.46	.80	.84
EXP_DIF	.22 to .52	.33	.63	.66
EXP_PREP	.36 to .64	.48	.83	.87
EXP_CAMP	.29 to .86	.51	.84	.88

Table 4. Model fit indices for each BCSSE Scale

BCSSE Scales	RMSEA	TLI	CFI	Chi-square	df
HS_QR	N/A	N/A	N/A	N/A	0
HS_LS	N/A	N/A	N/A	N/A	0
EXP_CL	<0.001	1.00	1.00	.01	1
EXP_SFI	.128	.98	1.00	1127.58	1
EXP_DD	.048	1.00	1.00	156.57	1
EXP_PER	.066	.98	.99	2098.45	7
EXP_DIF	.021	1.00	1.00	31.35	1
EXP_PREP	.080	.97	.99	3880.80	9
EXP_CAMP	.068	.99	1.00	3511.81	11
Overall model	.068	.90	.90	252824.75	783

Notes: Some residuals were allowed to be correlated. See Appendix D.
Cut-off criteria for acceptable fit: RMSEA < .08; TLI/CFI > .90
Cut-off criteria for good fit: RMSEA < .05, TLI/CFI > .94

SUMMARY

Overall, the psychometric properties of the BCSSE Engagement Scales were deemed adequate for use in assessing incoming first-year students' past and expected engagement behaviors. The preponderance of evidence reported here should provide confidence to researchers, first-year program staff, and administrators who use BCSSE data.

Though the results are generally good, there are some areas of concern that will be investigated further. One is the skewed distribution of Interaction with Diverse Others (EXP_DD). The mean for that scale is higher than psychometrically preferable, indicating that most students expected to interact frequently ("often" or "very often") with a diversity of students. Though that may well be the case, further investigation is warranted to verify that this scale provides the most accurate and reliable data possible. The other concern is the less-than -adequate model fit for Expected Student-Faculty Interaction (EXP_SFI). Though two of the fit indices (CFI and TLI) indicated good fit, the RSMEA, which is a more conservative fit index, indicates less-than-adequate fit. Further research is warranted to determine best course of action to improve this model fit.

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Appendix A
Items Included in the BCSSE Scales

Items Included in BCSSE Scales

BCSSE Scale	Abbrev.	Variable Name	Item
High School engagement in quantitative reasoning	HS_QR		During your last year of high school, about how often did you do the following?
		hQRconclud	Reached conclusions based on your own analysis of numerical information (numbers, graphs, statistics, etc.)
		hQRproblm	Used numerical information to examine a real-world problem or issue (unemployment, climate change, public health, etc.)
		hQRevaluat	Evaluated what others have concluded from numerical information
High School engagement in learning strategies	HS_LS		During your last year of high school, about how often did you do the following?
		hLSreading	Identified key information from reading assignments
		hLSnotes	Reviewed your notes after class
		hLSsummry	Summarized what you learned in class or from course materials
Expected engagement in collaborative learning	EXP_CL		During the coming school year, about how often do you expect to do each of the following?
		fyCLaskhlp	Ask another student to help you understand course material
		fyCLxplain	Explain course material to one or more students
		fyCLstudy	Prepare for exams by discussing or working through course material with other students
		fyCLprojct	Work with other students on course projects or assignments
Expected engagement with faculty	EXP_SFI		During the coming school year, about how often do you expect to do each of the following?
		fySFcareer	Talk about career plans with a faculty member
		fySFothrwrk	Work with a faculty member on activities other than coursework
		fySFprform	Discuss your academic performance with a faculty member
		fySFdiscuss	Discuss course topics, ideas, or concepts with a faculty member outside of class
Expected engagement with diverse others	EXP_DD		During the coming school year, about how often do you expect to have discussions with people from the following groups?
		fyDVrace	People of a race or ethnicity other than your own
		fyDVeconomc	People from an economic background other than your own
		fyDVreligion	People with religious beliefs other than your own
		fyDVpolitical	People with political views other than your own

Items Included in BCSSE Scales

BCSSE Scales	Abbrev.	Variable Name	Item
Expected Academic Perseverance Scale	EXP_PER		During the coming school year, how certain are you that you will do the following?
		cotherint	Study when there are other interesting things to do
		cfindinfo	Find additional information for course assignments when you don't understand the material
		ccourdis	Participate regularly in course discussions, even when you don't feel like it
		caskinst	Ask instructors for help when you struggle with course assignments
		cfinish	Finish something you have started when you encounter challenges
		cstaypos	Stay positive, even when you do poorly on a test or assignment
Expected Academic Difficulty Scale	EXP_DIF		During the coming school year, how difficult do you expect the following to be?
		clearnma	Learning course material
		cmantime	Managing your time
		cgethelp	Getting help with school work
		cintfac	Interacting with faculty
Perceived Academic Preparation Scale	PER_PREP		How prepared are you to do the following in your academic work at this institution?
		fySGwrite	Write clearly and effectively
		fySGspeak	Speak clearly and effectively
		fySGthink	Think critically and analytically
		fySGanalyze	Analyze numerical and statistical information
		fySGothers	Work effectively with others
		cgncompt13	Use computing and information technology
		cgninq	Learn effectively on your own
Importance of Campus Environment Scale	IMP_CAMP		How important is it to you that your institution provides each of the following?
		fyacadexp	A challenging academic experience
		fySEacad	Support to help students succeed academically
		fySEdiv	Opportunities to interact with students from different backgrounds
		fySEnacad	Help managing your non-academic responsibilities
		fySEsoc	Opportunities to be involved socially
		fySEact	Opportunities to attend campus activities and events
		fySEserv	Learning support services

Appendix B
Item-Level Distributions

Item-Level Distributions

		Frequencies		Descriptives			
Variable	*Response Options*	*Count*	*%*	*Mean*	*SD*	*Skewness*	*Kurtosis*
hQRconclud	Never	4,812	*7%*	2.8	0.86	-0.20	-0.69
	Sometimes	20,967	*30%*				
	Often	28,445	*41%*				
	Very often	15,115	*22%*				
	Total	69,339	*100%*				
hQRproblm	Never	10,020	*14%*	2.5	0.92	0.13	-0.80
	Sometimes	27,688	*40%*				
	Often	21,253	*31%*				
	Very often	10,431	*15%*				
	Total	69,392	*100%*				
hQRevaluat	Never	9,787	*14%*	2.4	0.87	0.18	-0.62
	Sometimes	29,721	*43%*				
	Often	21,725	*31%*				
	Very often	7,929	*11%*				
	Total	69,162	*100%*				
hLSreading	Never	1,036	*1%*	3.2	0.77	-0.51	-0.55
	Sometimes	12,246	*18%*				
	Often	29,326	*42%*				
	Very often	26,583	*38%*				
	Total	69,191	*100%*				
hLSnotes	Never	4,283	*6%*	2.8	0.89	-0.08	-0.95
	Sometimes	24,023	*35%*				
	Often	23,435	*34%*				
	Very often	17,518	*25%*				
	Total	69,259	*100%*				
hLSsummry	Never	4,291	*6%*	2.7	0.87	-0.05	-0.83
	Sometimes	24,264	*35%*				
	Often	25,385	*37%*				
	Very often	15,118	*22%*				
	Total	69,058	*100%*				
fyCLaskhlp	Never	816	*1%*	2.8	0.77	0.12	-0.99
	Sometimes	23,988	*35%*				
	Often	28,550	*42%*				
	Very often	15,034	*22%*				
	Total	68,388	*100%*				
fyCLxplain	Never	856	*1%*	2.7	0.71	0.36	-0.68
	Sometimes	29,530	*43%*				
	Often	28,738	*42%*				
	Very often	9,042	*13%*				
	Total	68,166	*100%*				

Item-Level Distributions

		Frequencies		Descriptives			
Variable	*Response Options*	*Count*	*%*	*Mean*	*SD*	*Skewness*	*Kurtosis*
fyCLxplain	Never	856	*1%*	2.7	0.71	0.36	-0.68
	Sometimes	29,530	*43%*				
	Often	28,738	*42%*				
	Very often	9,042	*13%*				
	Total	68,166	*100%*				
fyCLstudy	Never	784	*1%*	3.1	0.75	-0.35	-0.66
	Sometimes	13,364	*20%*				
	Often	31,515	*46%*				
	Very often	22,585	*33%*				
	Total	68,248	*100%*				
fyCLprojct	Never	684	*1%*	3.0	0.75	-0.18	-0.82
	Sometimes	16,310	*24%*				
	Often	31,822	*47%*				
	Very often	19,407	*28%*				
	Total	68,223	*100%*				
fySFcareer	Never	1,287	*2%*	2.8	0.81	0.11	-1.04
	Sometimes	25,303	*37%*				
	Often	25,684	*38%*				
	Very often	15,961	*23%*				
	Total	68,235	*100%*				
fySFothrwrk	Never	4,275	*6%*	2.6	0.83	0.31	-0.65
	Sometimes	32,238	*47%*				
	Often	20,961	*31%*				
	Very often	10,751	*16%*				
	Total	68,225	*100%*				
fySFprform	Never	1,442	*2%*	2.8	0.78	0.13	-0.88
	Sometimes	25,539	*37%*				
	Often	27,670	*41%*				
	Very often	13,613	*20%*				
	Total	68,264	*100%*				
fySFdiscuss	Never	2,443	*4%*	2.7	0.79	0.25	-0.73
	Sometimes	29,447	*43%*				
	Often	24,895	*37%*				
	Very often	11,261	*17%*				
	Total	68,046	*100%*				
fyDVrace	Never	650	*1%*	3.3	0.74	-0.64	-0.45
	Sometimes	9,908	*15%*				
	Often	27,132	*40%*				
	Very often	30,237	*45%*				
	Total	67,927	*100%*				

Item-Level Distributions

		Frequencies		Descriptives			
Variable	*Response Options*	*Count*	*%*	*Mean*	*SD*	*Skewness*	*Kurtosis*
fyDVeconomc	Never	604	*1%*	3.3	0.72	-0.61	-0.38
	Sometimes	9,180	*14%*				
	Often	28,902	*43%*				
	Very often	29,187	*43%*				
	Total	67,873	*100%*				
fyDVreligion	Never	1,074	*2%*	3.2	0.78	-0.60	-0.52
	Sometimes	11,676	*17%*				
	Often	26,546	*39%*				
	Very often	28,535	*42%*				
	Total	67,831	*100%*				
fyDVpolitical	Never	1,217	*2%*	3.2	0.78	-0.60	-0.46
	Sometimes	11,549	*17%*				
	Often	27,130	*40%*				
	Very often	27,794	*41%*				
	Total	67,690	*100%*				
cotherint	1 Not at all certain	799	*1%*	4.3	1.11	-0.28	-0.20
	2	2,453	*4%*				
	3	12,034	*18%*				
	4	23,703	*35%*				
	5	18,078	*27%*				
	6 Very certain	10,870	*16%*				
	Total	67,937	*100%*				
cfindinfo	1 Not at all certain	311	*0%*	4.9	1.03	-0.74	0.24
	2	1,069	*2%*				
	3	5,643	*8%*				
	4	15,585	*23%*				
	5	24,036	*35%*				
	6 Very certain	21,166	*31%*				
	Total	67,810	*100%*				
ccourdis	1 Not at all certain	711	*1%*	4.3	1.16	-0.30	-0.44
	2	3,575	*5%*				
	3	12,482	*18%*				
	4	20,935	*31%*				
	5	18,664	*28%*				
	6 Very certain	11,473	*17%*				
	Total	67,840	*100%*				

Item-Level Distributions

		Frequencies		Descriptives			
Variable	*Response Options*	*Count*	*%*	*Mean*	*SD*	*Skewness*	*Kurtosis*
caskinst	1 Not at all certain	324	*0%*	5.0	1.05	-0.99	0.56
	2	1,105	*2%*				
	3	4,877	*7%*				
	4	12,410	*18%*				
	5	20,692	*31%*				
	6 Very certain	28,368	*42%*				
	Total	67,776	*100%*				
cfinish	1 Not at all certain	246	*0%*	5.1	0.94	-0.96	0.88
	2	486	*1%*				
	3	3,421	*5%*				
	4	12,358	*18%*				
	5	24,765	*37%*				
	6 Very certain	26,426	*39%*				
	Total	67,702	*100%*				
cstaypos	1 Not at all certain	781	*1%*	4.7	1.18	-0.74	0.01
	2	2,172	*3%*				
	3	7,491	*11%*				
	4	15,867	*23%*				
	5	19,510	*29%*				
	6 Very certain	21,922	*32%*				
	Total	67,743	*100%*				
clearnma	1 Not at all difficult	1,419	*2%*	3.9	1.09	-0.29	-0.01
	2	5,276	*8%*				
	3	14,788	*22%*				
	4	26,776	*40%*				
	5	15,286	*23%*				
	6 Very difficult	4,188	*6%*				
	Total	67,733	*100%*				
cmantime	1 Not at all difficult	1,867	*3%*	4.3	1.30	-0.50	-0.42
	2	5,182	*8%*				
	3	10,784	*16%*				
	4	17,532	*26%*				
	5	19,116	*28%*				
	6 Very difficult	13,199	*20%*				
	Total	67,680	*100%*				
cgethelp	1 Not at all difficult	10,502	*16%*	2.7	1.20	0.43	-0.29
	2	20,242	*30%*				
	3	19,698	*29%*				
	4	11,912	*18%*				
	5	4,061	*6%*				
	6 Very difficult	1,217	*2%*				
	Total	67,632	*100%*				

Item-Level Distributions

		Frequencies		Descriptives			
Variable	*Response Options*	*Count*	*%*	*Mean*	*SD*	*Skewness*	*Kurtosis*
cintfac	1 Not at all difficult	14,100	*21%*	2.7	1.29	0.48	-0.43
	2	18,511	*27%*				
	3	17,674	*26%*				
	4	11,203	*17%*				
	5	4,633	*7%*				
	6 Very difficult	1,589	*2%*				
	Total	67,710	*100%*				
fySGwrite	1 Not at all prepared	458	*1%*	4.7	1.12	-0.62	-0.10
	2	1,855	*3%*				
	3	7,379	*11%*				
	4	17,762	*26%*				
	5	20,943	*31%*				
	6 Very prepared	19,415	*29%*				
	Total	67,812	*100%*				
fySGspeak	1 Not at all prepared	537	*1%*	4.6	1.15	-0.58	-0.22
	2	2,430	*4%*				
	3	8,377	*12%*				
	4	17,655	*26%*				
	5	20,523	*30%*				
	6 Very prepared	18,233	*27%*				
	Total	67,755	*100%*				
fySGthink	1 Not at all prepared	218	*0%*	4.8	1.01	-0.62	0.01
	2	985	*1%*				
	3	5,755	*9%*				
	4	17,189	*25%*				
	5	23,968	*35%*				
	6 Very prepared	19,524	*29%*				
	Total	67,639	*100%*				
fySGanalyze	1 Not at all prepared	815	*1%*	4.4	1.20	-0.40	-0.44
	2	3,655	*5%*				
	3	11,415	*17%*				
	4	19,117	*28%*				
	5	19,118	*28%*				
	6 Very prepared	13,550	*20%*				
	Total	67,670	*100%*				
fySGothers	1 Not at all prepared	216	*0%*	5.1	0.97	-0.96	0.76
	2	730	*1%*				
	3	3,668	*5%*				
	4	12,435	*18%*				
	5	24,187	*36%*				
	6 Very prepared	26,390	*39%*				
	Total	67,626	*100%*				

Item-Level Distributions

		Frequencies		Descriptives			
Variable	*Response Options*	*Count*	*%*	*Mean*	*SD*	*Skewness*	*Kurtosis*
cgncompt13	1 Not at all prepared	493	*1%*	4.7	1.14	-0.66	-0.10
	2	2,309	*3%*				
	3	7,601	*11%*				
	4	16,447	*24%*				
	5	21,250	*31%*				
	6 Very prepared	19,458	*29%*				
	Total	67,558	*100%*				
cgninq	1 Not at all prepared	296	*0%*	4.8	1.05	-0.65	0.05
	2	1,284	*2%*				
	3	6,046	*9%*				
	4	17,165	*25%*				
	5	23,097	*34%*				
	6 Very prepared	19,599	*29%*				
	Total	67,487	*100%*				
fyacadexp	1 Not important	652	*1%*	4.6	1.10	-0.56	0.04
	2	1,610	*2%*				
	3	7,828	*12%*				
	4	20,027	*30%*				
	5	21,349	*31%*				
	6 Very important	16,399	*24%*				
	Total	67,865	*100%*				
fySEacad	1 Not important	112	*0%*	5.4	0.87	-1.51	2.12
	2	372	*1%*				
	3	2,198	*3%*				
	4	7,622	*11%*				
	5	16,813	*25%*				
	6 Very important	40,629	*60%*				
	Total	67,746	*100%*				
fySEdiv	1 Not important	1,282	*2%*	4.7	1.26	-0.80	0.03
	2	2,663	*4%*				
	3	7,777	*11%*				
	4	15,005	*22%*				
	5	18,088	*27%*				
	6 Very important	22,915	*34%*				
	Total	67,730	*100%*				
fySEnacad	1 Not important	1,626	*2%*	4.4	1.31	-0.57	-0.37
	2	4,002	*6%*				
	3	9,992	*15%*				
	4	16,976	*25%*				
	5	17,373	*26%*				
	6 Very important	17,787	*26%*				
	Total	67,756	*100%*				

Item-Level Distributions

		Frequencies		Descriptives			
Variable	*Response Options*	*Count*	*%*	*Mean*	*SD*	*Skewness*	*Kurtosis*
fySEsoc	1 Not important	640	*1%*	4.9	1.11	-0.99	0.69
	2	1,476	*2%*				
	3	5,251	*8%*				
	4	13,328	*20%*				
	5	21,517	*32%*				
	6 Very important	25,449	*38%*				
	Total	67,661	*100%*				
fySEact	1 Not important	631	*1%*	4.9	1.10	-1.04	0.79
	2	1,490	*2%*				
	3	5,016	*7%*				
	4	12,749	*19%*				
	5	21,414	*32%*				
	6 Very important	26,278	*39%*				
	Total	67,578	*100%*				
fySEserv	1 Not important	386	*1%*	5.1	1.10	-1.07	0.61
	2	1,407	*2%*				
	3	4,979	*7%*				
	4	11,767	*17%*				
	5	18,063	*27%*				
	6 Very important	30,921	*46%*				
	Total	67,523	*100%*				

Appendix C

Polychoric Correlations

Polychoric Correlations

	HS_QR			HS_LS			EXP_CL				EXP_SFI				EXP_DD				EXP_PER (cont)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	1	15	16	17	18	19	20	21
1 hQRconclud	1.00																				
2 hQRproblm	.60	1.00																			
3 hQRevaluat	.56	.69	1.00																		
4 hLSreading	.31	.29	.36	1.00																	
5 hLSnotes	.12	.12	.15	.39	1.00																
6 hLSsummry	.19	.21	.25	.43	.63	1.00															
7 fyCLaskhlp	.04	.05	.07	.07	.13	.11	1.00														
8 fyCLxplain	.23	.22	.24	.20	.16	.21	.54	1.00													
9 fyCLstudy	.14	.15	.16	.19	.23	.22	.58	.50	1.00												
10 fyCLprojct	.13	.14	.16	.13	.17	.17	.52	.45	.73	1.00											
11 fySFcareer	.12	.16	.15	.18	.22	.22	.32	.34	.41	.41	1.00										
12 fySFothrwrk	.14	.19	.19	.16	.22	.23	.32	.37	.43	.43	.66	1.00									
13 fySFprform	.12	.15	.15	.18	.24	.24	.35	.33	.40	.38	.67	.59	1.00								
14 fySFdiscuss	.18	.21	.21	.19	.22	.25	.32	.38	.40	.38	.59	.61	.72	1.00							
15 fyDVrace	.14	.13	.13	.22	.14	.16	.21	.25	.26	.23	.23	.22	.23	.22	1.00						
16 fyDVeconomc	.15	.14	.15	.24	.14	.17	.22	.28	.27	.25	.24	.23	.24	.24	.88	1.00					
17 fyDVreligion	.15	.14	.15	.24	.12	.15	.18	.25	.23	.21	.20	.19	.19	.21	.80	.83	1.00				
18 fyDVpolitical	.16	.15	.16	.23	.12	.15	.17	.25	.23	.21	.20	.19	.20	.21	.77	.81	.85	1.00			
19 cotherint	.11	.10	.10	.18	.25	.20	.08	.15	.16	.10	.15	.13	.17	.18	.16	.17	.16	.17	1.00		
20 cfindinfo	.15	.12	.11	.25	.28	.24	.14	.19	.25	.19	.24	.20	.26	.25	.21	.22	.19	.19	.52	1.00	
21 ccourdis	.16	.17	.16	.23	.21	.24	.13	.27	.26	.23	.29	.31	.31	.34	.21	.23	.21	.21	.44	.47	1.00
22 caskinst	.08	.07	.06	.18	.25	.21	.24	.19	.31	.27	.35	.29	.41	.36	.20	.20	.16	.16	.36	.53	.54
23 cfinish	.18	.14	.13	.25	.21	.21	.09	.20	.22	.19	.23	.19	.25	.24	.22	.24	.21	.22	.46	.55	.50
24 cstaypos	.11	.11	.09	.10	.15	.15	.05	.16	.18	.18	.21	.20	.20	.20	.14	.14	.12	.13	.28	.35	.38

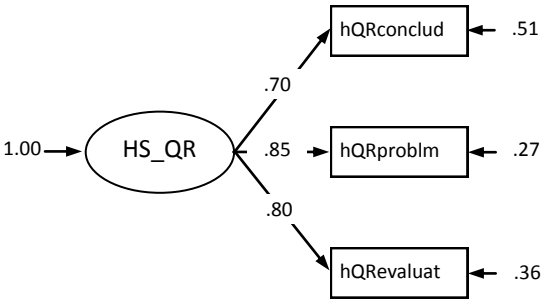
Polychoric Correlations

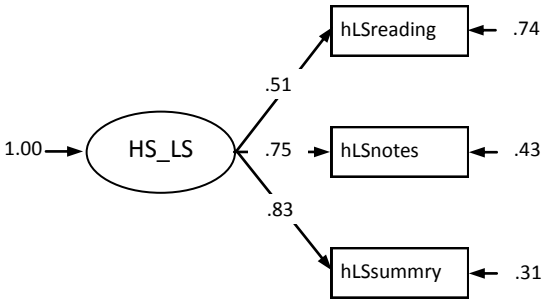
	(cont) EXP_PER			EXP_DIF				EXP_PREP							EXP_CAMP						
	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
22 caskinst	1.00																				
23 cfinish	.61	1.00																			
24 cstaypos	.42	.55	1.00																		
25 clearnma	.13	.05	-.03	1.00																	
26 cmantime	.02	-.04	-.09	.42	1.00																
27 cgethelp	-.17	-.19	-.15	.31	.28	1.00															
28 cintfac	-.28	-.21	-.23	.22	.22	.52	1.00														
29 fySGwrite	.20	.29	.21	-.07	-.07	-.15	-.15	1.00													
30 fySGspeak	.27	.31	.27	-.08	-.07	-.16	-.26	.64	1.00												
31 fySGthink	.21	.36	.26	-.14	-.07	-.19	-.21	.60	.62	1.00											
32 fySGanalyze	.12	.26	.23	-.12	-.09	-.14	-.13	.36	.38	.62	1.00										
33 fySGothers	.37	.38	.35	.02	-.03	-.19	-.28	.42	.53	.48	.39	1.00									
34 cgncompt13	.20	.26	.26	-.08	-.06	-.14	-.17	.36	.36	.45	.50	.48	1.00								
35 cgninq	.18	.35	.29	-.16	-.15	-.21	-.18	.48	.42	.59	.49	.44	.48	1.00							
36 fyacadexp	.26	.34	.22	.06	.01	-.13	-.13	.28	.25	.33	.25	.27	.19	.33	1.00						
37 fySEacad	.45	.39	.22	.18	.10	-.11	-.13	.25	.24	.22	.11	.36	.18	.19	.50	1.00					
38 fySEdiv	.29	.25	.24	.09	.03	-.07	-.12	.17	.19	.15	.07	.30	.15	.16	.42	.52	1.00				
39 fySEnacad	.27	.17	.18	.13	.10	.03	-.04	.12	.13	.06	.05	.21	.12	.07	.29	.43	.56	1.00			
40 fySEsoc	.30	.25	.22	.11	.08	-.08	-.12	.20	.24	.17	.10	.37	.16	.15	.36	.51	.59	.59	1.00		
41 fySEact	.30	.26	.23	.11	.07	-.09	-.12	.20	.23	.16	.11	.37	.17	.16	.35	.52	.56	.52	.86	1.00	
42 fySEserv	.42	.30	.19	.20	.09	-.05	-.08	.14	.17	.08	.03	.30	.14	.08	.33	.66	.51	.50	.55	.59	1.00

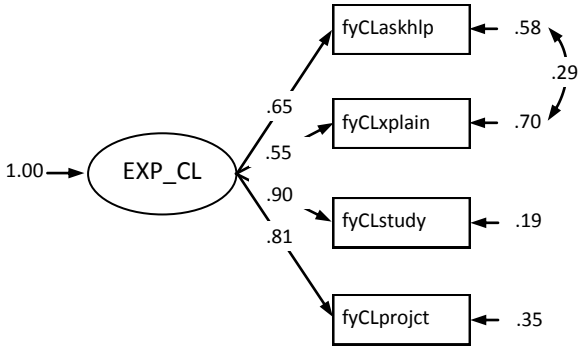
Appendix D

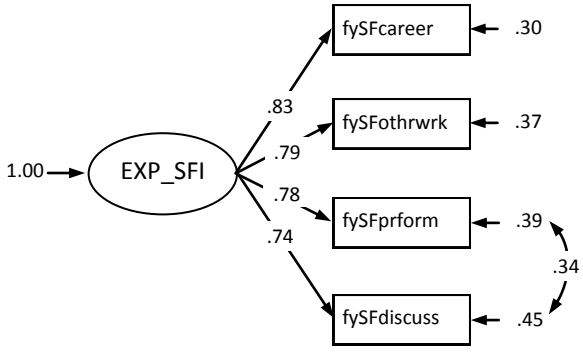
Factor-Level Parameter Estimates and Residual Variances

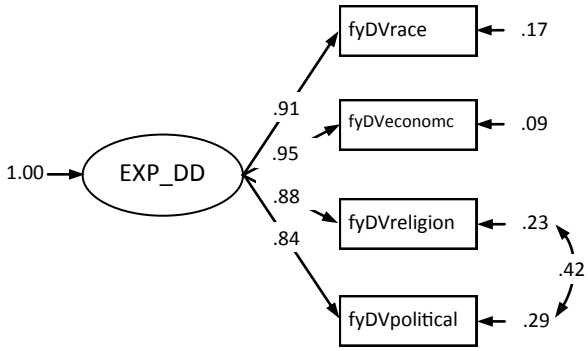
Factor-Level Parameter Estimates and Residual Variances

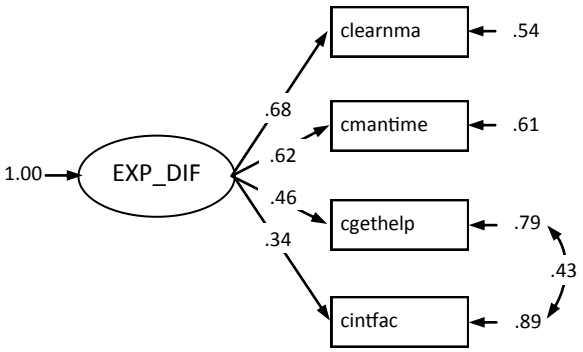




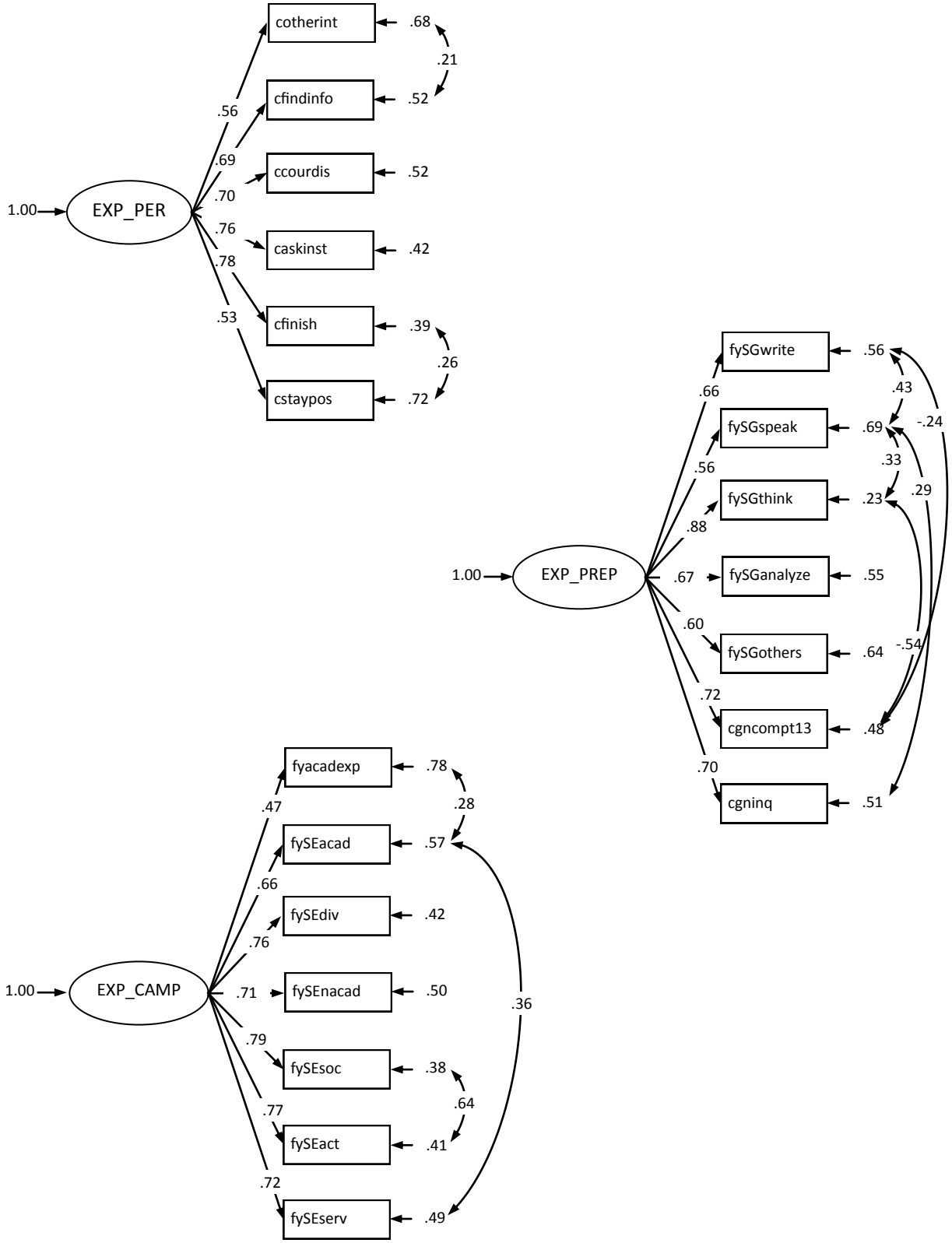








Factor-Level Parameter Estimates and Residual Variances



Appendix E

Overall Parameter Estimates For Nine Factor Model and Residual Variances

Overall Parameter Estimates For Nine Factor Model and Residual Variances

Scale	Variable Name	Factor loadings	Residual variances
HS_QR	hQRconclud	.74	.45
	hQRproblm	.82	.34
	hQRevaluat	.81	.34
HS_LS	hLSreading	.70	.51
	hLSnotes	.71	.50
	hLSsummry	.75	.44
EXP_CL	fyCLaskhlp	.64	.59
	fyCLxplain	.72	.49
	fyCLstudy	.87	.25
	fyCLprojct	.80	.36
EXP_SFI	fySFcareer	.80	.36
	fySFothrwrk	.79	.38
	fySFprform	.83	.31
	fySFdiscuss	.81	.34
EXP_DD	fyDVrace	.90	.19
	fyDVeconomc	.94	.13
	fyDVreligion	.91	.17
	fyDVpolitical	.89	.21
EXP_PER	cotherint	.56	.69
	cfindinfo	.71	.50
	ccourdis	.72	.48
	caskinst	.76	.42
	cfinish	.78	.40
	cstaypos	.59	.65
EXP_DIF	clearnma	.28	.92
	cmantime	.32	.90
	cgethelp	.67	.55
	cintfac	.85	.27
PER_PREP	fySGwrite	.69	.52
	fySGspeak	.74	.45
	fySGthink	.81	.34
	fySGanalyze	.63	.60
	fySGothers	.76	.42
	cgncompt13	.60	.64
	cgninq	.69	.53
IMP_CAMP	fyacadexp	.60	.64
	fySEacad	.76	.43
	fySEdiv	.72	.49
	fySEnacad	.63	.61
	fySEsoc	.89	.21
	fySEact	.88	.23
	fySEserv	.73	.48

Appendix F

BCSSE Scale-Level Correlations From the Overall CFA Model

BCSSE Scale-Level Correlations From the Overall CFA Model

	HS_QR	HS_LS	EXP_CL	EXP_SFI	EXP_DD	EXP_PER	EXP_DIF	PER_PREP	IMP_CAMP
HS_QR	1.00								
HS_LS	.39	1.00							
EXP_CL	.24	.31	1.00						
EXP_SFI	.26	.37	.61	1.00					
EXP_DD	.20	.26	.34	.29	1.00				
EXP_PER	.22	.43	.37	.46	.30	1.00			
EXP_DIF	-.14	-.14	-.05	-.17	-.12	-.28	1.00		
PER_PREP	.38	.35	.24	.23	.28	.54	-.35	1.00	
IMP_CAMP	.12	.32	.38	.42	.33	.51	-.08	.36	1.00

Additional Information, Comments, and Questions

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