Psychosocial Scales as Operational Predictors of Academic Success

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What’s up with the First Year Survey (FYSS)?

- Each Summer/Fall, IR surveys the incoming cohort of undergrads.
- In the past, the FYSS was used to **track trends** and **analyzed** for statistical relationships with academic outcomes.
- In 2015 interest shifted to individual student **prediction** and **intervention**.
- Psychometric scale methods developed in educational psychology such as Grit and Self Efficacy have been used elsewhere to some success.
Belonging

Adapted from School Belonging Scale and Sense of Social and Academic Fit Scale. Scales were both retrospective (high school experiences) and prospective (think forward to college).

Continue thinking about your *last two years of high school* as you read the statements below. Select the answer that best represents your experience.

<table>
<thead>
<tr>
<th>Disagree</th>
<th>Somewhat disagree</th>
<th>Somewhat agree</th>
<th>Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>I mattered to others at my high school.</strong></td>
<td><img src="image" alt="Circle" /></td>
<td><img src="image" alt="Circle" /></td>
<td><img src="image" alt="Circle" /></td>
</tr>
<tr>
<td><strong>The students at my school showed me respect.</strong></td>
<td><img src="image" alt="Circle" /></td>
<td><img src="image" alt="Circle" /></td>
<td><img src="image" alt="Circle" /></td>
</tr>
</tbody>
</table>
Academic Self-Efficacy

Adapted from the MSLQ and the University of Chicago CCSR. Domain specific questions were developed to differentiate humanities vs. quantitative coursework.

Thinking about your study habits during the last two years of high school, about how often did you do the following?

<table>
<thead>
<tr>
<th>Activity</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>I made sure I kept up with weekly readings and assignments.</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>I summarized what I learned in class.</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
</tbody>
</table>
For the next two questions:

- **Quantitative classes** include subjects such as science, technology, math, and engineering.
- **Humanities classes** include subjects such as writing, literature, languages, history, art, and philosophy.

In regards to your **academic work in college**, how confident are you that you can do the following tasks in your **quantitative classes**?

<table>
<thead>
<tr>
<th>Task</th>
<th>Not at all confident</th>
<th>Somewhat confident</th>
<th>Mostly confident</th>
<th>Completely confident</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understand the most difficult concepts taught in my <strong>quantitative</strong> classes.</td>
<td>![Circle]</td>
<td>![Circle]</td>
<td>![Circle]</td>
<td>![Circle]</td>
</tr>
<tr>
<td>Master the skills taught in my <strong>quantitative</strong> classes.</td>
<td>![Circle]</td>
<td>![Circle]</td>
<td>![Circle]</td>
<td>![Circle]</td>
</tr>
</tbody>
</table>
Self Efficacy for College Navigation

Focuses on non-academic challenges such as socializing, planning a degree program, finding help, and finances.

In regards to navigating college life, how confident are you that you can do the following tasks?

<table>
<thead>
<tr>
<th>Maintain good relationships with my family while I am away at school.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all confident</td>
</tr>
<tr>
<td>O</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Seek out help from advisors or others on campus if I am having trouble adjusting to college.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all confident</td>
</tr>
<tr>
<td>O</td>
</tr>
</tbody>
</table>
Academic Capital

Detects influences in family, community, and peer relationships that either facilitate or impede adaptation to college.

For each statement below, select the answer that best represents your beliefs and experiences.

I have people in my life who support my decision to attend college.

Disagree  Somewhat Disagree  Somewhat Agree  Agree

I have family members who attend or have attended college.
Grit

Used to measure traits like persistence and perseverance.

Mark the choice that best represents your belief. Again, there are no right or wrong answers.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Disagree</th>
<th>Somewhat Disagree</th>
<th>Somewhat Agree</th>
<th>Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setbacks don’t discourage me.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I finish whatever I begin.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am a hard worker.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am diligent.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Intelligence Mindset

Based on research indicating students who believe abilities can be developed perform better than those who believe their abilities are not malleable.
Intelligence Mindset

Read each statement below regarding your perception of *math ability*.

Mark the choice that best represents your belief. Again, there are no right or wrong answers.

<table>
<thead>
<tr>
<th>Disagree</th>
<th>Somewhat Disagree</th>
<th>Somewhat Agree</th>
<th>Agree</th>
</tr>
</thead>
</table>

People's *math ability* is something about them that they can't change very much.

- [ ]
- [ ]
- [ ]
- [ ]

People have a certain amount of *math ability* and they really can't do much to change it.

- [ ]
- [ ]
- [ ]
- [ ]
Other custom question sets covering topics such as personal or family crises, intended work hours, intention to complete higher degrees, and frequency of intended visits home.

How many of your close friends will be attending college (at any college)?

- None
- Some
- Most
- Almost all
Are you or any of your family members or close friends currently experiencing any of the following?
Please select all that apply.

Who is experiencing this issue?

You

- Serious financial difficulties
  - [ ]

- Serious problem or crisis involving a close friend or family member
  - [ ]

Family member or close friend

- [ ]
- [ ]
About how many hours per week do you want to be employed during your first semester?

<table>
<thead>
<tr>
<th>Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undecided</td>
</tr>
<tr>
<td>0 hours or only occasional jobs</td>
</tr>
<tr>
<td>1-5 hours</td>
</tr>
<tr>
<td>6-10 hours</td>
</tr>
<tr>
<td>11-15 hours</td>
</tr>
<tr>
<td>16-20 hours</td>
</tr>
<tr>
<td>More than 20 hours</td>
</tr>
</tbody>
</table>
Goals of this Analysis

- The primary goal was to assess whether, and to what degree, predictive models of retention and GPA including survey variables ("survey model") out-perform those without access to survey variables ("null model").
- Analysis is ongoing.
- In July, update the 2017 survey, iterate.
- If and when the survey is good enough, make it mandatory.
- If not, kill it (or at least shorten it!).
These instruments are not clearly distinct!

WEB OF MEANING

SE for College
Nav
Belonging
Academic SE
Grit

Assorted one-offs
Academic Capital
Intelligence Mindset
Other Variables Used: Outcomes

- **RETENTION_FALL_2017**: Indicating that the student has enrolled in their 2nd fall term.
- **SPRING_2017_CUMULATIVE_GPA**: The student’s cumulative grade point average through their first two major terms.
- **GRADE**: The grade in each class during the 2016-17 academic year, on a four point scale.
Other Variables Used: Predictors (Admissions Variables)

- **HS_GPA**: Weighted grade point average from last attended high school.
- **ACT/SAT**: The students maximum composite ACT score, coalesced with converted SAT.
- **UNMET_NEED**: Total tuition, housing and fees, minus expected family contribution and financial aid, in their cohort term. UNMET_NEED is imputed as $0 when FAFSA data is missing.
- **ON_CAMPUS**: The student lived in on-campus housing in their cohort term.
- **KY_RESIDENT**: The student’s permanent address is in Kentucky.
- **FIRST_GEN**: Indicates that neither parent attended a post-secondary institution. This data is collected on the student’s admissions application.
Factor Analysis!

- Let’s leave formal factor analysis for another day.

30 = 2*3*5
Data Reduction Methods

- **Correlate** all 73 question items with dependents
  - Retention (Kendall’s τ)
  - Grades (Pearson’s $r$)
- **Cut off** at $|r$ or $\tau| > 0.05$ (pretty low!)
  - About 10% of correlations were above 0.10
  - p-values are all < 0.05
- Conceptually **group** the remaining questions
- Reverse-code questions that correlate negatively
- Standardize and **average** the grouped items.
Data Reduction Methods

- 8 resulting groups:
  - **Belonging** (6 retention / 2 GPA): “I feel confident that I will belong in college.”
  - **No-crisis** (1/1): “Serious problem or crisis involving a close friend or family member: You”
  - **Financial** (2/2): “Serious financial difficulties: You”
  - **Grit** (0/1): “I am a hard worker”
Data Reduction Methods

- **Home** (0/1): “How often do you plan to go home on the weekends during your first semester?”
- **Generation** (3/4): “I have family members who attend or have attended college.”
- **Ties** (6/4): “How many of your close friends will be attending college (at any college)?”
- **Study** (2/6): “I made sure I kept up with weekly readings and assignments.”
Modeling Methods

- Logistic Regression for Retention
- “Good Ole” Regression for GPA
- Genetic algorithm used for model optimization
  - Based on Bayesian Information Criterion, but still prone to overfitting
  - Faster than exhaustive search
  - Allows up to 2-way interaction
- All analysis performed in R
And what comes of all this mysterious magic?!
(Preliminary) Results!
Comparison of Logistic Regression Models of Retention Excluding and Including Survey Factors

<table>
<thead>
<tr>
<th></th>
<th>Null Model</th>
<th>Survey Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nagelkerke $R^2$</td>
<td>18.4%</td>
<td>24.7%</td>
</tr>
<tr>
<td>AUC</td>
<td>75.6%</td>
<td>79.2%</td>
</tr>
</tbody>
</table>
## Comparison of Regression Models of GPA Excluding and Including Survey Factors

<table>
<thead>
<tr>
<th></th>
<th>Null Model</th>
<th>Survey Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R^2$</td>
<td>32.2%</td>
<td>36.7%</td>
</tr>
<tr>
<td>Adj. $R^2$</td>
<td>32.0%</td>
<td>36.3%</td>
</tr>
</tbody>
</table>
### Survey Variables Increase Model Accuracy

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Criterion</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retention</td>
<td>Nagelkerke R2</td>
<td>34%</td>
</tr>
<tr>
<td></td>
<td>AUC</td>
<td>14%</td>
</tr>
<tr>
<td>GPA</td>
<td>Adjusted R2</td>
<td>13%</td>
</tr>
</tbody>
</table>

10% 20% 30% 40% % increase with FYSS
HS_GPA is King
Admissions Variables for Retention (null model)

- HS_GPA (++)
- UNMET_NEED (--)
- FIRST_GEN magnifies the effect of HS_GPA (+interaction)
Admissions Variables for GPA (null model)

- HS_GPA (++)
- ACT (+)
- FIRST_GEN (-)
- KY_RESIDENT (-)
- UNMET_NEED negatively moderates the effect of ACT (- interaction)
Survey Variables for Retention

- *Belonging (+)*
- *No-Crisis (+)*
- *Financial and generation* mitigate the negative effect of UNMET_NEED
- (If you are OFF-CAMPUS, UNMET_NEED has less of an effect.)
Survey Variables for GPA

- **Financial (+)**
- **Generation (+)**
- **Ties (+)**
- **Work (+)**
- All are small effects
Survey Variables for GPA

● “Crisis” increases the effect of ACT while reducing that of HS_GPA.

● Lack of Grit magnifies the negative effect of low ACT scores // Grit magnifies the effect of ACT scores

● ACT is negatively moderated by Work
Example Policy Recommendations

- If the survey is to be used for interventions:
  - We need **good coverage** for interventions to be fair. Survey should be **mandatory** (with opt-out at the question level), perhaps linked to a hold or other penalty. Outreach should be incorporated into onboarding activities such as Summer Advising Conferences and K Week.
  - **Privacy** and data use policies should be clearly communicated to students. Potential benefits of participation should not be over-sold. Aggregate results from past years should be **shared** with students.
Example Policy Recommendations

- **Note:** Intervention policies should be formed in **cooperation** with relevant administrative units.

- **Financial:** Student scores are shared with the Financial Ombud. Interventions might include financial counseling or hardship loans and scholarships.

- **Crisis:** With consent, students are referred to Counseling Services or Resident Advisors.
Example Policy Recommendations

- **Generation and Ties:** Student scores are shared with the Office of First Generation Initiatives. Students with low values are targeted for additional orientation and networking activities such as special sections of UK 101.

- **Belonging:** With consent, students are referred to Counseling Services or Resident Advisors. They can also be targeted for social skills classes, peer mentoring, or consultation with Office of Student Organizations and Activities.
Example Policy Recommendations

- **Study**: Students with low values of are preferentially targeted for tutoring, study skills classes, and UK 101.
- **Work**: Students with high values are referred to Student Employment, and be provided with networking opportunities with local employers.
Slops

● Left “Work” question out of retention analysis, by accident.
● A couple typos in the poster.


References


Future Work (Oh July!)

- Contact some peer institutions (Iowa, UIC)
- Revise methodology
  - Take a more formal factor analysis approach (Chronbach’s $\alpha$, etc.)
  - Look at other classical techniques
    - Alternatives to OLS regression
    - Polynomial terms, transformations
  - Use cross-validation in optimization algorithms
  - Let linear models compete with random forests
- Improve translation of results (odds ratios, confusion matrix, marginal means, workbook of descriptives)
- Extend institutional data (add more predictors such as gender, AP credits, engagement data)
- Get the 2017 FYSS ready!!!
Acknowledgements

Many thanks to

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- Kathryn Wong for project management
- Virginia Lacefield for just about everything
- The AA team for data flowing through ODBC
- Dr. Craig Rudick for letting us spend so much effort on a survey!