Addressing Gaps in Research On First-Year Success
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Gauging the Influence of the High School Environment, Part-Time College Instructors, and Classroom Diversity

Peer-reviewed paper:

http://www.uark.edu/ua/der/EWPA/Research/Achievement/1808.html

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Challenges Facing Higher Education

- *Academic:* Mounting numbers of under-prepared students graduating from high schools
- *Economic*: Greater reliance on part-time, non-regular adjunct instructors
- *Demographic*: Increase in the ethnic/racial diversity of students

How do they affect preparation, cognitive growth and persistence of first-year students?

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Case Study at One University

- Total enrollment of ~17,000 students
- Moderately selective admission
- Public, research institution in medium-size town
- 2,800 new freshmen from 55 high schools (93% of 2004/05 in-state cohort)
- Data sources:
  - Institutional student information system (SIS)
  - State Department of Education accountability reports
- Variables tested:
  - Student demographics, academic preparation, first-year university experience, financial aid
  - Ten high school environment features

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Analytical Approach

- Input-environment-output model by Astin (1993) to isolate marginal effect of variables
- All variables are measured on basis of *objective* indicators
  - % of courses taken in first year that were taught by part-time faculty
  - % of classmates by ethnic/racial identity in courses
  - Quantitative metrics to measure HS environment
- Output measures
  - Academic preparation at college entry: 100-point index comprising grades, test scores, AP credits
  - First-year cumulative grades (GPA)
  - Enrollment persistence into second year of study

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Variable Definitions

High school environment

- Student enrollment
- Expenditure per student
- % of not highly qualified teachers (not certified)
- Student dropout rate
- Disciplinary incident rate
- % of non-Asian minorities
- % of Asian minorities
- % limited English learners
- Average class size
- Urban vs. rural location

Grading and curricular rigor in freshman year

- Average grade awarded in courses taken during first year

- Highest level math and English course (with grade) taken in first year (6 and 7 groups, respectively)

- Number of science-based courses taken in first year

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Gauging Effects on Cognitive Growth

Effects on GPA are calibrated on covariates

- Input-environment-output model by Astin (1993, pp. 9-13) to isolate marginal effect over time
- Input measures
  - Academic preparation index score (HSGPA, ACT, AP)
  - Socio-demographics, high school environment
- Environment or freshmen experience
  - *Campus life*: living in dorms, employment, recreation
  - *Academic*: credit load/transfer, major, gateway courses, grading and curricular rigor, part-time faculty
  - *Financial aid*: package type and unmet need $
  - *Peer influence*: classmate ethnic/racial diversity
- Output measure
  - First-year cumulative academic performance (GPA)

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Statistical Technique

- To estimate high school environment influence on academic preparation and first-year performance, *mixed-level linear regression* with cross-level interaction takes following form:

$$Y_{ij} = y_{00} + yp_0 X_{pij} + y_0 q Z_{qj} + ypq Z_{qj} X_{pij} + u_0 j + e_{ij}$$

- To estimate probability of enrollment persistence into second year, *logistic regression* with higher-order interaction term:

$$\text{Log}_n(p_i / [1 - p_i]) = y_0 + y_1 X_i + y_2 Z_j + y_3\ XZ_{ij} + e_i$$

Findings: Descriptives

- High school environment from which students came shows great variation:
  - Student enrollment: 101 to 3,500
  - Per student $ expenditure: $1,160 to $11,900
  - % of not highly qualified teachers: 0 to 70.4
  - Number of safety violations per 100 students: 0 to 14.2
  - % of non-Asian minority students: 6.1 to 74
  - Average class size: 5.6 to 33.1
  - % of students with limited English skills: 2.4 to 61
  - 82% of schools are located in urban areas

- But they have no significant effect on level of academic preparation at college entry, except
  - 5.5 percentage point rise in Asian students is associated with a one-unit increase in AP credits

Findings: High School Effects

- Significant effects on first-year GPA:
  - Average class size in high schools (5-student rise leads to 0.10 drop in GPA)
  - Negative effect of high school environment for low-income students
    - % of non-Asian minority student enrollment : one std.deviation rise ⟶ 0.10 *drop* in GPA
    - % of students with limited English proficiency: one std.deviation rise ⟶ 0.14 *drop* in GPA
    - Number of safety violations (guns, drugs, violence): one std.deviation rise ⟶ 0.11 *drop* in GPA
  - Positive effect of per-pupil $ for Asians
    - One std.deviation rise ⟶ 0.14 *rise* in GPA

Cross-level interactions

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Findings: Effects on 1st Year GPA

- Net of grading and curricular rigor, no significant high school environment effect
- Classroom ethnic/racial diversity effects:
  - One percentage point rise in non-Asian minority classmates ⟶ 0.016 *drop* in GPA
  - No significance due to Asian classmates, borderline significance due to foreign students
  - Enrollment in diversity course ⟶ 0.06 GPA *rise*
- Grading/curricular rigor effects:
  - One letter-grade difference in course grades awarded ⟶ 0.26 *change* in GPA
  - Taking 3 or more science courses ⟶ 0.17 *drop* in GPA

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Gauging Effects on 1st Year GPA

Significant Beta Coefficients
(Blue = positive; Black = negative)

No significance:
- Student ethnicity/race
- Income background
- County residency
- Living on campus
- Undeclared major
- Transferred credits
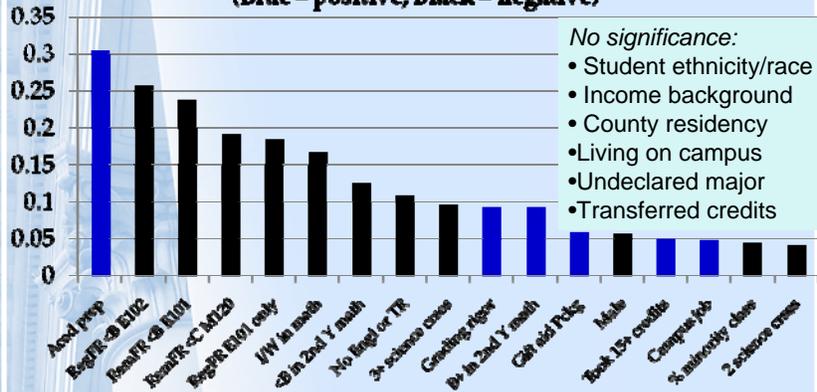
- Model explains 54.4% of variation in GPA, nearly double compared to other estimation models(VIF < 3.2; var matrix <0.6)

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Findings: Effects on Persistence

- Not significant:
  - High school environment
  - Classroom ethnic/racial diversity *in general*
  - Taking courses from part-time faculty
- Significant:
  - First-year GPA ⟶ 14% *change* per one letter grade
  - Local residency ⟶ 10.3% *rise*
  - Asian students ⟶ 7.5% *rise*
  - 3+ science courses ⟶ 6.5% *rise*
  - Received I, W, D, F grade(s) ⟶ 6 % *drop*
  - At least 15 first-semester credits ⟶ 5.75% *rise*
  - Female gender ⟶ 5.3% *drop*
  - 2 science courses ⟶ 4.8% *rise*

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Findings: Effects on Persistence

- Significant interaction effects on enrollment persistence (% probability):
  - % of non-Asian minority classmates
    - Positive for non-Asian minority students
    - Negative for students outside commuter distance
  - For male students, positive effect with
    - First-year academic performance (GPA) ⟶ 4% *rise* per one letter grade over females
    - Working on campus ⟶ 17% *rise*
  - Living on campus, positive effect with
    - Academic preparation at college entry ⟶ > 10% *rise* for those in 50%ile or higher compared to bottom Quartile
  - Foreign student classmates ⟶ 6% *rise* for top Q

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Significant Interaction Effect

% Probability of Second-Year Persistence

One standard deviation (50-84 %ile)

% of Non-Asian Minority Classmates

— Whites — Non-Asian Minority

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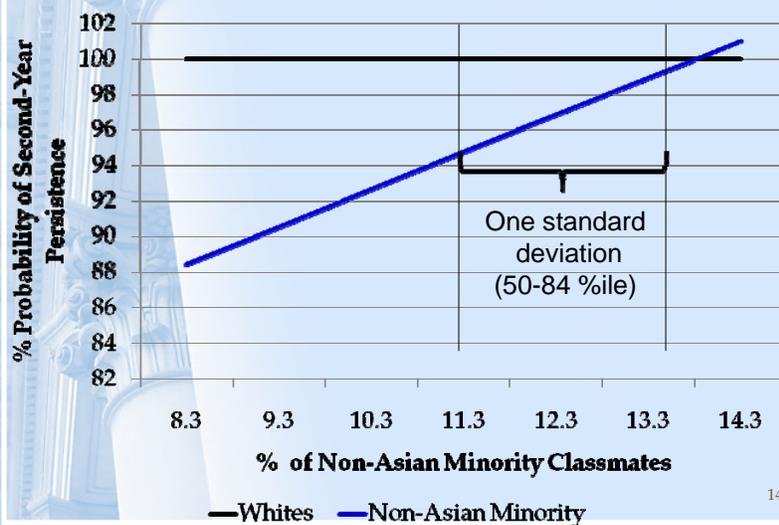
Conclusion

- First-year students from low-income background *may* be negatively affected by the confluence of environmental factors in high schools that relate to peer culture, physical safety, and probably immigrant student enrollment
- There is *no* evidence that part-time status of teaching faculty influences academic success and enrollment persistence of first-year students
- There *is* evidence that ethnic/racial diversity in the classroom has mixed effects on enrollment persistence of first-year students depending on their background

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Future Research

- Use of objective measures of diversity to replace or complement subjective data from student/faculty surveys
- Examine high school data from individual schools in larger states to increase number of schools in the analysis
- Explore effects of part-time faculty across different disciplinary areas, beyond first-year
- Test for higher-order effects in single multivariate model, rather than multiple tests on subsets of students

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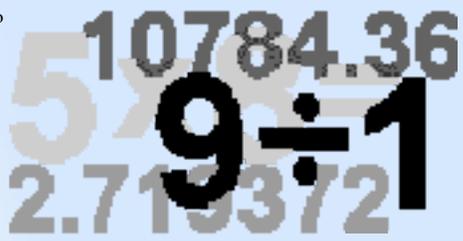
Link to paper and presentation:
http://www.uark.edu/ua/der/EWPA/Research/
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