Contextualizing Student Engagement Effect Sizes: An Empirical Analysis

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Outline

- **Effect size review**
- **Interpreting effect sizes**
- **What is NSSE?**
- **Methods**
- **Results**
- **Conclusions**
- **Q & A**

What is an effect size?

- A statistic that quantifies the degree to which sample results diverge from the expectations specified in the null hypothesis (Cohen, 1994)

- Provides a measure of "practical significance" of a statistical result, whereas p-values indicate statistical significance

- Useful with abstract measurement indices (such as NSSE's Engagement Indicators)

We need more than statistical significance

- A lot of researchers do not know what the p-value actually means: probability of these data (or more extreme data) given that H_0 is true

- The $p<.001$ error

- Statistical significance evaluates sample size

- APA requires providing an effect size estimate when reporting a p-value.

Types of effect sizes

Kirk (1996), Rosnow & Rosenthal (2003) list three types of effect size measures:

1. **Measures of Differences**
   Ex.) Cohen's *d, h;* Hedge's *g;* Glass's *g*

   NSSE Institutional Reports use Cohen's *d* & *h*

2. **Strength of association (correlations)**
   Ex.) *r, r², µ², ω²*

3. **Other measures (ratios)**
   E.g., Odds ratio, Relative risk, Risk difference

Cohen's *d*

- **Divides the mean difference between two groups by the pooled standard deviation**

$$d = \frac{\overline{X_1} - \overline{X_2}}{\sqrt{\dfrac{(n_1 - 1)s_1 + (n_2 - 1)s_2}{n_1 + n_2 - 2}}}$$

Cohen's *h*

- **Difference between arcsine transformed proportions**

$$\mathbf{h} = (2\,\sin^{-1}\sqrt{\mathbf{P_1}}) - (2\,\sin^{-1}\sqrt{\mathbf{P_2}})$$

- **Why an arcsine transformation? To make the proportions comparable in the sense of having variances independent of the parameter**

$$VAR(p) = \frac{(p)(1-p)}{n}$$

Interpreting effect sizes

- **Context matters:** Reporting and interpreting effect sizes in the context of previously reported effects is essential (APA, 1999).

- **Cohen's rules of thumb (reluctantly provided)**
  .2 = small effect
  .5 = medium effect
  .8 = large effect

- **Despite caveats, Cohen's rules of thumb are widely used**

Context matters

- **McCartney & Rosenthal (2000) note that in research involving hard to change outcomes, such as the incidence of heart attacks, the largest effect size found was below .20. However, those "small" effects correspond to reducing the incidence heart attacks by about half, an enormous practical significance.**

- **Ellis (2010) found that around two-thirds of effect sizes reported in international business were small ($r < .30$).**

- **Hill, et al. (2008) summarized average effect sizes for educational intervention research and found an average effect size of .33 in elementary school, .51 for middle school, and .27 for high school.**

- **Lipsey et al. (2012) found effect sizes investigating academic performance on standardized reading and mathematics achievement tests to rarely be as large as .30.**

What is NSSE?

- **National Survey of Student Engagement**

  - **NSSE gives a snapshot of college student experiences in and outside of the classroom**
  - **NSSE items represent good practices related to desirable college outcomes**
  - **Indirect, process measures of student learning and development**

Engagement Indicators

- **Higher-Order Learning**
- **Reflective & Integrative Learning**
- **Learning Strategies**
- **Quantitative Reasoning**
- **Collaborative Learning**
- **Discussions with Diverse Others**
- **Student-Faculty Interaction**
- **Effective Teaching Practices**
- **Quality of Interactions**
- **Supportive Environment**

High-Impact Practices

- **Learning Community**
- **Service-Learning**
- **Research with Faculty**
- **Internship or Field Experience**
- **Study Abroad**
- **Culminating Senior Experience**

Purpose & Research Questions

The purpose of this study is to examine the distribution of statistical comparisons and their effects between institutions and their comparison groups using measures from NSSE, and to make recommendations for the interpretation of effect sizes from engagement results.

1. **How do the effect sizes from NSSE institutional comparisons distribute within Cohen's small, medium, and large ranges?**

2. **Is it possible to derive more useful effect size cut points that fit the context of institutional engagement results?**

Data

- **2013 & 2014 administrations of NSSE**

- **984 U.S. institutions**

- **More than 580,000 students**

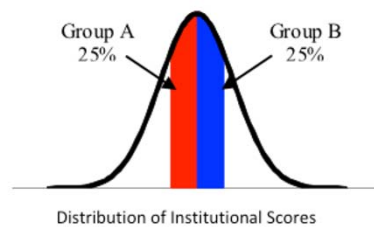- **Comparisons with the entire 2013 & 2014 cohort**

Methods

Effects of various sizes were modeled using actual distribution of NSSE institutional means, done in two stages:
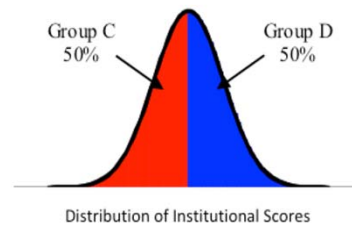
1. **Institution-level distribution to establish percentile groupings**

2. **Student-level effect size calculations**
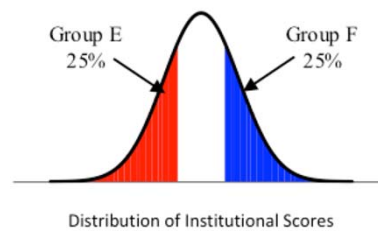
Methods

Small

Group A
25%

Group B
25%

Distribution of Institutional Scores

Medium

Group C
50%

Group D
50%

Distribution of Institutional Scores

Large

Group E
25%

Group F
25%

Distribution of Institutional Scores

Frequency of NSSE Effect Sizes by Cohen's Ranges

	Trivial ES < |.2|		Small |.2| ≤ ES < |.5|		Medium |.5| ≤ ES < |.8|		Large ES ≥ |.8|	
	FY	SR	FY	SR	FY	SR	FY	SR
HO	72%	75%	26%	23%	1%	1%	<1%	<1%
RI	71%	68%	26%	28%	2%	3%	<1%	1%
LS	75%	66%	22%	33%	2%	1%	<1%	<1%
QR	76%	79%	20%	18%	2%	2%	1%	<1%
CL	64%	58%	30%	35%	4%	5%	2%	2%
DD	61%	63%	34%	33%	4%	3%	<1%	1%
SF	60%	41%	33%	39%	6%	16%	1%	4%
ET	68%	71%	30%	27%	1%	2%	<1%	<1%
QI	59%	59%	37%	37%	2%	4%	<1%	0%
SE	61%	55%	34%	38%	4%	6%	<1%	<1%
Lrn Com	57%	69%	38%	26%	3%	3%	1%	1%
Serv-Lrn	47%	46%	36%	36%	11%	13%	6%	5%
Res w/Fac	84%	55%	15%	32%	1%	11%	0%	2%
Intern	--	43%	--	38%	--	15%	--	4%
Study Ab	--	40%	--	43%	--	10%	--	7%
SR Cap	--	36%	--	36%	--	17%	--	10%

Effect sizes from percentile group comparisons

	First-year			Senior		
	Small	Medium	Large	Small	Medium	Large
HO	0.09	0.22	0.37	0.10	0.25	0.36
RI	0.11	0.26	0.39	0.10	0.27	0.41
LS	0.09	0.23	0.35	0.08	0.20	0.31
QR	0.09	0.24	0.35	0.11	0.30	0.47
CL	0.13	0.36	0.55	0.12	0.38	0.59
DD	0.13	0.33	0.50	0.12	0.32	0.51
SF	0.12	0.34	0.54	0.19	0.49	0.74
ET	0.10	0.28	0.41	0.09	0.25	0.37
QI	0.14	0.32	0.46	0.13	0.36	0.52
SE	0.12	0.31	0.49	0.14	0.34	0.53
Minimum d	0.09	0.22	0.35	0.08	0.20	0.31
Maximum d	0.14	0.36	0.55	0.19	0.49	0.74
Average d	0.11	0.29	0.44	0.12	0.32	0.48

Effect sizes from percentile group comparisons

	First-year			Senior		
	Small	Medium	Large	Small	Medium	Large
Learning Community	0.10	0.35	0.51	0.10	0.29	0.43
Service-Learning	0.18	0.43	0.73	0.17	0.43	0.69
Research with Faculty	0.06	0.17	0.25	0.16	0.41	0.61
Internship	--	--	--	0.20	0.50	0.76
Study Abroad	--	--	--	0.20	0.50	0.78
Senior Capstone	--	--	--	0.25	0.60	0.92
Minimum h	0.06	0.17	0.25	0.10	0.29	0.43
Maximum h	0.18	0.43	0.73	0.25	0.60	0.92
Average h	0.11	0.31	0.50	0.18	0.46	0.70

Proposed reference values

	d range	h range*
Small	≥ .1	≥ .2
Medium	≥ .3	≥ .5
Large	≥ .5	≥ .8

* Particularly for Service-Learning, Internship, Study Abroad, and Capstone

Frequency of effect sizes using proposed references

	Trivial		Small		Medium		Large	
	ES ≤ |.1|		|.1| < ES ≤ |.3|		|.3| < ES ≤ |.5|		ES > |.5|	
	FY	SR	FY	SR	FY	SR	FY	SR
HO	45%	46%	44%	45%	9%	8%	1%	1%
RI	40%	40%	47%	44%	11%	12%	2%	4%
LS	44%	38%	46%	46%	8%	15%	2%	1%
QR	47%	49%	42%	41%	8%	7%	3%	3%
CL	34%	30%	46%	48%	14%	14%	5%	7%
DD	33%	35%	47%	47%	15%	14%	4%	4%
SF	33%	23%	43%	34%	17%	23%	6%	20%
ET	38%	41%	48%	46%	12%	11%	1%	2%
QI	34%	30%	46%	48%	16%	18%	3%	4%
SE	36%	30%	45%	46%	15%	18%	4%	6%

Conclusions

- **Cohen's rules of thumb do not adequately classify effect sizes for NSSE Engagement Indicator comparisons**

- **The proposed thresholds of .1, .3, .5 for Engagement Indicators and .2, .5, .8 for High-Impact Practices are grounded in actual NSSE data and allow for refined interpretations of NSSE results**

- **Contextualizing effect sizes in normative data appears to be useful and appropriate for interpreting effect sizes in the context of student engagement**

Questions & Contact Info

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