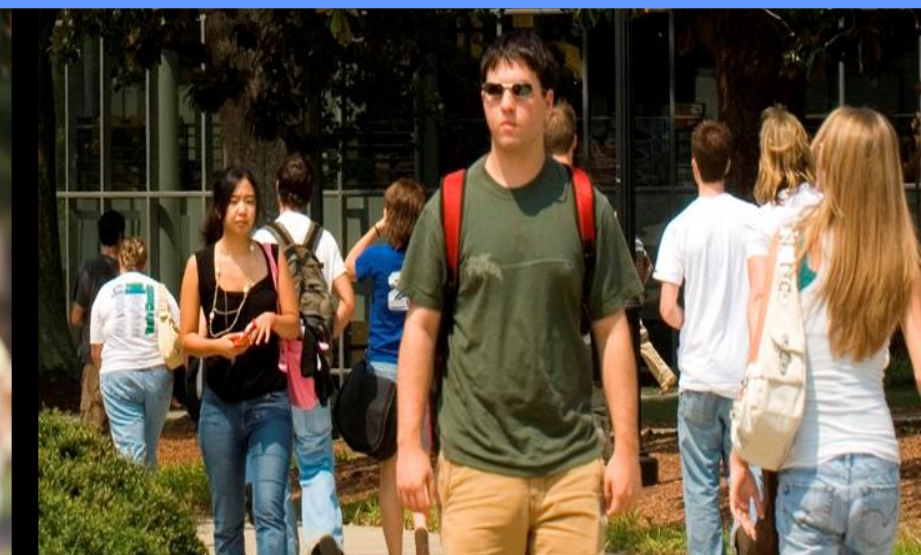


## Psychometric properties and factorial invariance for the updated BCSSE survey

**James Cole, Ph.D.**  
Associate Scientist

**Yiran Dong**  
PhD student





# Introduction

- **Overview**
- **Survey revision process (interviews, cog interviews, lit)**
- **FY Engagement Indicator (scale) descriptions**
- **Items, means, central tendency stats**
- **CFA & invariance examined (metric and scalar)**
- **Results for each scale by each group**
- **Conclusion**

# Survey Overview

BCSSE collects data about entering college students' high school academic and co-curricular experiences, as well as their expectations for participating in educationally purposeful activities during the first college year. BCSSE administration usually takes place prior to the start of fall classes and is designed to be paired with a NSSE administration at the end of the first college year, providing an in-depth understanding of first-year student engagement on your campus.

**Beginning College Survey of Student Engagement**

We are interested in your high school experiences and how often you expect to participate in certain activities during your first year of college. The information that you provide will help your institution improve teaching, learning and the quality of the student experience. Thanks for your help. Write or mark your answers in the boxes. Examples:  or

Please print your student ID number in the box below. Do not print your Social Security number.

Please write in the 5-digit ZIP code of your home during your last year of high school.

When are you completing this survey? (Select only one.)

**HIGH SCHOOL EXPERIENCES**

1. Please write in the year you graduated from high school (for example, 2013):

2. From which type of high school did you graduate? (Select only one.)

3. What were most of your high school grades? (Select only one.)

4. To date, in which of the following math classes have you earned a grade of "C" or better? (Select all that apply.)

5. Did you take the SAT and/or ACT?

If yes, please write your scores below (as best you remember):

SAT (possible range=200-800)      ACT (possible range=1-30)

Critical Reading      Composite

Mathematical Reasoning

Writing

6. During high school, how many of the following types of classes did you complete?

Classes: 0 1-2 3-4 5-6 7-8 9-10 11 or more

a. Advanced Placement (AP) classes

b. College or university courses for credit

7. During your last year of high school, about how many papers, reports, or other writing tasks of the following length did you complete?

a. Up to 5 pages

b. Between 6 and 10 pages

c. 11 pages or more

8. During your last year of high school, about how many hours did you spend in a typical 7-day week doing each of the following?

a. Preparing for class (studying, reading, doing homework, etc.)

b. Working for pay

c. Participating in co-curricular activities (organizations, school publications, student government, sports, etc.)

d. Relaxing and socializing (time with friends, video games, TV or videos, keeping up with friends online, etc.)

9. During your last year of high school, of the time you spent preparing for class in a typical 7-day week, about how many hours were on assigned reading?



# Survey Overview

## **BCSSE revision goals:**

- Increase alignment between BCSSE and NSSE 2013 at the item and scale level
- Increase utility of the data for users
- Ensure psychometric soundness
- Improve the clarity and applicability of survey language
- Update terminology to reflect current educational contexts



# Survey Overview

## **BCSSE revision goals:**

- Increase alignment between BCSSE and NSSE 2013 at the item and scale level
- Increase utility of the data for users
- Ensure psychometric soundness
- Improve the clarity and applicability of survey language
- Update terminology to reflect current educational contexts

## **Data sources used during review:**

- Interviews with 16 CPM's
- IUB persistence and GPA data linked with two years of BCSSE data
- Item analysis using BCSSE data
- Correlations using BCSSE-NSSE data
- BCSSE scale analysis (CFA)
- Crosswalk between old BCSSE and new NSSE looking for inconsistencies
- Feedback from students
- Internal feedback



# Survey Overview

## Alignment of content with NSSE

		BCSSE			NSSE
		HS	EXP		FY
Items	Writing	X	X		X
Item	Reading	X	X		X
Items	Hours/Week	X	X		X
Item	Challenge	X			X
Scale	QR	X			X
Scale	LS	X			X
Scale	SFI		X		X
Scale	Diverse		X		X
Scale	CL		X		X
Scale	Acad Prep		X		X
Scale	Campus Imp		X		X
Item	SR Grades	X	X		X



# FY Engagement Indicators

<b>FY Engagement Indicator (0-60)</b>	<b>Description</b>
<b>Quantitative Reasoning (QR)</b>	High school engagement with analysis and numerical information
<b>Learning Strategies (LS)</b>	Use of effective learning strategies in high school.
<b>Collaborative Learning (CL)</b>	Expectation to interact and collaborate with peers
<b>Student-Faculty Interaction (SFI)</b>	Expectation to interaction and engage with faculty
<b>Interactions with Diverse Others (IDO)</b>	Expectation to interact with peers different from themselves
<b>Expected Academic Perseverance (EAP)</b>	Student certainty that they will persist in the face of academic adversity.
<b>Expected Academic Difficulty (EAD)</b>	Expected academic difficulty during the first year of college.
<b>Perceived Academic Preparation (PAP)</b>	Student perception of their academic preparation.
<b>Importance of Campus Env (ICE)</b>	Student-rated importance that the institution provides a challenging and supportive environment.



# FY Engagement Indicators

<b>FY Engagement Indicator (0-60)</b>	<b>Total items (Sample Item)</b>
<b>Quantitative Reasoning (QR)</b>	3-(Reached conclusions based on your own analysis of numerical information (numbers, graphs, statistics, etc.)
<b>Learning Strategies (LS)</b>	3-(Identified key information from reading assignments)
<b>Collaborative Learning (CL)</b>	4-(Prepare for exams by discussing or working through course material with other students)
<b>Student-Faculty Interaction (SFI)</b>	4-(Discuss course topics, ideas, or concepts with a faculty member outside of class)
<b>Interactions with Diverse Others (IDO)</b>	4-(People of a race or ethnicity other than your own)
<b>Expected Academic Perseverance (EAP)</b>	6-(Finish something you have started, even when you encounter challenges)
<b>Expected Academic Difficulty (EAD)</b>	4-(Learning course material)
<b>Perceived Academic Preparation (PAP)</b>	7-(Write clearly and effectively)
<b>Importance of Campus Env (ICE)</b>	7-(Support to help students succeed academically)





# Data

**Data source:** BCSSE 2013 administration

**Student count:** 54,131

**Institution Count:** 91

**Female:** 60.2%

**Public:** 43%

**Male:** 39.8%

**Private:** 57%

**First generation:** 48.4%

**Baccalaureate:** 45.5%

**Non first generation:** 52.5%

**Masters:** 35.4%

**Doctoral:** 19.1%

**Asian:** 6.5%

**Black/Afr. Am:** 11.3%

**Hispanic:** 9.7%

**White:** 76.4%



# Analytic Approach

- Scale level central tendency (mean, SD, skewness, kurtosis)
- Internal consistency
- Overall fit/inter-item correlation
- Factorial invariance



# Introduction

Engagement Indicator	N	M	SD	Skewness	Kurtosis	Alpha
QR	52056	30.71	14.78	.106	-.505	.785
LS	51739	37.97	13.17	-.101	-.558	.686
CL	51719	38.24	11.56	.095	-.563	.780
SFI	51635	34.22	13.22	.323	-.581	.842

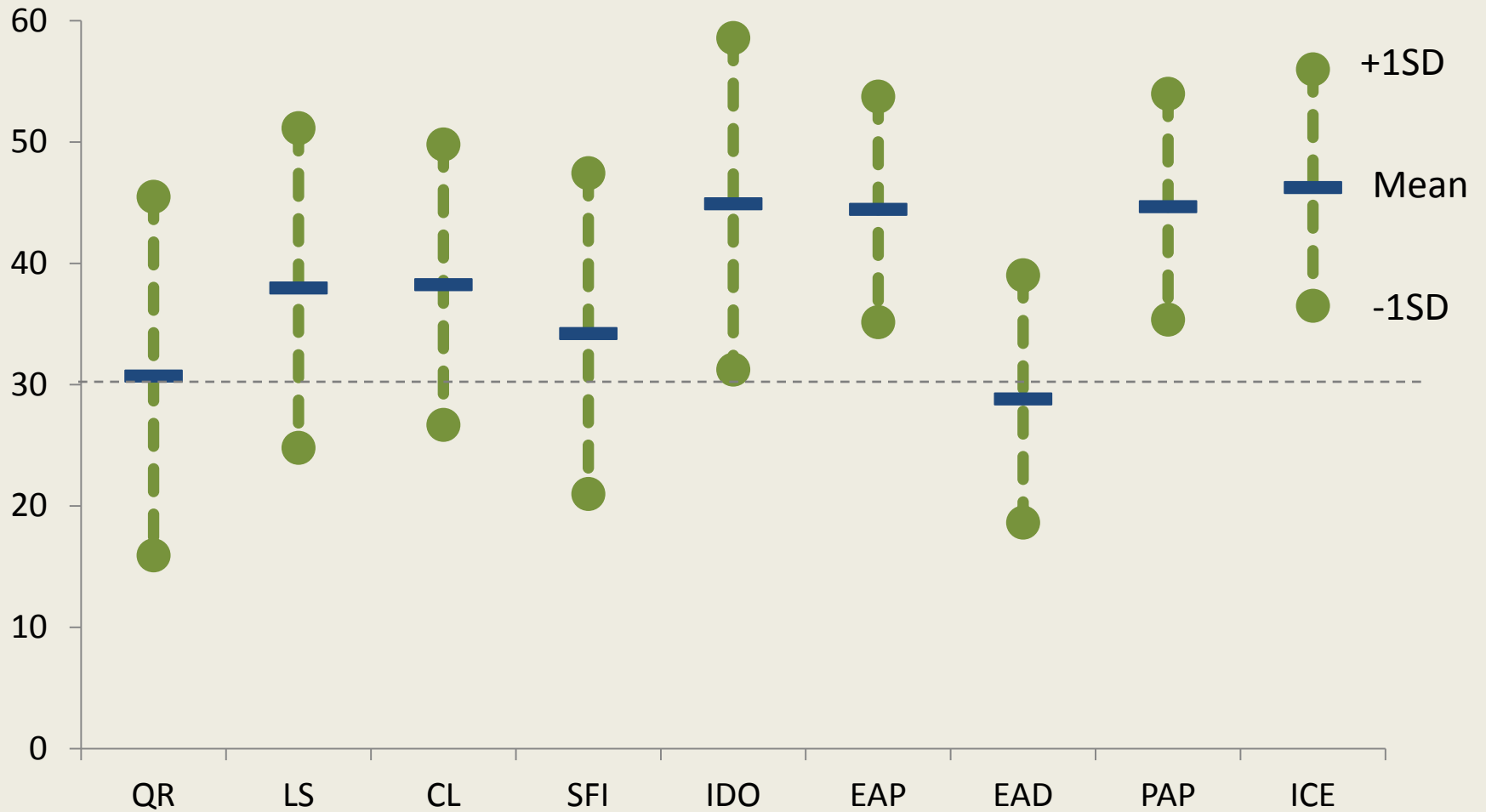


# Introduction

Engagement Indicator	N	M	SD	Skewness	Kurtosis	Alpha
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LS	51739	37.97	13.17	-.101	-.558	.686
CL	51719	38.24	11.56	.095	-.563	.780
SFI	51635	34.22	13.22	.323	-.581	.842
IDO	51269	44.91	13.66	-.507	-.462	.924
EAP	51307	44.45	9.30	-.620	.810	.806
EAD	51188	28.83	10.19	.066	.138	.642
PAP	51202	44.67	9.31	-.450	.339	.836
ICE	51219	46.25	9.74	-.670	.350	.841



# Introduction





# Introduction

What is measurement invariance:

Factorial invariance involves testing the assumption that measures of constructs have the same meaning in two or more groups or two or more measurement occasions.

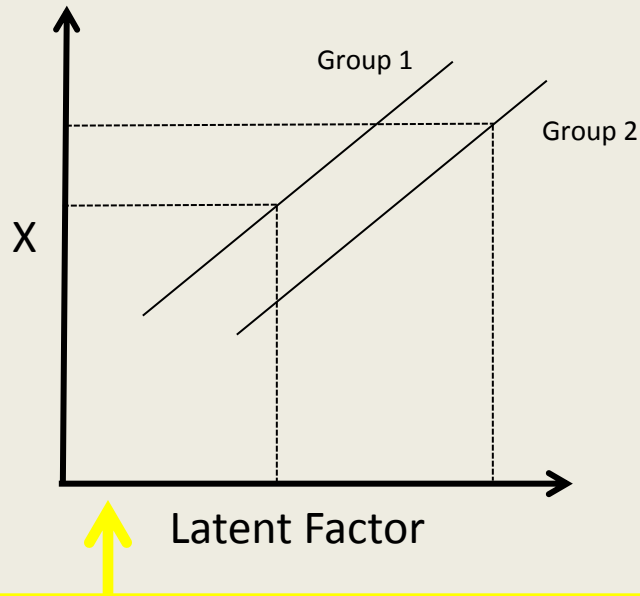
In other words, given there are multiple items that make up a scale, if the loadings for those items on the single underlying factor are the same across groups, then measurement invariance is supported.

Least stringent	Configural invariance	Do the groups have the same factor structure, in general?
Moderate	Metric invariance	Do the groups have same factor loadings?
Most stringent	Scalar invariance	Do the groups have same factor loadings and intercepts?

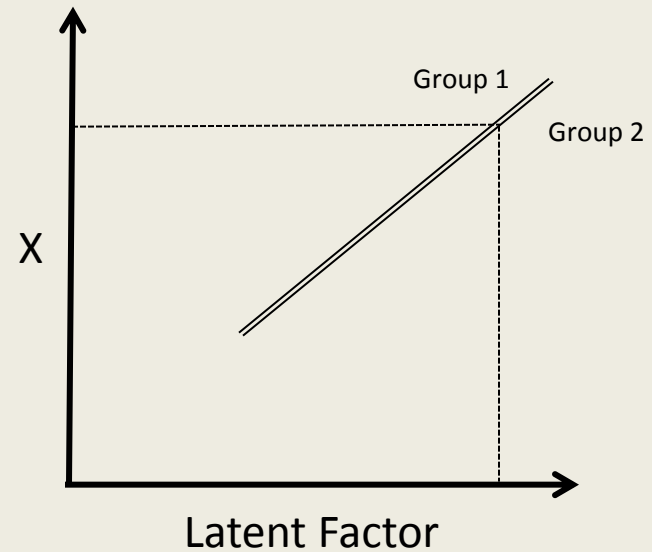


# Introduction

A. Yes Metric  
No Scalar



B. Yes Metric  
Yes Scalar

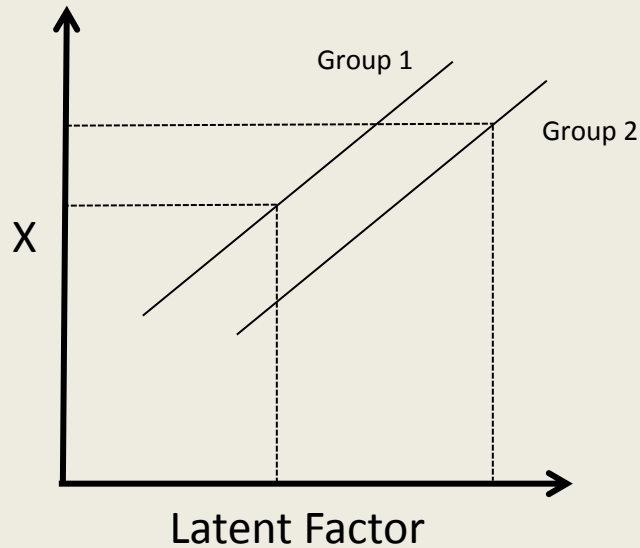


**A.** The factor loadings are the same, but intercepts are different across groups. Relationships between indicators and the latent factor are the same across groups. In example A, given the same level of the latent factor, members from group 2 have lower scores on the indicators than members from group 1.

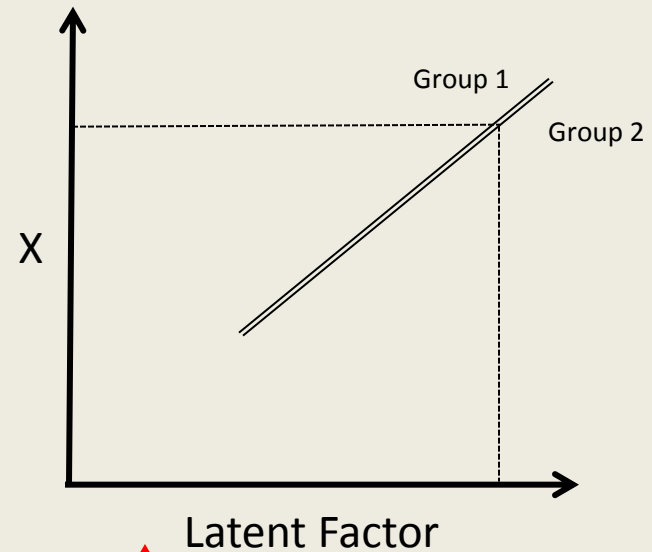


# Introduction

A. Yes Metric  
No Scalar



B. Yes Metric  
Yes Scalar



**B.** Both factor loadings and intercepts are the same across groups. Latent factor is measured in exactly the same way for both groups. Any between group mean difference on the indicators is because of the group difference in the latent factor.





# FY Engagement Indicators

## Student Faculty Interaction (alpha=.842)

<b>Factor loadings</b>	
fySFcareer	0.716
fySFothrwrk	0.776
fySFprform	0.847
fySFdiscuss	0.728
<b>Correlation of residuals</b>	
fySFprform with fySFothrwrk	-0.373

<b>Fix index</b>	
Chi-sqr	130.335
df	1
RMSEA	0.067
CFI	0.997
TLI	0.983



# FY Engagement Indicators

## Student Faculty Interaction (alpha=.842)

		RMSEA	CFI	TLI
Gender	Configural	0.065	0.997	0.984
	Metric	0.043	0.997	0.993
	Scalar	0.076	0.983	0.978
FG	Configural			
	Metric			
	Scalar			
Race	Configural			
	Metric			
	Scalar			
Grade	Configural			
	Metric			
	Scalar			
Carnegie	Configural			
	Metric			
	Scalar			
Control	Configural			
	Metric			
	Scalar			



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	Metric	0.042	0.997	0.993
	Scalar	0.048	0.993	0.991
Race	Configural			
	Metric			
	Scalar			
Grade	Configural			
	Metric			
	Scalar			
Carnegie	Configural			
	Metric			
	Scalar			
Control	Configural			
	Metric			
	Scalar			



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	Scalar	0.063	0.984	0.985
Grade	Configural			
	Metric			
	Scalar			
Carnegie	Configural			
	Metric			
	Scalar			
Control	Configural			
	Metric			
	Scalar			



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Race	Configural	0.067	0.997	0.983
	Metric	0.039	0.997	0.994
	Scalar	0.063	0.984	0.985
Grade	Configural	0.072	0.997	0.98
	Metric	0.049	0.996	0.991
	Scalar	0.090	0.976	0.969
Carnegie	Configural			
	Metric			
	Scalar			
Control	Configural			
	Metric			
	Scalar			



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	Metric	0.039	0.997	0.994
	Scalar	0.063	0.984	0.985
Grade	Configural	0.072	0.997	0.98
	Metric	0.049	0.996	0.991
	Scalar	0.090	0.976	0.969
Carnegie	Configural	0.069	0.997	0.982
	Metric	0.039	0.997	0.994
	Scalar	0.039	0.995	0.994
Control	Configural			
	Metric			
	Scalar			



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Grade	Configural	0.072	0.997	0.98
	Metric	0.049	0.996	0.991
	Scalar	0.090	0.976	0.969
Carnegie	Configural	0.069	0.997	0.982
	Metric	0.039	0.997	0.994
	Scalar	0.039	0.995	0.994
Control	Configural	0.071	0.997	0.981
	Metric	0.044	0.997	0.992
	Scalar	0.048	0.993	0.991



# FY Engagement Indicators

FY Engagement Indicator Scalar	Gender	First Gen	Ethnicity	Grades	Control	Carnegie
QR	✓✓	✓✓✓	✓✓✓		✓✓✓	✓✓✓
LS		✓✓✓	✓✓✓		✓✓✓	✓✓✓
CL	✓✓	✓✓✓	✓✓✓	✓✓	✓✓✓	✓✓✓
SFI	✓✓	✓✓✓	✓✓	✓✓	✓✓✓	✓✓✓





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QR	✓✓	✓✓✓	✓✓✓		✓✓✓	✓✓✓
LS		✓✓✓	✓✓✓		✓✓✓	✓✓✓
CL	✓✓	✓✓✓	✓✓✓	✓✓	✓✓✓	✓✓✓
SFI	✓✓	✓✓✓	✓✓	✓✓	✓✓✓	✓✓✓



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LS		✓✓✓	✓✓✓		✓✓✓	✓✓✓
CL	✓✓	✓✓✓	✓✓✓	✓✓	✓✓✓	✓✓✓
SFI	✓✓	✓✓✓	✓✓	✓✓	✓✓✓	✓✓✓



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LS		✓✓✓	✓✓✓		✓✓✓	✓✓✓
CL	✓✓	✓✓✓	✓✓✓	✓✓	✓✓✓	✓✓✓
SFI	✓✓	✓✓✓	✓✓	✓✓	✓✓✓	✓✓✓
IDO	✓✓✓	✓✓✓	✓✓	✓✓	✓✓✓	✓✓✓
EAP	✓✓	✓✓✓	✓✓✓	✓	✓✓✓	✓✓✓
EAD	✓✓	✓✓✓	✓✓✓		✓✓✓	✓✓✓
PAP	✓	✓✓✓	✓✓✓		✓✓✓	✓✓✓
ICE	✓✓	✓✓✓	✓✓✓		✓✓✓	✓✓✓



# Conclusion

- Overall FY EI's displayed good overall factor structure
- FY EI's also displayed good metric invariance (factor structure)
- FY EI's generally displayed good scalar invariance. However, grades was problematic with several of the EI's indicating that interpreting mean differences may be problematic.
- Need to investigate. Use institution reported SAT/ACT scores instead.
- Gender somewhat problematic, but generally ok



# Thank you!

Copy of this and past presentations can be found at:

[nsse.iub.edu/html/pubs.cfm](http://nsse.iub.edu/html/pubs.cfm)

Additional NSSE information can be found at:

[nsse.iub.edu/](http://nsse.iub.edu/)

Feel free to contact me with any questions regarding NSSE.

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