Measuring Deep Approaches to Learning Using the National Survey of Student Engagement

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Deep Learning

- Students who utilize “deep-level processing” focus not only on the substance but also the underlying meaning of information, taking them to deeper levels of understanding and meaning than simple rote memorization.

- Deep approaches to learning have been associated with numerous positive outcomes including higher grades, and the ability to retain, integrate and transfer information at higher rates, not to mention greater satisfaction with the learning experience.

- Several measures assess deep approaches to learning, but these are intensive instruments generally used on a small scale. A NSSE deep learning measure could provide a general assessment for a campus.
To examine the factor structure underlying NSSE items who appear to tap deep approaches to learning

Exploratory factor analysis using 2004 data: identify factors, assess reliability and determine inter-factor relationships

Confirmatory factor analysis using 2005 data: propose a model identifying the factor structure and examine its fit
Data Sources

- National Survey of Student Engagement (NSSE)
- 2004 and 2005 administrations
- Annual survey of college students at four-year institutions that measures students’ participation in educational experiences that prior research has connected to valued outcomes
- In 2004, NSSE tested items on reflective learning, a component of deep learning that compliments items on the core survey, with those students who took the survey online
- In 2005, NSSE added three of the reflective items to the core survey
2004 Sample

Over 110,000 first-year and senior students from 450 four-year institutions

- 63% female
- 31% first generation
- 52% live on campus
- 93% full-time students
- 81% are white
- 53% first-year students
- 5% African American
- 5% Asian
- 3% Hispanic
- 1% Native American
- < 1% other racial/ethnic background
- 5% multi-racial or ethnic

Compared to paper completers, web completers are more likely to be...

- Male
- White or Asian American
- Younger
- Full-time
- Living on campus
- Students with higher parental education
- Transfer students
2004 Measures

- **Deep Learning Scale**
  (Combination of 3 sub-scales below; \( \alpha = .77 \))

- **Deep Learning Sub-Scales**
  - **Higher-order learning** (4-items; \( \alpha = .82 \))
  - **Integrative learning** (5-items; \( \alpha = .71 \))
  - **Reflective learning** (6-items; \( \alpha = .89 \))
2004 Analyses

- **Exploratory factor analysis** *(SPSS)*
  - Principles components analysis
  - Oblique rotation *(Oblimin with Kaiser normalization)*
**Exploratory Factor Analysis**

**Structure and pattern matrices, pattern loadings in parentheses**

<table>
<thead>
<tr>
<th>Items</th>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Factor 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Higher Order Learning</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HL1</td>
<td></td>
<td>.80 (.80)</td>
<td></td>
</tr>
<tr>
<td>HL2</td>
<td></td>
<td>.83 (.79)</td>
<td></td>
</tr>
<tr>
<td>HL3</td>
<td></td>
<td>.78 (.76)</td>
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</tr>
<tr>
<td>HL4</td>
<td></td>
<td>.79 (.81)</td>
<td></td>
</tr>
<tr>
<td><strong>Integrative Learning</strong></td>
<td></td>
<td>.72 (.75)</td>
<td></td>
</tr>
<tr>
<td>IL1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IL2</td>
<td></td>
<td>.69 (.70)</td>
<td></td>
</tr>
<tr>
<td>IL3</td>
<td></td>
<td>.69 (.66)</td>
<td></td>
</tr>
<tr>
<td>IL4</td>
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<td>.66 (.66)</td>
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</tr>
<tr>
<td>IL5</td>
<td></td>
<td>.64 (.53)</td>
<td></td>
</tr>
<tr>
<td><strong>Reflective Learning</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RL1</td>
<td>.85 (.86)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RL2</td>
<td>.83 (.85)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RL3</td>
<td>.84 (.86)</td>
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<tr>
<td>RL4</td>
<td>.80 (.79)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RL5</td>
<td>.77 (.70)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RL6</td>
<td>.73 (.65)</td>
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</tbody>
</table>

| Percent Variance Explained   | 40.99    | 10.95    | 6.96     |
- Three factors have eigenvalues exceeding 1.0
- These factors explain nearly 60% of the item variance
- Factor loadings are relatively strong, with no substantial cross-loadings
- The internal consistency of the three item groupings is good
- The three factors are moderately correlated
2005 Sample

Over 40,000 first-year and senior students from 519 four-year institutions

- 65% female
- 31% first generation
- 52% live on campus
- 91% full-time students
- 71% are white
- 51% first-year students
- 7% African American
- 5% Asian
- 5% Hispanic
- 1% Native American
- < 1% other racial/ethnic background
- 6% multi-racial or ethnic

In order to run the confirmatory analyses, the overall 2005 sample of 209,834 respondents was reduced to 41,966
2005 Measures

- **Deep Learning Scale**
  (Combination of 3 sub-scales below; $\alpha = .73$)

- **Deep Learning Sub-Scales**
  - **Higher-order learning** (4-items; $\alpha(04) = .82$, $\alpha(05) = .82$)
  - **Integrative learning** (5-items; $\alpha(04) = .71$, $\alpha(05) = .71$)
  - **Reflective learning** (3-items*; $\alpha(04) = .89$, $\alpha(05) = .81$)

*Reflective learning = three top loading items from 2004
2005 Analyses

- **Confirmatory factor analysis** (EQS 6.1)
  - Proposed model compared to two other plausible models
  - Follows guidelines proposed by Raykov, Tomer, and Nessleroade (1991) as well as Boomsma (2000)
  - Goodness of fit measures: Normed Fit Index (NFI), non-normed fit index (NNFI), comparative fit index (CFI), and root mean square error of approximation (RMSEA)
Second-Order Factor Model
Alternative Models

Single Factor Model

Correlated Three Factor Model
## Summary of fit indices

<table>
<thead>
<tr>
<th>Model</th>
<th>$\chi^2$</th>
<th>df</th>
<th>NFI</th>
<th>NNFI</th>
<th>CFI</th>
<th>RMSEA</th>
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<tbody>
<tr>
<td>Single Factor</td>
<td>52,596.72</td>
<td>55</td>
<td>.71</td>
<td>.65</td>
<td>.71</td>
<td>.14</td>
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<tr>
<td>Second-Order Factor</td>
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<td>52</td>
<td>.97</td>
<td>.96</td>
<td>.97</td>
<td>.05</td>
</tr>
<tr>
<td>Correlated Three Factor</td>
<td>5,164.58</td>
<td>51</td>
<td>.97</td>
<td>.96</td>
<td>.97</td>
<td>.05</td>
</tr>
</tbody>
</table>

N = 41,966  
Note: NFI = normed fit index; NNFI = non-normed fit index; CFI = comparative fit index; RMSEA = root mean square error of approximation. All $\chi^2$ probabilities < .001.
Implications

- Deep learning processes are an important component of any postsecondary learning context.

- Our results suggest that NSSE contains a reliable measure of students’ uses of deep approaches to learning with three subscales: higher-order learning, integrative learning, and reflective learning.

- Although our measure is not intended as a replacement for other, more in-depth measures of deep learning; it serves as a quick way to address this important concept in a survey that reaches a substantial number of college students every year.
For More Information

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NSSE website: http://www.nsse.iub.edu/

Copies of the paper and presentation as well as other papers and presentations are available through the website
Students were asked how much (1 = Very little to 4 = Very much) their coursework emphasized the following:

- Analyzed the basic elements of an idea, experience, or theory, such as examining a particular case or situation in depth and considering its components?
- Synthesized and organized ideas, information, or experiences into new, more complex interpretations and relationships?
- Made judgments about the value of information, arguments, or methods, such as examining how others gathered and interpreted data and assessing the soundness of their conclusions?
- Applied theories or concepts to practical problems or in new situations?
Deep Learning Items: Integrative Learning

- Students were asked how often (1 = Never to 4 = Very often) they did the following during the current school year:
  - Worked on a paper or project that required integrating ideas or information from various sources?
  - Included diverse perspectives (different races, religions, genders, political beliefs, etc.) in class discussions or writing assignments?
  - Put together ideas or concepts from different courses when completing assignments or during class discussions?
  - Discussed ideas from your readings or classes with faculty members outside of class?
  - Discussed ideas from your readings or classes with others outside of class (students, family members, co-workers, etc.)?
Deep Learning Items: Reflective Learning

- Students were asked how often (1 = Never to 4 = Very often) they did the following during the current school year (the first three items were added to the core survey for the 2005 NSSE administration):
  - Learned something from discussing questions that have no clear answers?
  - Examined the strengths and weaknesses of your own views on a topic or issue?
  - Tried to better understand someone else's views by imagining how an issue looks from his or her perspective?
  - Learned something that changed the way you understand an issue or concept?
  - Applied what you learned in a course to your personal life or work?
  - Enjoyed completing a task that required a lot of thinking and mental effort?