Classroom Diversity and Student Dropout:

New Evidence from Panel Data Based on Objective Measures

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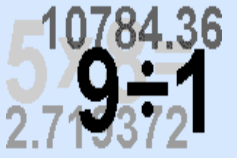
https://tinyurl.com/CAIR2010sbh

Study to be published in a forthcoming issue of
Innovative Higher Education



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Purpose of Study

- Estimate the effect of classroom diversity on student 4-year longitudinal dropout risk
  - *Classroom diversity*: Level and change in classmate ethnic/racial composition
  - *Dropout risk*: Average during enrollment spell, semester-to-semester change
  - *Covariate controls*: Pre-college preparation, socio-demographic background, campus engagement, classmate preparation/gender distribution, academic experience, financial aid, time (enrollment term)
- Address limitations of existing scholarship
  - Student self-reports, binary 'diversity' metric, omitted variable bias, cross-sectional data

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Limitations of Student Surveys

- "Although student self-reported gains can be revealing…, there are serious concerns about their actual validity. Inquiry that attempts to estimate the impact of diversity experiences on the development of cognitive and intellectual skills using objective standardized measures…is extremely limited." –(Pascarella et al., 2014)

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Limitations of Student Surveys

- *Survey methodology* research posits a four-step process to ensure valid responses: comprehension, retrieval of information, judgement, and response mapping (Tourangeau et al., 2000)
- *Lack of construct validity*
  - degree of inference from survey operationalization to theoretical construct (e.g., question content)
- *Measurement error*
  - Short, vague Qs; response scales/categories
- *Response processing error*
  - Student comprehension, recall, judgment, estimation, response mapping

See Tourangeau, Rips, & Rasinski (2000); Porter (2011); Herzog & Bowman (2011)

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Other Limitations

- Students of color vs Whites vs Asian students
  - Vast majority of studies capture student ethnic-racial diversity with a binary metric that contrasts White students with students of color (Denson et al., 2020; Dills, 2018; Roksa et al., 2017a; Roksa et al., 2017b; Mayhew et al., 2016; Pascarella et al., 2014; Loes et al., 2012; Bowman, 2010, 2009; Gurin, 1999). On average sig. difference in Asian academic profiles/achievements (Martin et al., 2017; Adelman, 2004a; Adelman, 2004b)
- Omitted variable bias
  - College GPA is key predictor of Black-White gap in graduation rates (Ciocca Eller & DiPrete, 2018)
  - No formal testing of interaction effect between compositional and interactional/curricular diversity (e.g., Gurin, 1999).
- Cross-sectional vs longitudinal data
  - Mitigating bias w/ panel data & broad controls: ~90% (Eckles & Bakshy, 2020)

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Other Limitations

- Paucity of classroom-focused diversity research
  - "The classroom is the crossroads where the social and the academic meet," yet "little has been done to explore how the experience of the classroom matters to shape student persistence" (Tinto, 1997, p. 599).
  - Failed to identify a single published higher-ed diversity study at classroom level based on direct objective data on both sides of tested equation.
- Omitted confounding factors and selective reporting of statistical results: see https://tinyurl.com/sbhch1
  - "How Diversity Makes Us Smarter" (*Scientific American*, Oct. 2014; Altmetric score= 11,980, highest as of 11/29/18). Cites 4 studies, none based on causal inference estimation, 3 suffering omitted variable bias, 1 based on self-report.

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Meta Analysis on Diversity

Table 2.1 Summary of overall findings for diversity courses

	Ethnic studies	Women studies	Other departments/ programs	Unknown/ multiple	Curricular diversity composite	Number of courses	Total
Positive	4	5	6	6	2	2	25
Negative	0	0	0	0	0	0	0
No change	2	1	0	2	1	7	13
Mixed	10	4	14	11	4	19	62
Total	16	10	20	19	7	28	100

- **Twenty-five percent** of studies show positive relationship with measured outcomes (Denson & Bowman, chap. 2 "Higher Ed: Handbook of Theory & Research", 2017)
- Most studies correlating diversity inputs with diversity outputs

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Remedies to Address Limitations

- Classroom diversity
  - Objective measures based on official matriculation records
  - Under-Represented Minority (URM) student-to-White student ratio (control for 'majority dominance', stereo-type threat, see Steele & Aronson, 1995)
  - Enrollment in 'diversity' courses (interactional diversity)
  - Separate metrics: proportion of female, Asian classmates, classmate academic preparation (HS GPA, ACT/SAT, AP)
  - Compositional-curricular diversity interaction effect
  - Non-linear effects: % and quartile metrics
- Covariate controls: Five clusters tied to research
- Panel data: Time-variant, time-invariant variables

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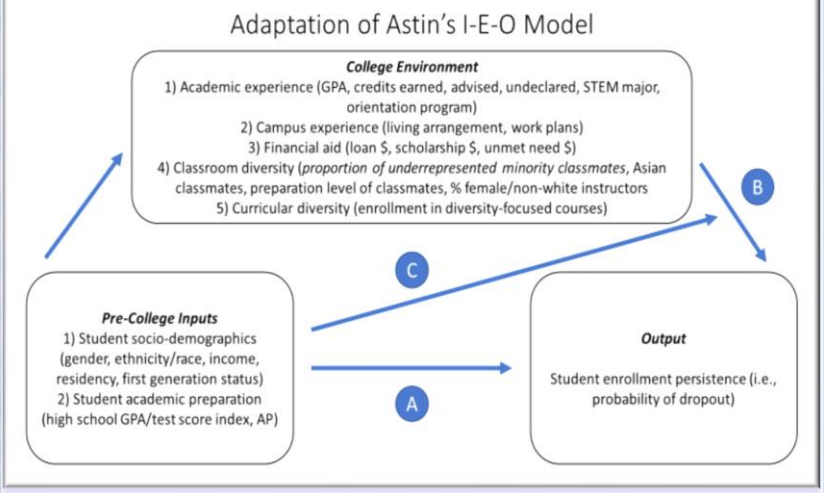
Conceptual Framework



Data and Analysis

- Effective sample
  - Fall 2016 entry 3,545 freshmen (N= 21,698 during 4-year tracking period)
- Analytical method
  - *Kaplan-Meier* cumulative hazard function with select stratification
  - KM factor level tests based on Mantel-Cox Log Rank, Tarone-Ware Chi-Sq
  - Semiparametric *generalized estimating equation (GEE)* with complementary log-log function for interval-censored repeated-measure outcome
  - Covariance matrix for repeated-measure data governed by QIC (AR-1)
  - Covariate selection to optimize estimation based on corrected QIC (CQIC)
  - Dropout risk: % change based on formulae by Cruce, 2009; Peterson, 1985.
  - Huber-White robust estimator:

$$\eta_{ti} = \log(\pi_{ti} / (1-\pi_{ti})) = \beta_0 + \beta_1 time + \beta_2\gamma_i + \beta_3\gamma_{ti} + \beta_4\gamma_{i*}\gamma_{ti} + \varepsilon_{ti}$$

- Data centering
  - Group-mean at student level: time-variant variables on continuous scale
  - Grand-mean: time-invariant variables on a continuous scale

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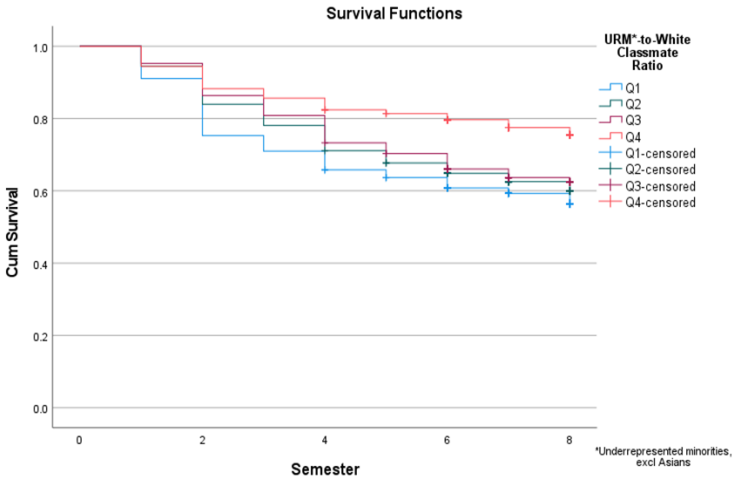
KM Cumulative Dropout Hazard



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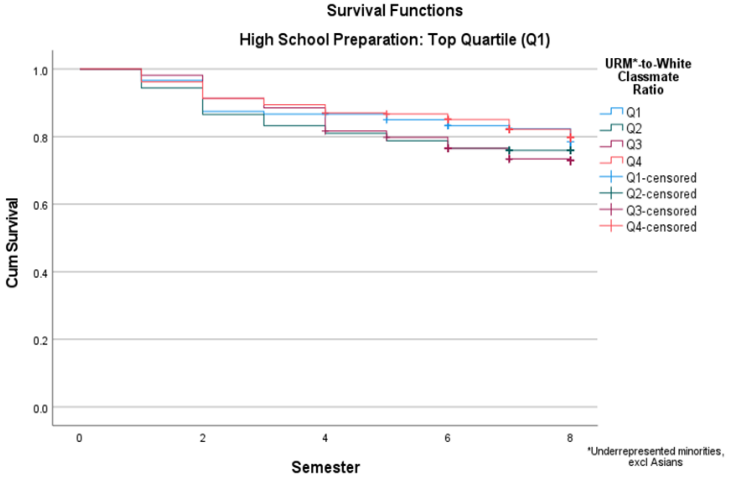

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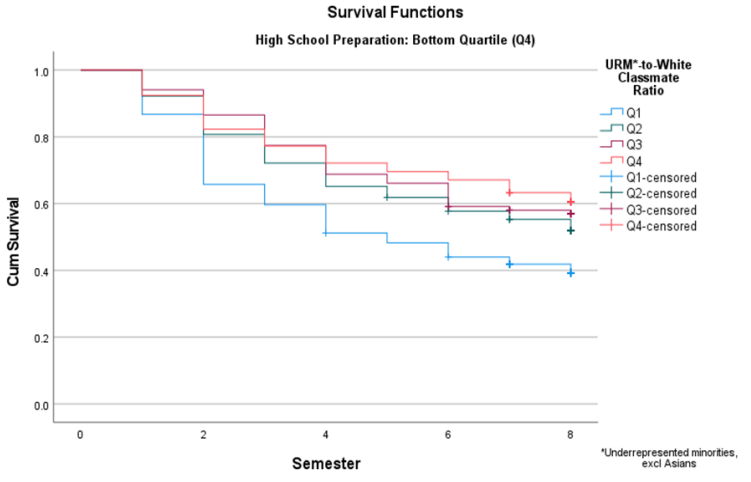

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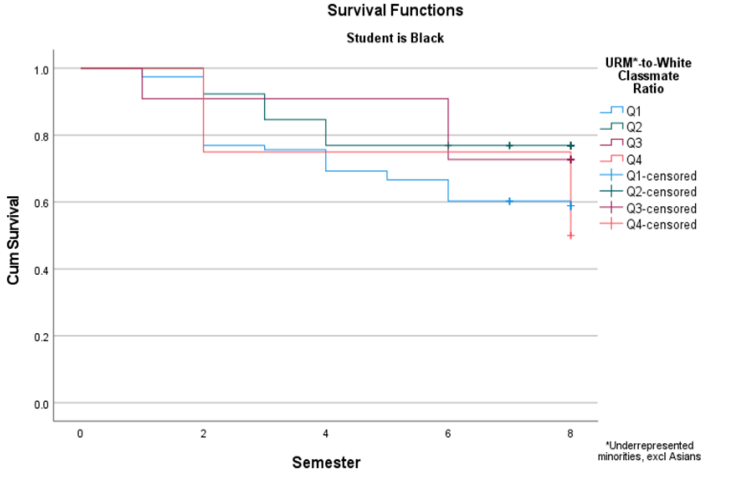

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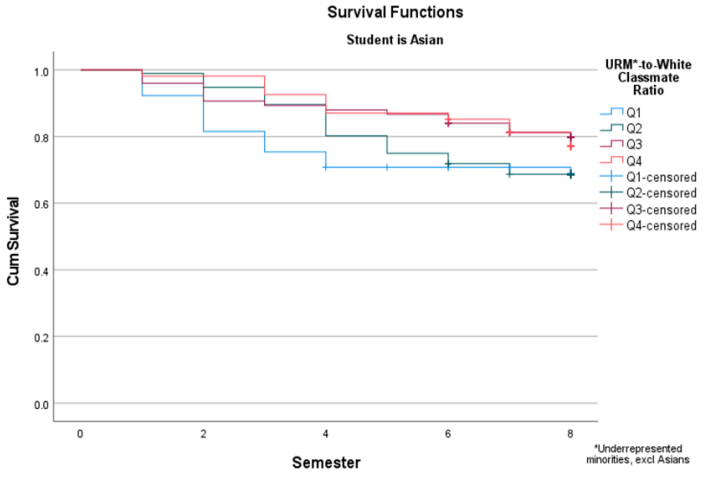

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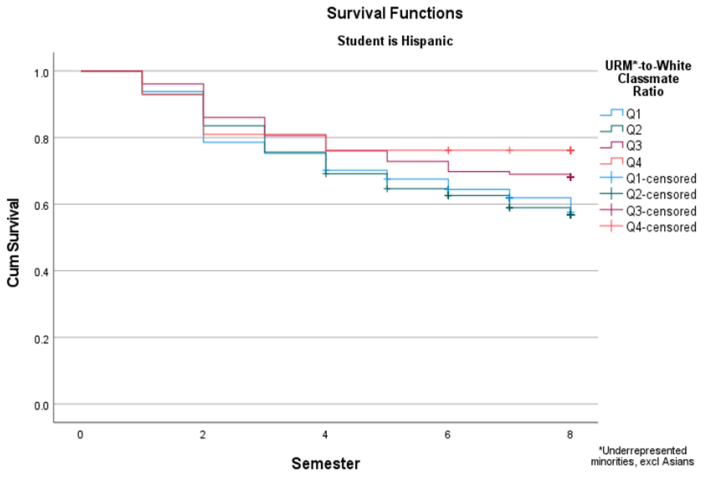
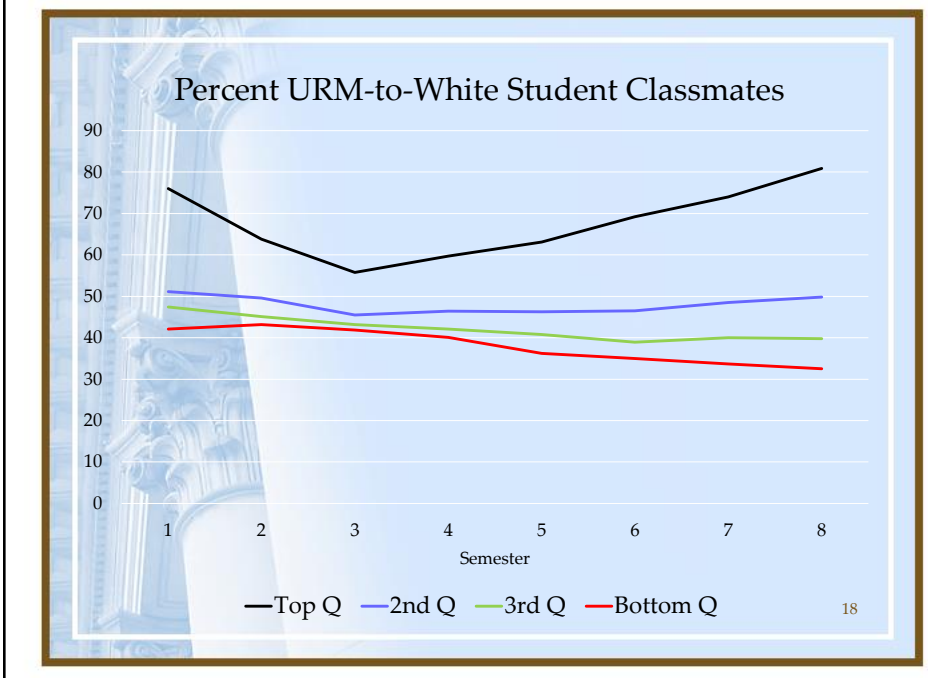
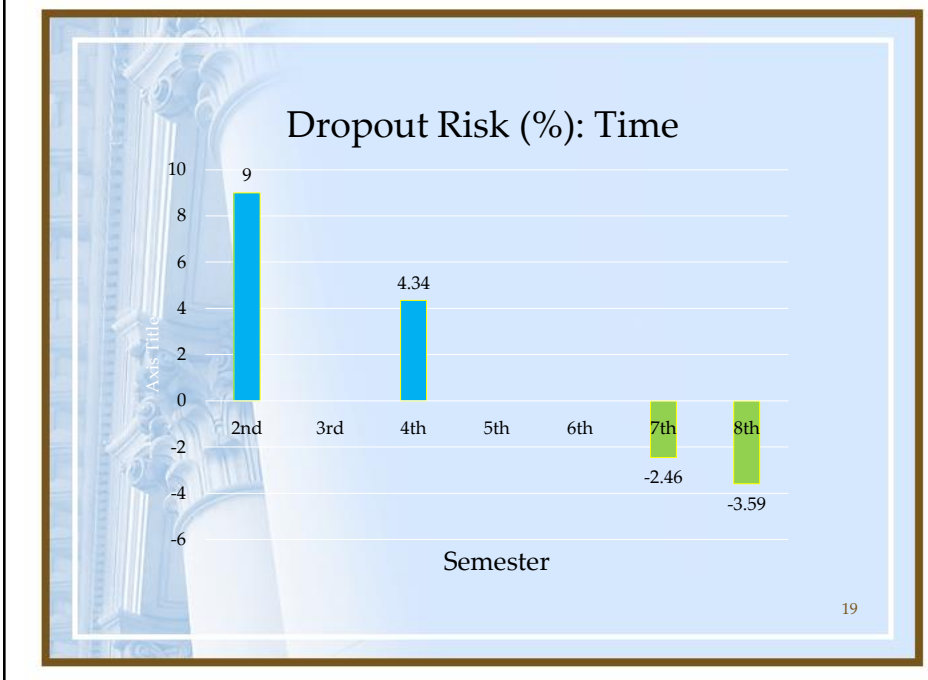
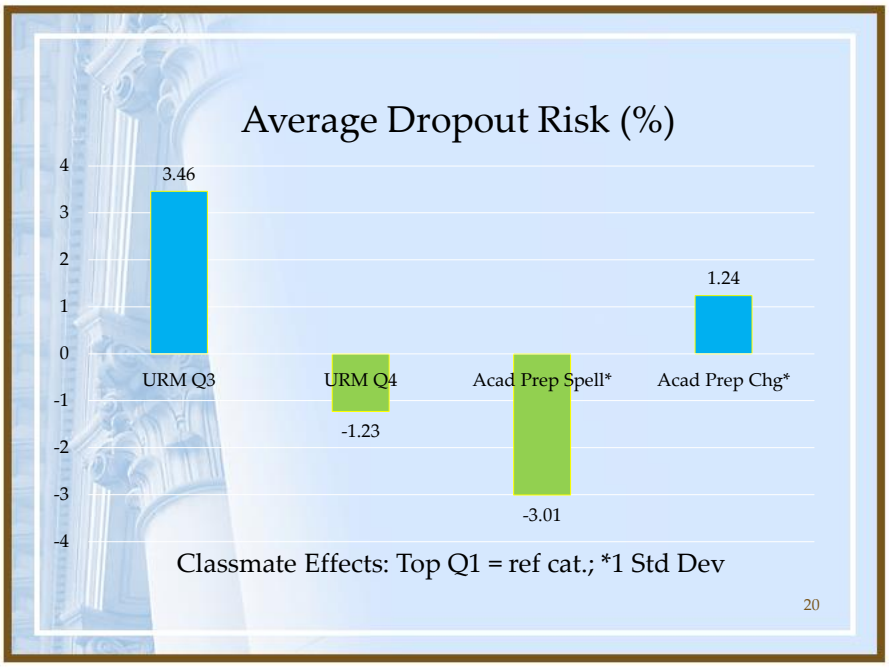



Percent URM-to-White Student Classmates
90
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
8
Semester
Top Q
2nd Q
3rd Q
Bottom Q
18


Dropout Risk (%): Time
10
8
6
4
2
0
-2
-4
-6
Axis Title
9
4.34
-2.46
-3.59
2nd
3rd
4th
5th
6th
7th
8th
Semester
19



Dropout Risk (%): Conditional Effects

Table 4: Dropout Risk Associated with Significant Factor Interactions

No.	Factor Interaction	Wald Chi-Square	Sig.	OR	95% CI Lower	95% CI Upper	1SD ▲ Dropout Risk
1	Male student x avg academic preparation of classmates	15.11	***	1.11	1.05	1.16	1.77%
2	Student of other ethn/race x avg % URM classmates	13.83	***	0.97	0.96	0.99	-2.32%
3	Academic advising x avg % female classmates	13.27	***	1.16	1.07	1.26	2.61%
4	Hispanic student x avg % URM classmates	11.87	***	0.99	0.98	0.99	-1.34%
5	First-generation student x avg % URM classmates	8.61	**	0.99	0.98	1.00	-1.17%
6	First-generation status n/a x avg % URM classmates	8.57	**	0.99	0.98	1.00	-1.25%
7	Male x avg % female classmates	8.53	**	1.01	1.00	1.02	1.31%
8	AP student x chg in acad preparation of classmates^	8.39	**	0.88	0.81	0.96	-1.42%
9	AP student x avg academic preparation of classmates	7.09	**	1.08	1.02	1.13	1.29%
10	Academic advising x chg in acad preparation of classmates^	5.22	*	0.90	0.82	0.98	-1.26%
11	AP student x avg % female classmates	4.90	*	0.99	0.98	1.00	-0.91%
12	Non-local in-state student x chg in % Asian classmates^	4.08	*	0.95	0.90	1.00	-0.99%
13	Black student x chg in % Asian classmates^	4.02	*	0.87	0.76	1.00	-2.42%
14	Asian student x % Asian classmates in 25-50th%ile preparation	5.12	*	0.78	0.62	0.97	-3.63%
15	Black student x % Asian classmates in top quartile preparation	8.56	**	0.79	0.67	0.92	-3.32%

α sig.:*<0.05, **<0.01, ***<0.001; ^Time-variant by semester, 1SD = 1 standard deviation; results are net of covariates listed in Table 3

Reference category: student ethnicity/race is white; student residency is local in-state

Odds Ratios (OR) above (below) 1.00 indicate a positive (negative) relationship between factor (parameter) and odds of student dropout.

1SD ▲ Dropout Risk: Positive value indicates increase in dropout risk, negative value indicates decrease in dropout risk

Note: Average (avg) % URM classmates measures a 1% change in URM classmates during the enrollment spell.

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Summary of Conditional Effects

- URM classmate diversity effects are moderated by
  - Student ethnicity/race
  - First-generation status
- Asian classmate exposure is associated with
  - Lower dropout risk for Black students
  - Mixed dropout risk for Asian students
- Classmate academic preparation effects are moderated by
  - Student gender
  - Advance Placement (AP) status
  - Academic advising
- Female classmate effects are moderated by
  - Student gender, AP status

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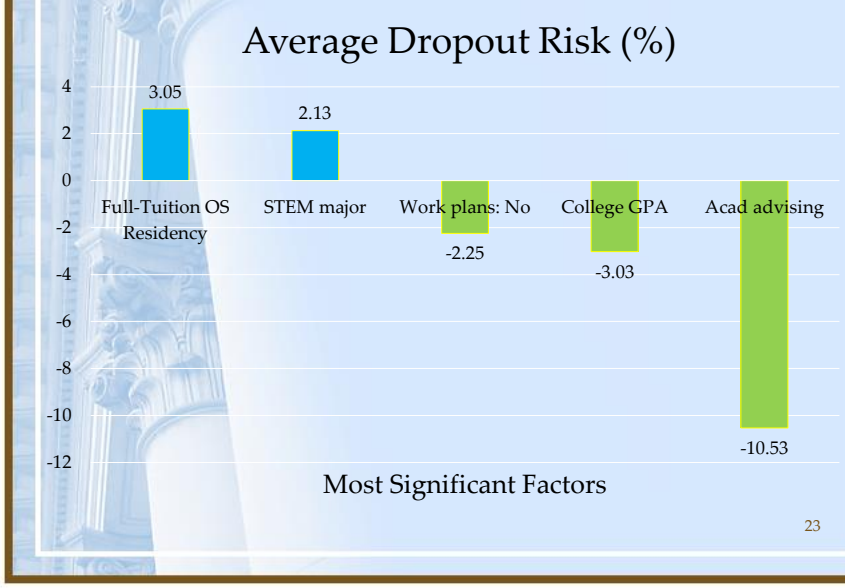

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Findings

- Corroboration of previous studies
  - Mixed results with compositional/classroom diversity
  - Conditional effects: Student attributes, level of exposure
  - 'Diversity' outcomes vs objective academic outcomes
  - Small effect sizes for longitudinal vs cross-sectional data
  - Congruence with experimental designs (de Oliveira & Nisbett, 2018; Sommers et al., 2008; Antonio et al., 2004)
- Value-added to corpus of research
  - Objective metrics vs self-reported data
  - Time-variant and time-invariant measures
  - Pre-post test design coupled with broad controls
  - Compositional-interactional diversity nexus: No sig.
  - Disaggregation of Asian students

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Revisiting Astin's Work

- Multi-institution study, 140 factors, >20K students
  - Summary chapter on ethnic-racial peer effects concludes that *"with few exceptions, outcomes are generally not affected by peer measures, and in all but one case the effects are very weak and indirect"* (Astin, 1993, p. 362). On the effects of curricular diversity, "none" of the tested effects appeared to be direct in the presence of other control variables, with the exception of students' perception of an institution's "diversity orientation" and "resources and reputation" (Astin, 1993, p.332-333).

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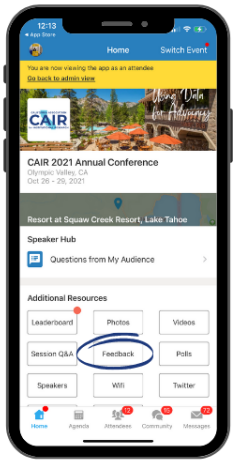

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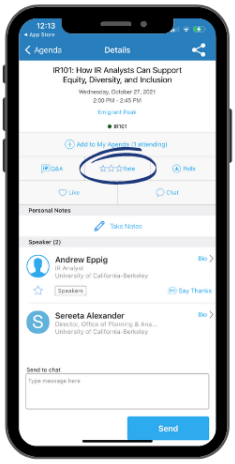

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