

One way to estimate reliability, specifically the internal consistency, of FSSE results is by calculating Cronbach's alphas and intercorrelations for the FSSE scales. Internal consistency is the extent to which a group of items measure the same construct, as evidenced by how well they vary together, or intercorrelate. A high degree of internal consistency enables the researcher to interpret the composite score as a measure of the construct (Henson, 2001). Assuming the FSSE scales effectively measure an underlying construct, we would expect to find high estimates of their internal consistency.

## Data

The data for this study are drawn from the 2017 administration of the FSSE survey, with 24,418 faculty from 154 bachelor's-granting colleges and universities. Response rates at individual institutions ranged from 13% to 80%. The average institutional response rate was 43%. Fifty survey items are included in these scales: Higher-Order Learning, Reflective and Integrative Learning, Quantitative Reasoning, Learning Strategies, Collaborative Learning, Discussions with Diverse Others, Student-Faculty Interaction, Effective Teaching Practices, Quality of Interactions, and Supportive Environment.

## Methods

Cronbach's alpha measures the internal consistency of a group of items by measuring the homogeneity of the group of items. "It is an indication of how well the different items complement each other in their measurement of different aspects of the same variable or quality" (Litwin, 2003, p. 22). Cronbach's alpha ranges in value between zero and one. Values closer to one indicate a higher internal consistency; values closer to zero indicate a lower internal consistency. McMillan and Schumacher (2001) suggest that groups of items with an alpha below .70 should be used with caution. The internal consistency of a scale can also be examined with item-to-scale correlations and intercorrelations of items within a scale (DeVellis, 2003). If a group of items measures a single latent construct, we would assume that each item alone correlates with the scale overall and that items within such a scale are positively correlated. According to Clark and Watson (1995), average inter-item correlations should fall somewhere between .15 and .50 as anything below .15 would be too broad of a construct while anything above .50 would indicate redundancy of items on the scale.

Internal consistency reliability for this study was measured in a variety of ways: Cronbach's alpha for each measure, Cronbach's alpha for a measure if a single item is removed, correlations between an item and the remaining items in the measure (called corrected item-scale correlations), the average inter-item correlation, the range of inter-item correlations, and the [individual inter-item correlations of the scale](#). All correlations are Pearson's *r* correlations. The criteria used are summarized in Table 1.

Table 1. Internal Consistency Criteria for This Study

Reliability Statistics	Criteria for a Good Scale
Cronbach's Alpha	Greater than or equal to .70
Range of inter-item correlations	between .15 and .85
Average inter-item correlation	Between .15 and .50
Range of Cronbach's alpha's if item deleted	Deleting any item would decrease the alpha
Range of corrected item-scale correlations	Greater than or equal .50

## Results

Cronbach's alphas for the FSSE scales and average inter-item correlations by faculty who teach lower- and upper-division courses can be found in Table 2. The results in Table 2 suggest a high degree of internal consistency for all of the ten FSSE scales. Cronbach's alphas range between .73 and .94, all above our criteria of .70. With the exception of the lower division Effective Teaching Practices scale (with one inter-item correlation equal to .14), the inter-item correlations are all between .15 and .85. The average inter-item correlations rose well above .50 in the case of Quantitative Reasoning and Discussions with Diverse Others. This indicates that those scales contain items that are particularly intercorrelated, having a narrower focus. This is reasonable as these are the narrowest constructs in the survey. No average inter-item correlation fell below .15 indicating that none of the scales represent overly broad constructs.

Table 2. Scale Cronbach's Alphas by Course Division

FSSE scales	Cronbach's $\alpha$		Inter-Item Correlation		Average Inter-Item Correlation	
	Lower-Division	Upper-Division	Lower-Division	Upper-Division	Lower-Division	Upper-Division
Higher-Order Learning	.74	.73	.15-.63	.19-.58	.42	.39
Reflective & Integrative Learning	.89	.87	.33-.78	.28-.76	.53	.49
Learning Strategies	.76	.77	.42-.62	.44-.62	.52	.53
Quantitative Reasoning	.88	.87	.64-.80	.61-.77	.71	.68
Collaborative Learning	.85	.83	.51-.78	.46-.76	.60	.56
Discussions with Diverse Others	.94	.93	.72-.84	.70-.83	.79	.78
Student-Faculty Interaction	.77	.78	.31-.53	.34-.52	.47	.47
Effective Teaching Practices	.76	.77	.14-.41	.16-.45	.30	.30
Quality of Interactions	.85	.85	.38-.73	.45-.74	.53	.54
Supportive Environment	.87	.86	.29-.66	.28-.62	.44	.44

The range of each scale's overall Cronbach's alpha if individual items are removed and the range of corrected item-scale correlations by faculty who teach lower- and upper-division courses can be found in Table 3. Individual item-scale analyses by course division can be found in Table 4. With the exception of a handful of items (fHOapply, fRIintegrate, fQRconclude, fCLproject, and fQIstudent), all items meet the criteria for a good scale if they were deleted. Of the identified items, only fHOapply makes a meaningful impact on change in reliability (+.06, the rest are +.01-.02). Another handful of items (fHOanalyze, fRIintegrate, fETgoals, fETorganize, fETexample, fETvariety, fETdraftfb, fETfeedback) fall below the criteria for corrected item-scale correlations (greater than or equal to .50). Of these, fHOapply is the least correlated, while the rest of these items are .40 or greater. Cronbach's alphas for upper-division faculty are similar to that for lower-division faculty across all FSSE scales.

Overall, these ten FSSE scales show high levels of internal consistency. Results suggest that Quantitative Reasoning and Discussions with Diverse Others have more narrowly focused items while Effective Teaching Practices may be somewhat broader. Researchers wanting the most internally consistent scales may want to consider the removal of one item from Higher-Order Learning (fHOapply). Overall results suggest, however, that these ten FSSE scales can be considered reliable measures of faculty involvement in and perceptions of undergraduate student student engagement.

Table 3. Scale Item-Scale Analyses by Course Division

FSSE scales	Cronbach's $\alpha$ If Item Deleted		Corrected Item- Scale Correlation	
	Lower-Division	Upper-Division	Lower-Division	Upper-Division
Higher-Order Learning	.61-.80	.61-.77	.29-.67	.31-.61
Reflective & Integrative Learning	.86-.89	.83-.88	.49-.78	.41-.76
Learning Strategies	.59-.76	.61-.76	.51-.67	.53-.67
Quantitative Reasoning	.78-.89	.72-.89	.70-.82	.68-.80
Collaborative Learning	.79-.86	.76-.85	.58-.77	.53-.75
Discussions with Diverse Others	.91-.92	.90-.92	.83-.88	.82-.87
Student-Faculty Interaction	.68-.75	.69-.75	.53-.64	.53-.65
Effective Teaching Practices	.73-.75	.72-.75	.41-.53	.42-.55
Quality of Interactions	.81-.86	.81-.85	.52-.73	.55-.74
Supportive Environment	.84-.86	.84-.86	.53-.69	.53-.70

Table 4. Item-Scale Analyses by Course Division

Content Area	Scale	Items	Cronbach's $\alpha$ If Item Deleted		Corrected Item- Scale Correlation	
			Lower-Division	Upper-Division	Lower-Division	Upper-Division
Academic Challenge	Higher-Order Learning	fHOapply	.80	.77	.29	.31
		fHOanalyze	.61	.61	.67	.61
		fHOevaluate	.66	.63	.59	.58
		fHOform	.63	.62	.62	.59
	Reflective and Integrative Learning	fRIintegrate	.89	.88	.49	.41
		fRIsocietal	.86	.84	.76	.72
		fRIdiverse	.86	.84	.78	.76
		fRIlowview	.86	.84	.77	.75
		fRIperspect	.86	.83	.81	.79
	Learning Strategies	fRInewview	.88	.86	.62	.61
		fRIconnect	.89	.87	.57	.53
		fLSreading	.76	.76	.51	.53
		fLSnotes	.67	.69	.60	.61
	Quantitative Reasoning	fLSsummary	.59	.61	.67	.67
		fQRconclude	.89	.87	.70	.68
fQRproblem		.78	.76	.82	.80	
fQRevaluate		.82	.80	.78	.76	

Table 4. Item-Scale Analyses by Course Division (continued)

Content Area	Scale	Items	Cronbach's $\alpha$ If Item Deleted		Corrected Item- Scale Correlation		
			Lower-Division	Upper-Division	Lower-Division	Upper-Division	
Learning with Peers	Collaborative Learning	fCLaskhelp	.79	.76	.76	.73	
		fCLexplain	.78	.75	.77	.75	
		fCLstudy	.82	.79	.68	.65	
		fCLproject	.86	.85	.58	.53	
	Discussions with Diverse Others	fDDrace	.92	.92	.83	.82	
		fDDeconomic	.91	.90	.88	.87	
		fDDreligion	.91	.91	.86	.87	
Experiences with Faculty	Student-Faculty Interaction	fSFcareer	.68	.70	.64	.62	
		fSFotherwork	.75	.75	.53	.55	
		fSFdiscuss	.69	.69	.63	.65	
		fSFperform	.75	.75	.52	.53	
	Effective Teaching Practices	fETgoals	.74	.74	.49	.47	
		fETorganize	.75	.75	.43	.45	
		fETexample	.75	.75	.41	.42	
		fETvariety	.74	.74	.48	.49	
		fETreview	.73	.73	.52	.51	
		fETstandards	.73	.72	.53	.55	
		fETdraftfb	.75	.75	.46	.45	
	Supportive Campus Environment	Quality of Interactions	fQIstudent	.86	.85	.52	.55
			fQIadvisor	.81	.82	.71	.71
			fQIfaculty	.82	.82	.68	.67
			fQIstaff	.81	.81	.73	.74
fQIadmin			.82	.82	.69	.68	
Supportive Environment		fSEacademic	.86	.86	.54	.53	
		fSElearnsup	.86	.86	.53	.53	
		fSEdiverse	.85	.85	.62	.62	
		fSEsocial	.84	.84	.67	.68	
		fSEwellness	.84	.84	.69	.70	
		fSEnonacad	.85	.85	.64	.62	
fSEactivities	.85	.85	.62	.62			
fSEevents	.85	.85	.63	.62			

## References

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