Psychosocial Scales as Operational Predictors of Academic Success

Adam Lindstrom and Dr. Jason Chen

Institutional Research and Advanced Analytics

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.

Institutional Research and Advanced Analytics

see blue.

qualtrics

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.

	Disagree	Somewhat disagree	Somewhat agree	Agree
I mattered to others at my high school.	O	O	O	O
The students at my school showed me respect.	O	O	O	O

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?

	Rarely	Sometimes	Often	Always
I made sure I kept up with weekly readings and assignments.	○	○	○	○
I summarized what I learned in class.	○	○	○	○

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**?

	Not at all confident	Somewhat confident	Mostly confident	Completely confident
Understand the most difficult concepts taught in my *quantitative* classes.	O	O	O	O
Master the skills taught in my *quantitative* classes.	O	O	O	O

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?

	Not at all confident	Somewhat confident	Mostly confident	Completely confident
Maintain good relationships with my family while I am away at school.	O	O	O	O
Seek out help from advisors or others on campus if I am having trouble adjusting to college.	O	O	O	O

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.

	Disagree	Somewhat Disagree	Somewhat Agree	Agree
I have people in my life who support my decision to attend college.	O	O	O	O
I have family members who attend or have attended college.	O	O	O	O

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.

	Disagree	Somewhat Disagree	Somewhat Agree	Agree
Setbacks don't discourage me.	O	O	O	O
I finish whatever I begin.	O	O	O	O
I am a hard worker.	O	O	O	O
I am diligent.	O	O	O	O

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.

	Disagree	Somewhat Disagree	Somewhat Agree	Agree
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.	○	○	○	○

Institutional Research and Advanced Analytics

see blue.

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	Family member or close friend
Serious financial difficulties	☐	☐
Serious problem or crisis involving a close friend or family member	☐	☐

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

Undecided

0 hours or only occasional jobs

1-5 hours

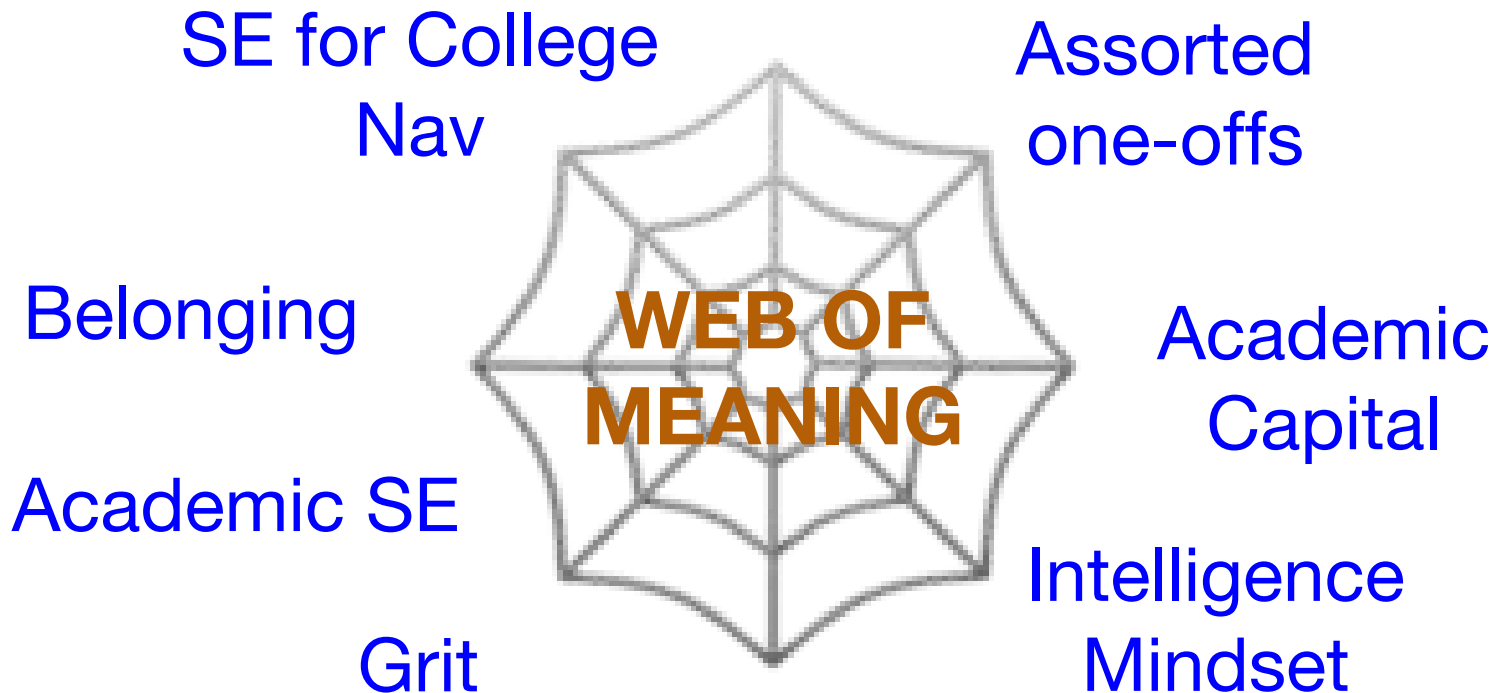6-10 hours

11-15 hours

16-20 hours

More than 20 hours

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!

SE for College Nav

Assorted one-offs

Belonging

WEB OF MEANING

Academic Capital

Academic SE

Grit

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.
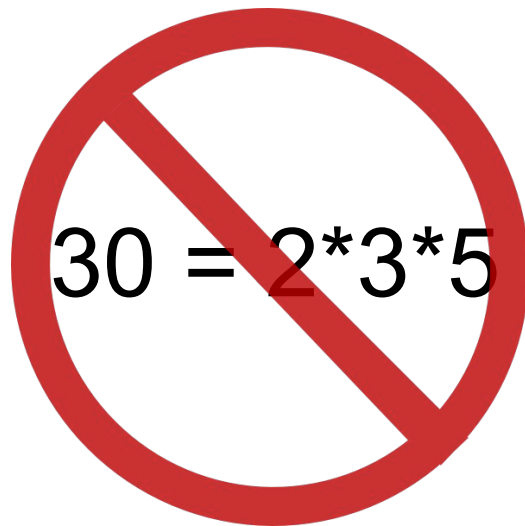
Other Variables Used: Predictors
(Admissions Variables)

- **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 τ]| > 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

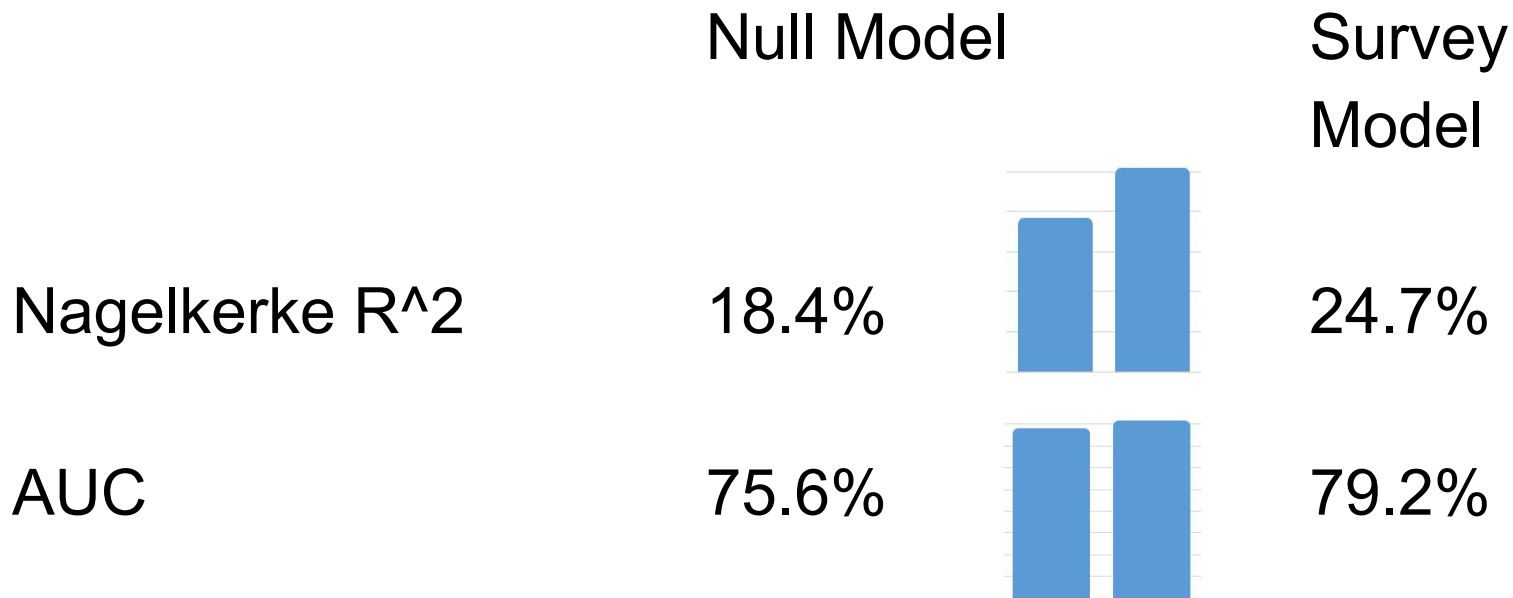 - Allows up to 2-way interaction

- All analysis performed in R
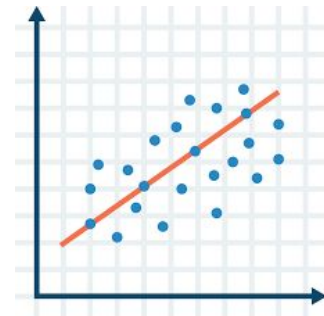
And what comes of all this mysterious magic?!
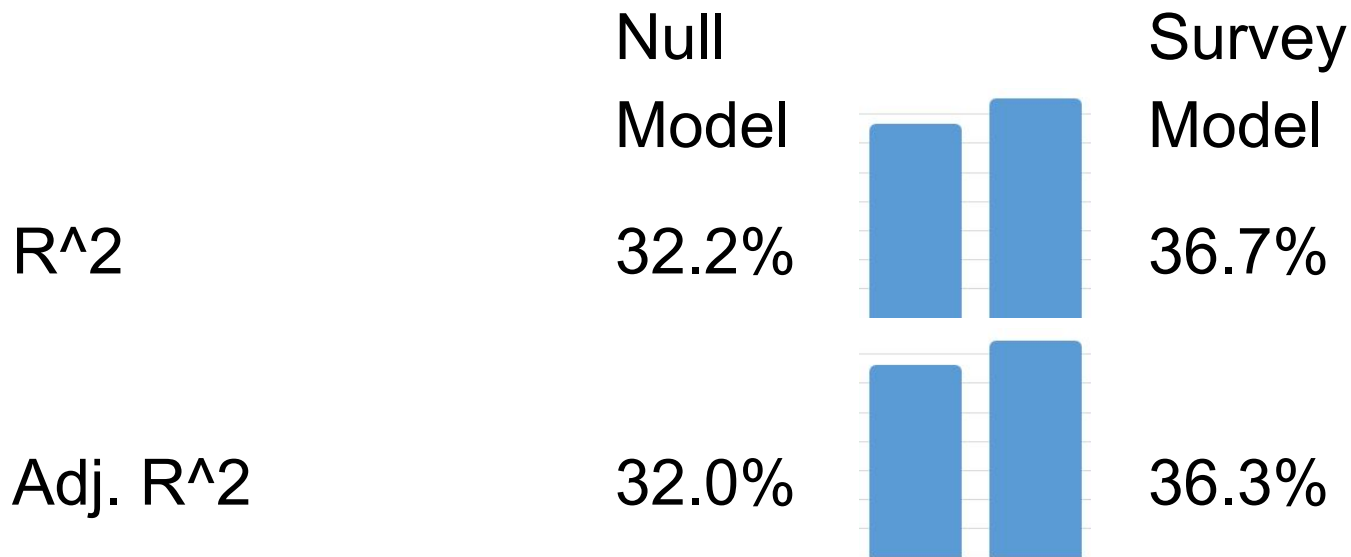
(Preliminary) Results!

Comparison of Logistic Regression Models of Retention Excluding and Including Survey Factors

	Null Model		Survey Model
Nagelkerke R^2	18.4%		24.7%
AUC	75.6%		79.2%

Comparison of Regression Models of GPA Excluding and Including Survey Factors

	Null Model	Survey Model
R^2	32.2%	36.7%
Adj. R^2	32.0%	36.3%

Survey Variables Increase Model Accuracy

Outcome	Criterion		
Retention	Nagelkerke R2		34%
	AUC		14%
GPA	Adjusted R2		13%

10% 20% 30% 40%

% increase with FYSS
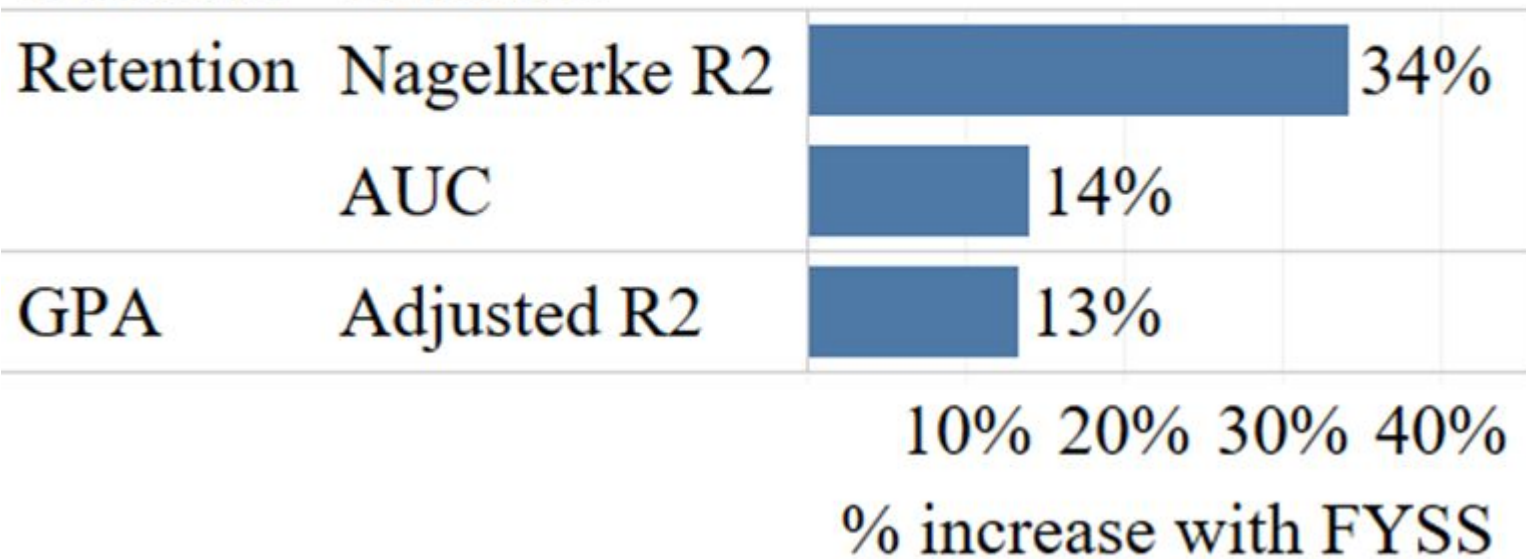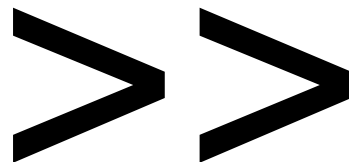
HS_GPA is King

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

Bandura, A. (1997). Self-efficacy: The exercise of control. Macmillan.

Calcagno, V., & de Mazancourt, C. (2010). glmulti: an R package for easy automated model selection with (generalized) linear models. *Journal of statistical software*, *34*(12), 1-29.

Duckworth, A. L., & Quinn, P. D. (2009). Development and validation of the Short Grit Scale (GRIT–S). *Journal of personality assessment*, *91*(2), 166-174.

Dweck, C. S., & Sorich, L. (1999). Mastery-oriented thinking. *Coping*, *11*, 232-251.

Farrington, C. A., Roderick, M., Allensworth, E., Nagaoka, J., Keyes, T. S., Johnson, D. W., & Beechum, N. O. (2012). Teaching Adolescents to Become Learners: The Role of Noncognitive Factors in Shaping School Performance--A Critical Literature Review. Consortium on Chicago School Research. 1313 East 60th Street, Chicago, IL 60637.

Gibbons, MM (2005). College-Going Beliefs of Prospective FirstGeneration College Students: Perceived Barriers, Social Supports, Self-Efficacy, and Outcome Expectations. *Dissertation*, University of North Carolina at Greensboro

References

Nagaoka, J., Farrington, C. A., Roderick, M., Allensworth, E., Keyes, T. S., Johnson, D. W., & Beechum, N. O. (2013). Readiness for College: The Role of Noncognitive Factors and Context. *Voices in Urban Education*, 38, 45-52.

NSSE - National Survey of Student Engagement. (n.d.). Retrieved June 01, 2016, from http://nsse.indiana.edu/

Pintrich, P. R. (1991). A manual for the use of the Motivated Strategies for Learning Questionnaire (MSLQ).

Solberg, V. S., O'Brien, K., Villareal, P., Kennel, R., & Davis, B. (1993). Self-efficacy and Hispanic college students: Validation of the college self-efficacy instrument. *Hispanic journal of behavioral sciences*, 15(1), 80-95.

Walton, G. M., & Cohen, G. L. (2007). A Question of Belonging: Race, Social Fit, and Achievement. *Journal of Personality and Social Psychology*, 92(1), 82.

Winkler, C., & Sriram, R. (2015). Development of a scale to measure academic capital in high-risk college students. *The Review of Higher Education*, *38*(4), 565-587.

Yeager, D. S., & Walton, G. M. (2011). Social-Psychological Interventions in Education: Theyre Not Magic. *Review of Educational Research*, 81(2), 267-301.

Future Work (Oh July!)

- Contact some peer institutions (Iowa, UIC)
- Revise methodology
  - Take a more formal factor analysis approach (Chronbach's α, 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

- Dr. Ellen Usher, Dr. Christia Brown, and Dr. Jane Jensen for assisting with construction of the 2016 survey

- 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!