Exploring Approaches to Constructing Comparable Groups Within Hierarchies

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The College Board

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The Challenge: Constructing Comparable Groups for an Evaluation with Limited Data

- Program implemented school-wide (no comparison students within a school)
- Decision to implement the program was based on school-level variables (lower school achievement and serving minority and low-SES students)
- Outcome measures of interest were student-level (attitudes and beliefs about college)

School Data

- Collected student-level data from 8 schools: 5 program schools and 3 comparison schools

School	*n*	School Ach. Score	Free/ Reduced Lunch	Minority
Prgm A	35	469 (7)	34% (2)	19% (1)
Prgm B	48	430 (5)	62% (6)	99% (8)
Prgm C	22	384 (3)	52% (4)	89% (4)
Prgm D	19	500 (8)	50% (3)	66% (3)
Prgm E	22	405 (4)	59% (5)	95% (6)
Comp A	40	350 (1)	68% (7)	99% (7)
Comp B	53	442 (6)	33% (1)	63% (2)
Comp C	38	376 (2)	74% (8)	92% (5)

(#) = rank, 1-8

Variables

- School-level:
  - School Achievement Score
  - % Free/Reduced Lunch
  - % Minority
- Student-level:
  - Gender
  - Ethnicity
  - Parent Education Level*
  - Number of College Preparatory Exams Taken*

* Some hs, hs grad, some college, AA, BA, graduate degree

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Student Data

- Student demographics, program vs. comparison:

Variable		Program Students *n* = 146	Comp. Students *n* = 131	Total *n* = 277
Gender	Male	41.1%	50.4%	45.5%
	Female	58.9%	49.6%	54.5%
Ethnicity	% Black	52.7%	57.3%	54.9%
	% Hispanic	19.9%	20.6%	20.2%
	% White	22.6%	18.3%	20.6%
Parent Educ.	(1-6)	2.81	2.86	2.83
# Exams	(0-5)	.610	.687	.646

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How to Match?

- Propensity score matching (Rosenbaum & Rubin, 1983) uses logistic regression to combine and weight variables into one score
- Calculate “propensity” to be in the treatment group: propensity score variables are related to the treatment decision, control for a priori bias in outcome measures
- But, problematic to match solely on school:
  - Data probably not a random sample at each school
  - Outcome measures of interest were student-level
- Not enough data for a multi-level logistic model

Three Variations:

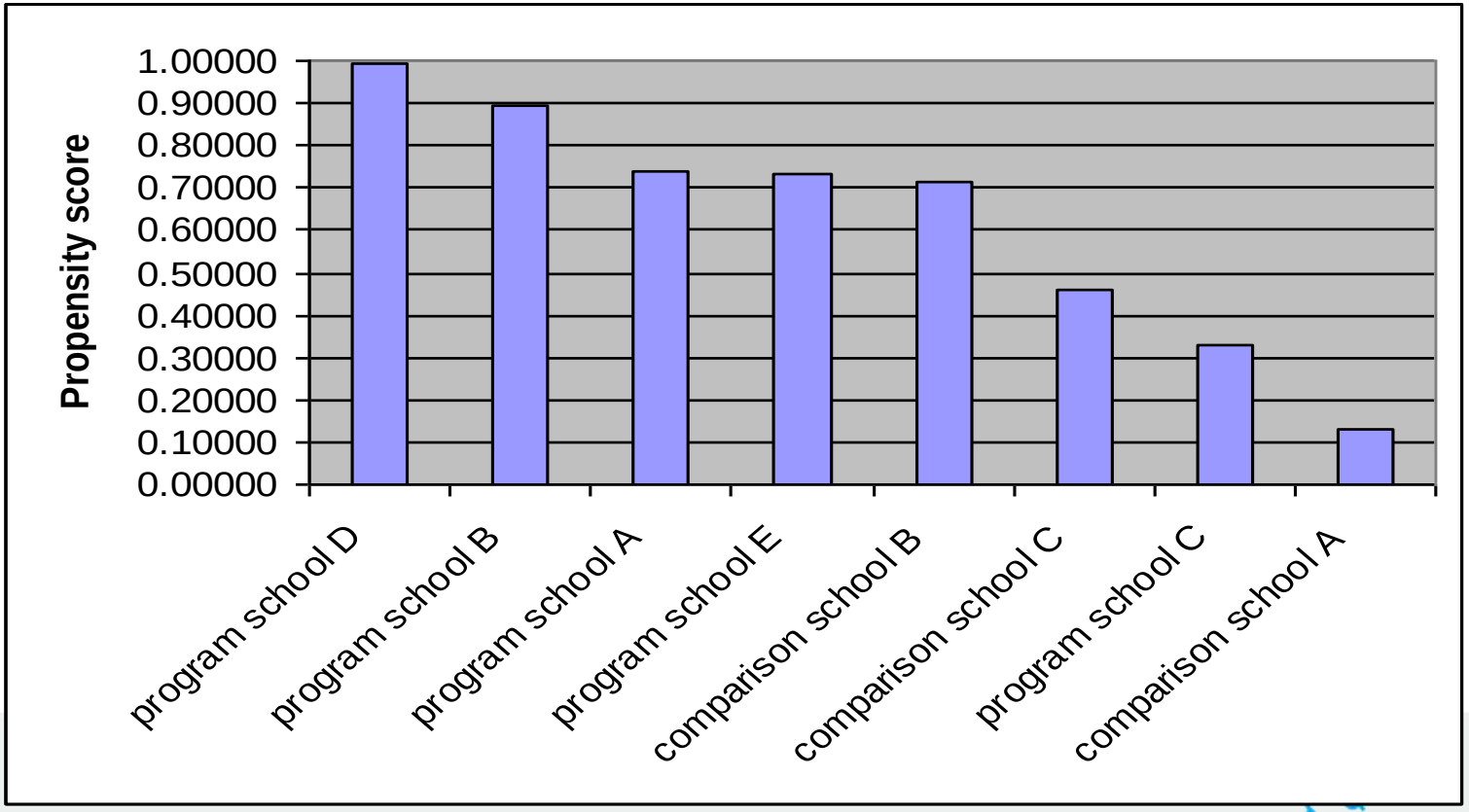
- Match on schools, but include a student-level variable
- Match on students, but include a school-level variable
- Match on schools, then match on students within those schools

Match on Schools, Include Student-Level Variable

- Use the 3 school-level variables: school achievement score, % free/reduced lunch, % minority
- Use the student-level variable most highly correlated with outcome: # of college preparatory exams taken
- With logistic regression, calculate the propensity score for each school
  - Model predicted 4/5 of program group membership, 2/3 of comparison group membership

Results of School Match

- Program Schools A and E matched to Comparison School B
- There were no other matches (within ¼ of sd of propensity score, Cochran & Rubin, 1973)



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Match on Students, Include School-Level Variable

- Use the 4 student-level variables: gender, ethnicity, parent education level, # of college preparatory exams taken
- Use the school-level variable most highly correlated with group membership: school achievement score
- With logistic regression, calculate propensity score for each student
  - Model predicted 80.8% of program group membership, 72.5% of comparison group membership
- 16 students could not be matched (no comparison students within ¼ sd of propensity score); after four matching runs (allowing replacement), 95% of remainder matched

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Results of Student Match

- 124 program students matched, from all program schools
- Most matches came from Comparison School B

# of Matches	Comp A	Comp B	Comp C	Total
One	1	11	10	22
Two	0	9	1	10
Three	0	14	0	14
Four	0	10	0	10
Total # of Comp Students	1	44	11	56

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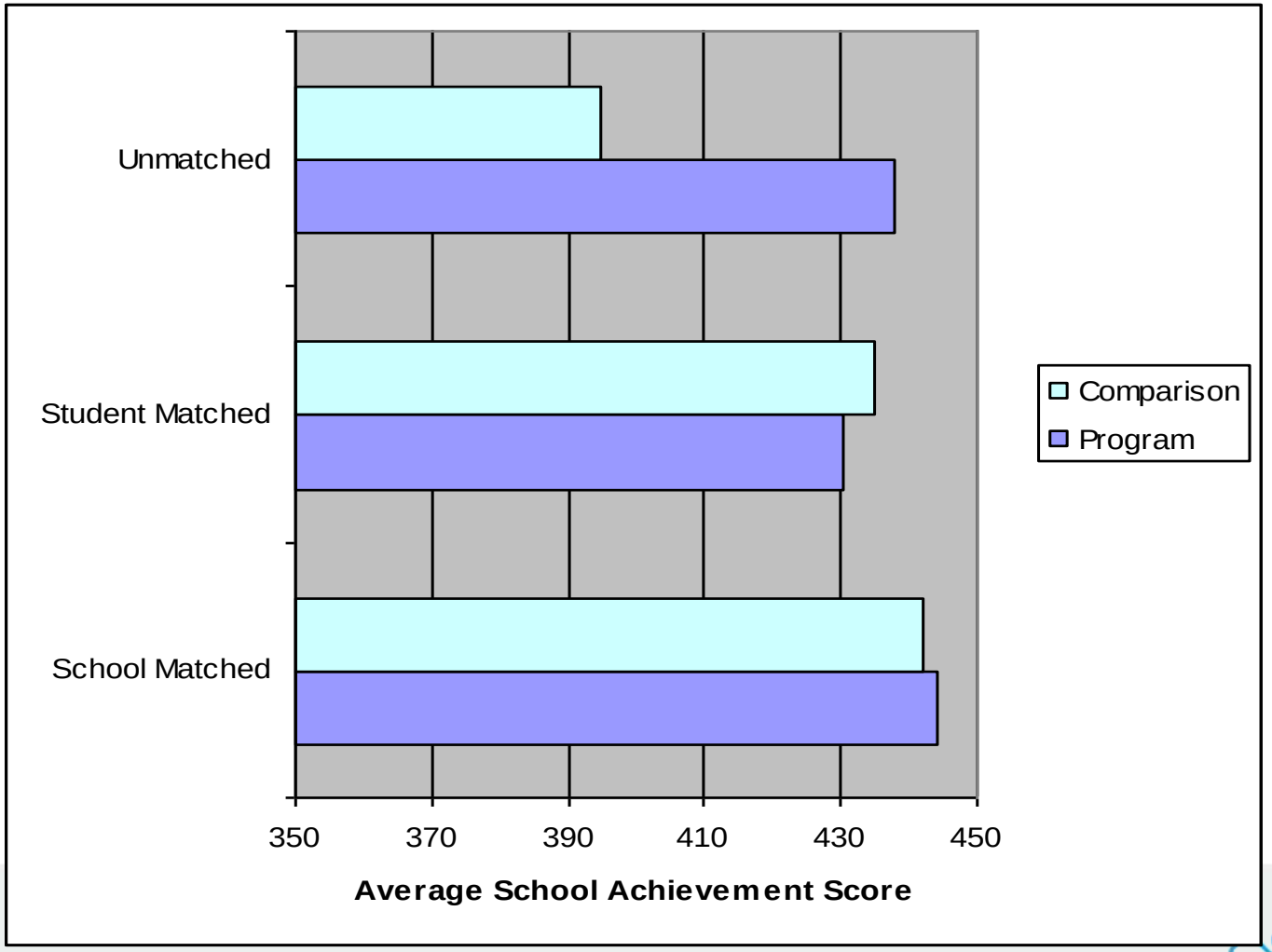
Match on Schools, Then Match on Students

- Results the same as matching on schools with student-level variable: Program Schools A and E matched to Comparison School B
- 57 program students and 53 comparison students
- Because of low match rate, no further match undertaken

Comparison of Match Results: School Achievement Score (School-Level)



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Comparison of Match Results: % Free/Reduced Lunch (School-Level)

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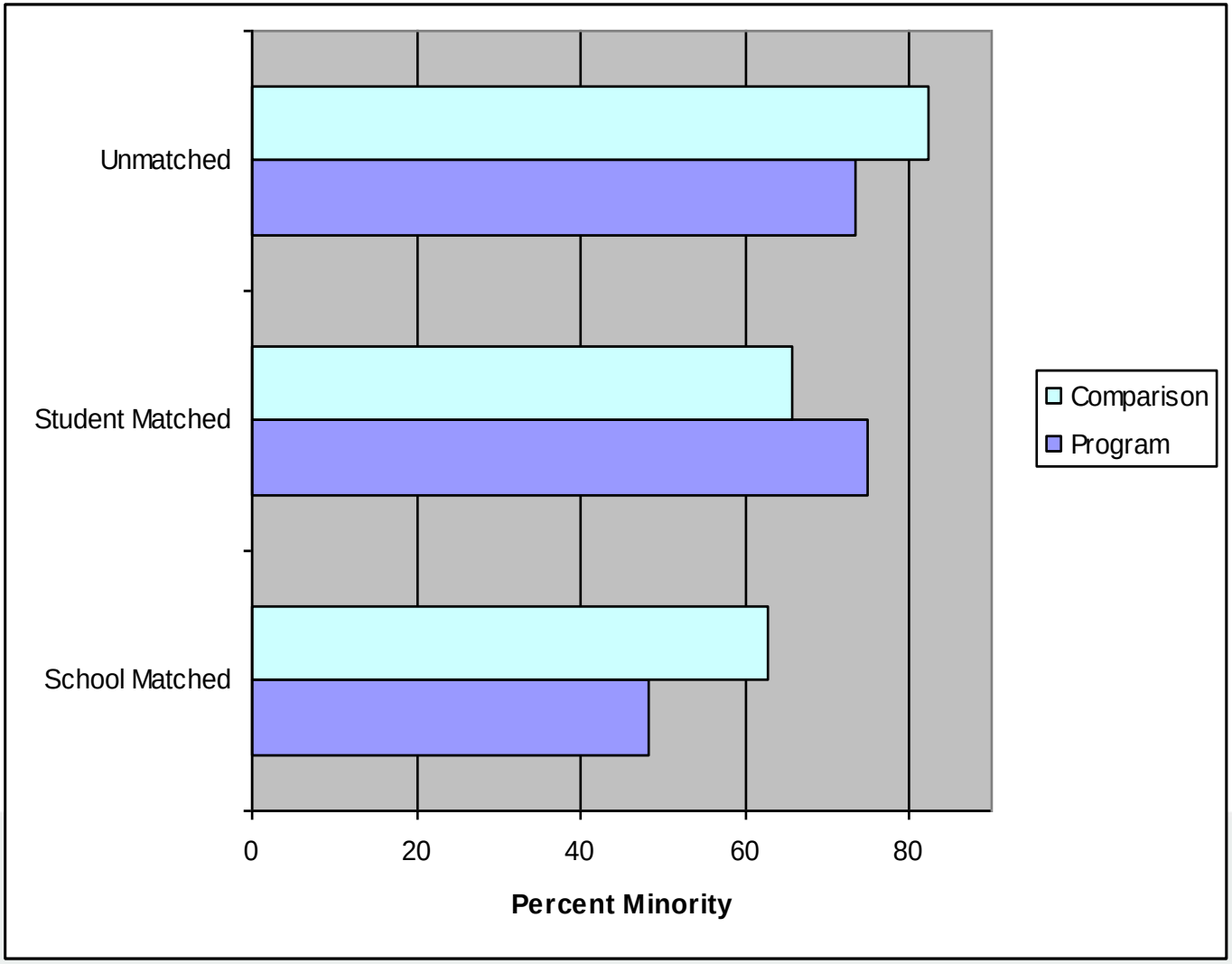
Comparison of Match Results: % Minority (School-Level)



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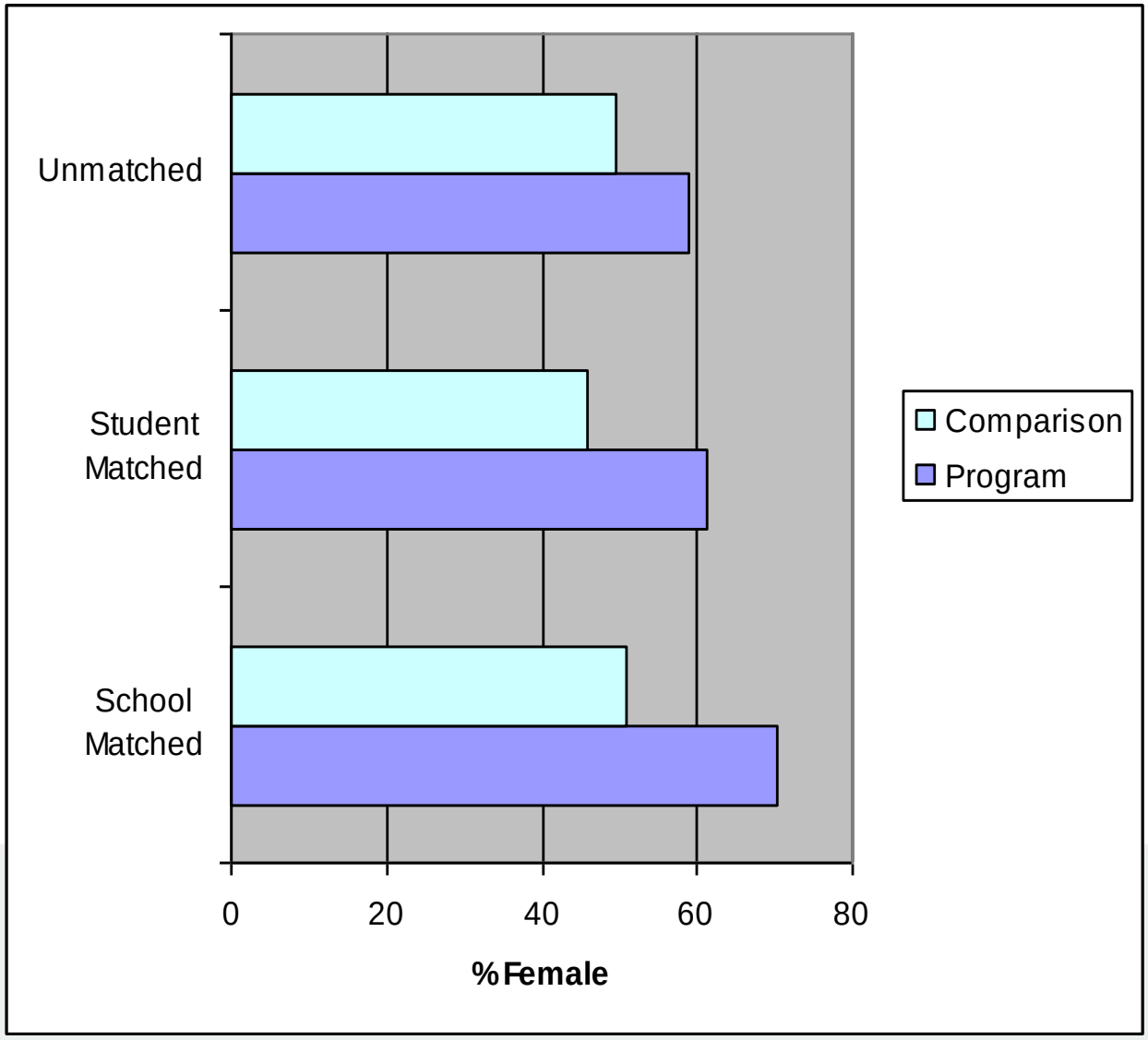
Comparison of Match Results: Gender (Student-Level)



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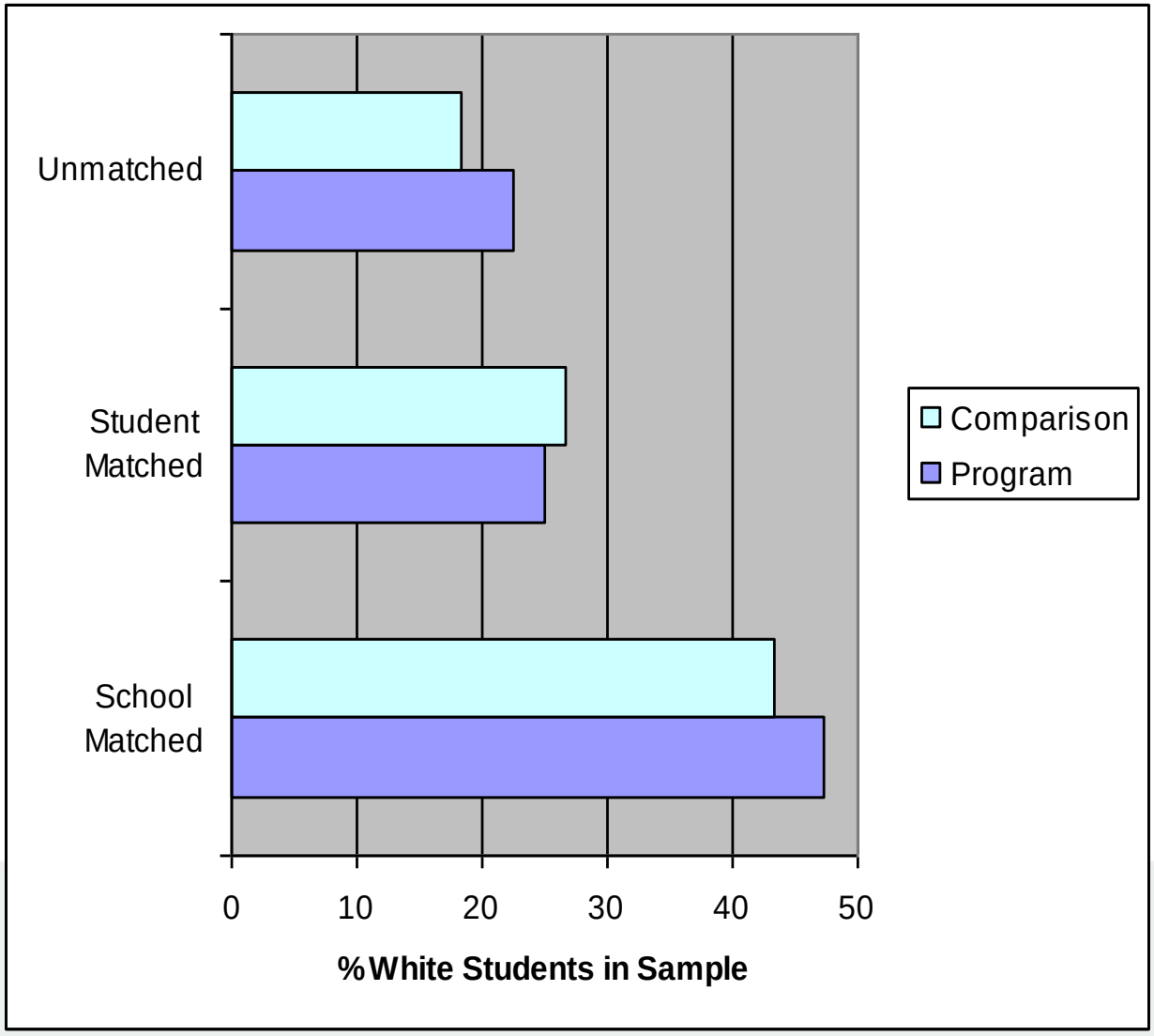
Comparison of Match Results: Ethnicity (Student-Level)



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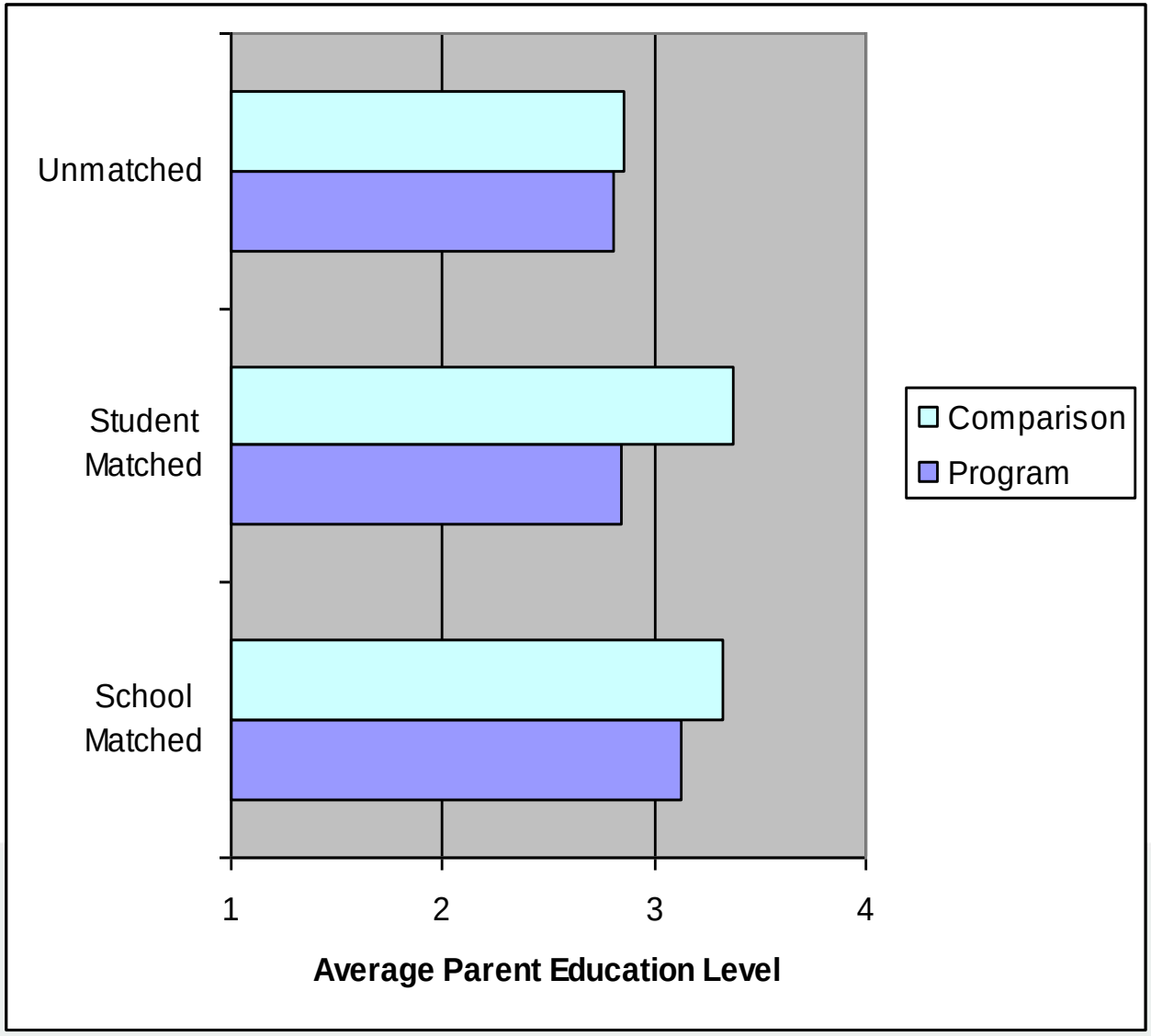
Comparison of Match Results: Parent Education Level (Student-Level)



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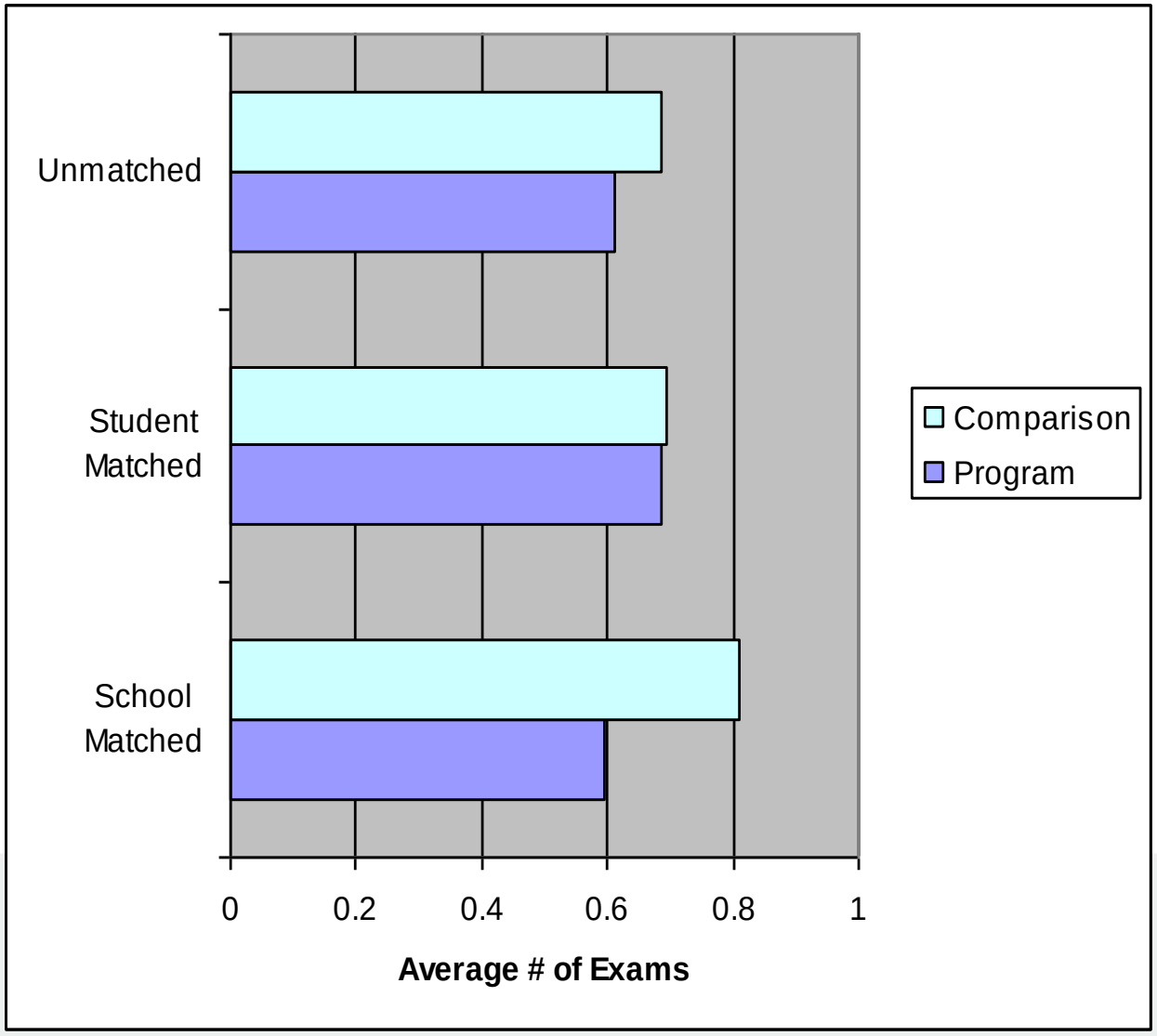
Comparison of Match Results:
of College Prep Exams Taken (Student-Level)



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Discussion

- Because of data limitations, no ideal approach for match
- Variations of the match attempted to take into account both school-level variables (basis of program decision) and student-level variables (to control for bias on outcome measure)
- Best match obtained by matching on students and using a school-level variable
- Possible future directions with a larger data set:
  - Use more variables
  - Compare against matching on schools, then students (as originally intended)
  - Compare against multi-level logistic model

Questions, Comments, Suggestions

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- Please forward any questions, comments, and suggestions to:

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