Analysis of ALEKS Placement Test

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OVERVIEW

1. Background

2. Goals of the study

3. Data/Method

4. Results

5. Discussion

1. Background

Recent research and debates about effectiveness of Developmental

Unnecessary delay causing dropout, cost in time and money

Efficacy of placement test as sole criterion
- Placed students lower than their potential
- High school GPA improved the accuracy of placement

Initiatives to use multiple measures

 for placement

Belfied, C. R., & Crosta, P. M. (2012)

Hughes, K. L., & Scott-Clayton, J. (2011)

Scott-Clayton, J. (2012)

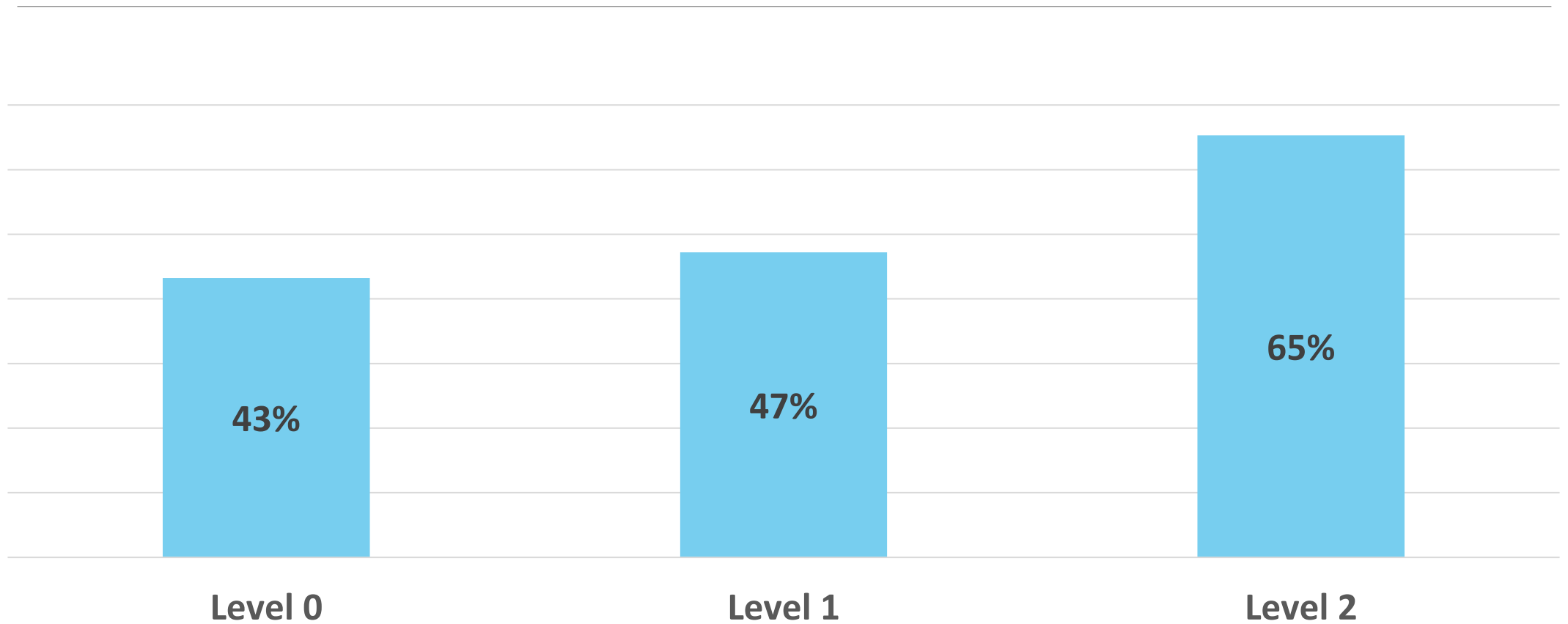*Bahr, P.R., Orians, E. L., & Schanker, J.B. (2016)*

Snapshot

What happens to WCC students who are initially placed in a developmental Math level:
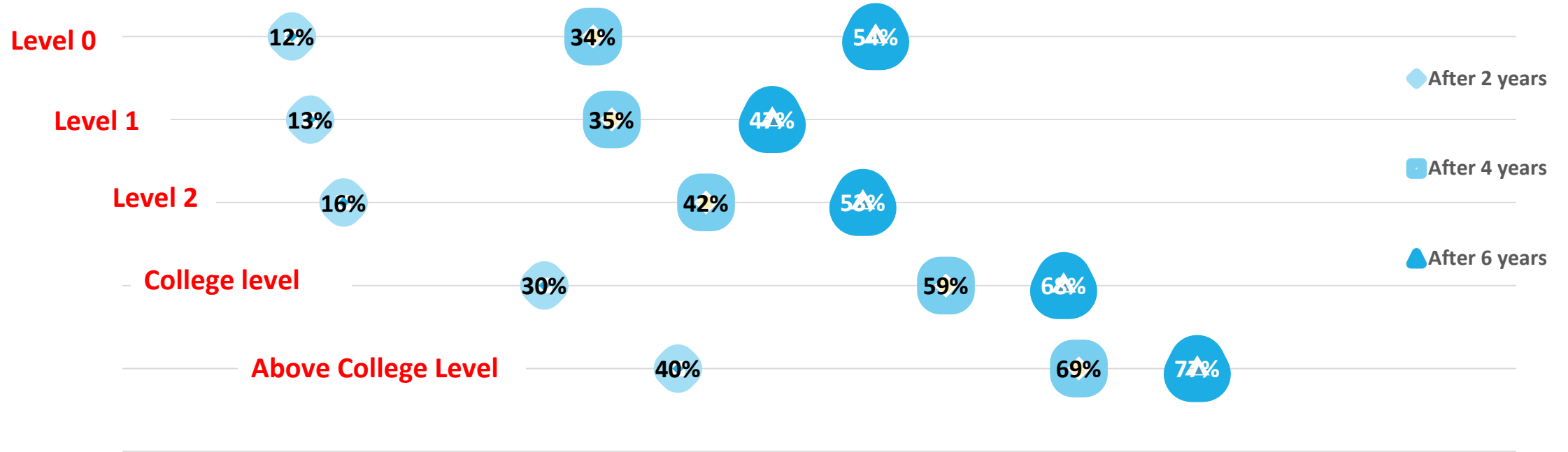
Fall 2010 new students (n = 1960)

Tracked over 6 years of elapsed time

WCC: Percent of students who eventually took at least college level Math course (level 3) by initial Dev. Math placement

WCC: Percent of Dev. Math students who graduated and/or transferred to a university by initial Math placement

Math Level at Entry

Level 0 12% 34% 54%

Level 1 13% 35% 47%

Level 2 16% 42% 56%

College level 30% 59% 66%

Above College Level 40% 69% 74%

● After 2 years

■ After 4 years

▲ After 6 years

College Level: Level 3   Above College Level: above Level 3

2. Goals of the study

- Examine the validity of ALEKS as placement test using WCC data
  - How to quantify the evidence of effectiveness of ALEKS as a placement test?
  - Use the same method as national studies

- Explore other measures w.r.t. predictive capabilities to student performance

3. Method

o Estimate strength of correlation between initial ALEKS test score and final grade points of first math courses (Correlation of Determination, or R-Square)
  How well does ALEKS score predict grade in a student's first math course?

o Estimate Placement Accuracy rates and Error rates (Decision model) as indexes of evaluating effectiveness of current cut scores
    Three reference courses: MTH 169, MTH 176, and MTH 180

o Estimate strength of correlation between ACT math, HSGPA, SAT math, ALEKS scores and measures of first term students performance (Correlation of Determination)

4. Data

Entering students Winter, Spring/Summer, and Fall of 2017 (2017 calendar year)

Samples vary by analyses
- Valid ALEKS scores: reported within one month semester begins.
- Full ALEKS sample: 1,290 students, 610 students took math courses in the first term
- Course samples: initial ALEKS score + math grade
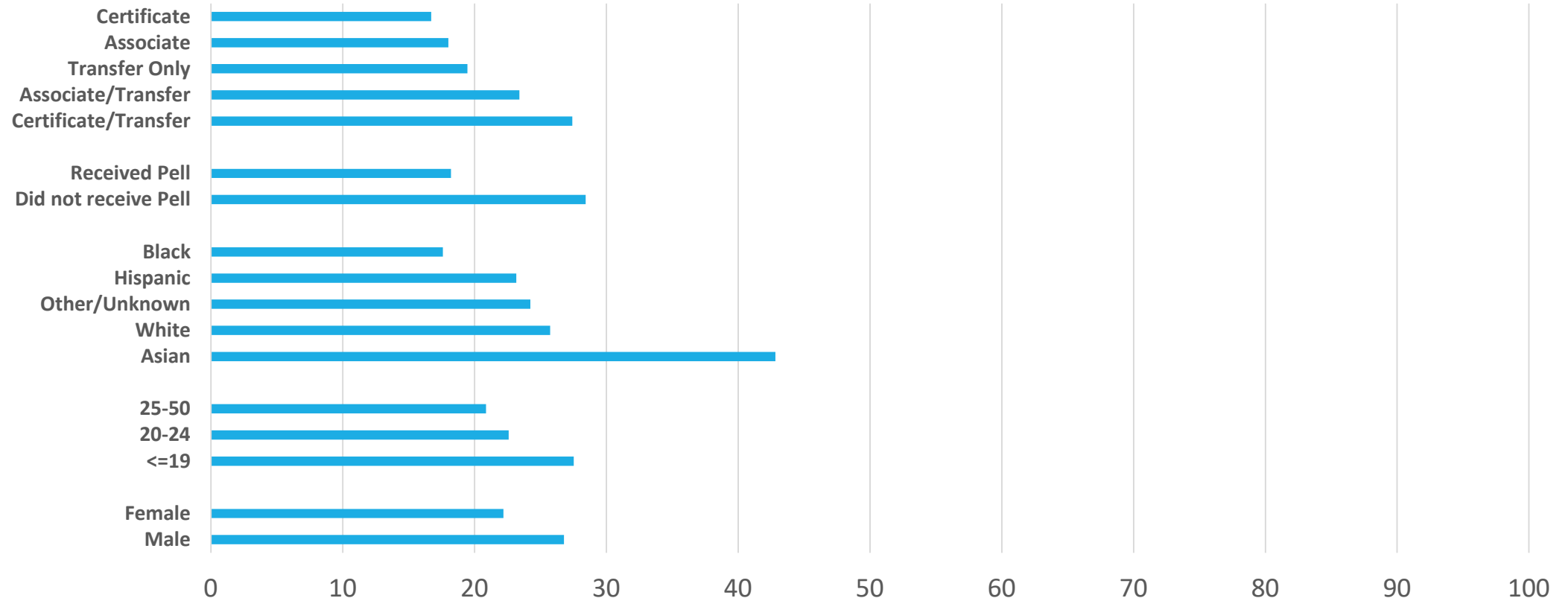- Samples of all other test score than ALEKS

5. Results
Data summary: ALEKS score distribution

65% of students in

placement sample placed in

Developmental courses, using

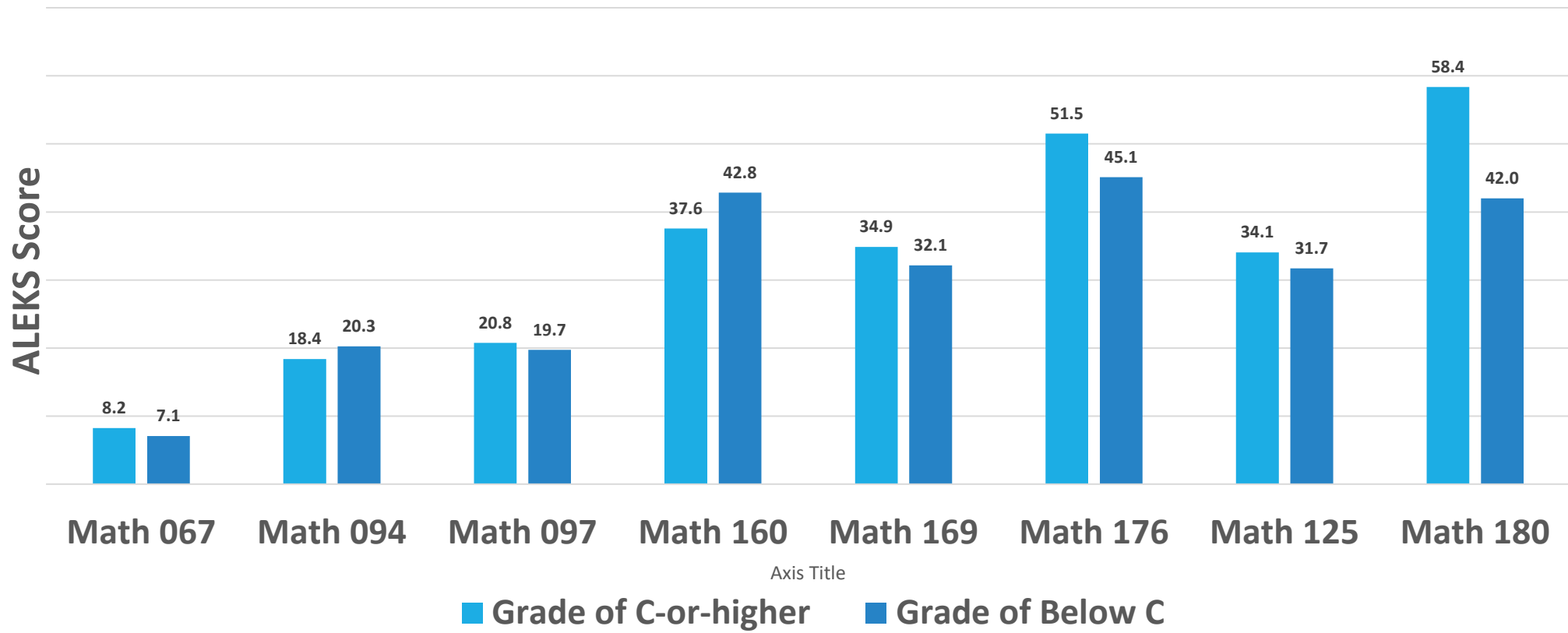current cut score (ALEKS = 30)
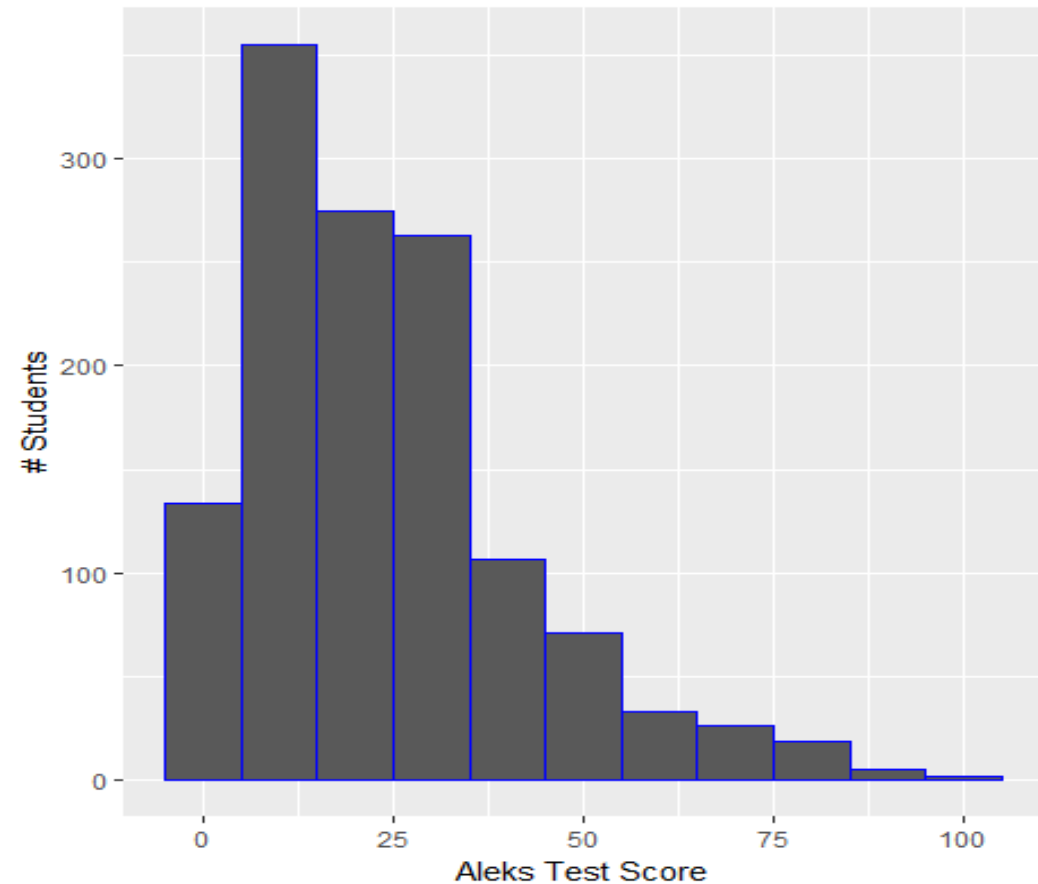
Data summary: average ALEKS score by subgroup

Average ALEKS score by subgroups

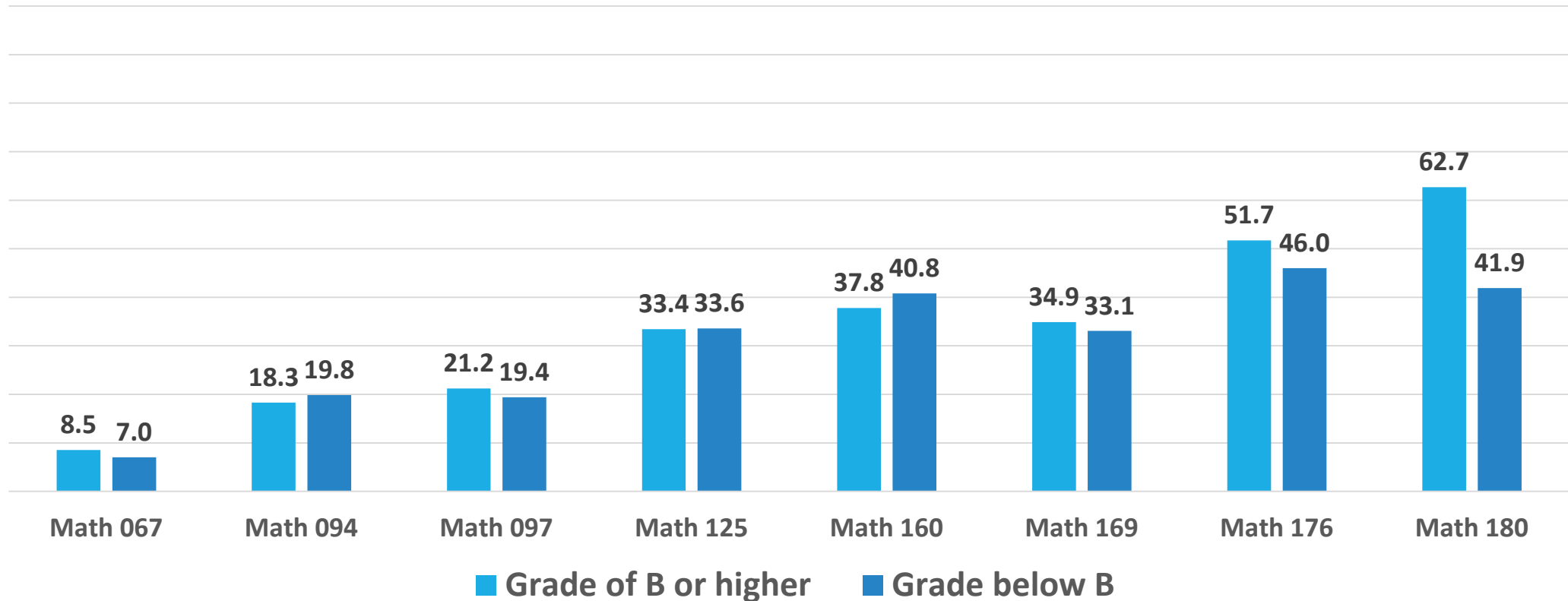Correlation between ALEKS score and course grade:
Average ALEKS score of students receiving a grade of C or higher/grade below C, by course

Correlation between ALEKS score and course grade:
Average ALEKS score of students receiving a grade of B or higher/grade below B, by course
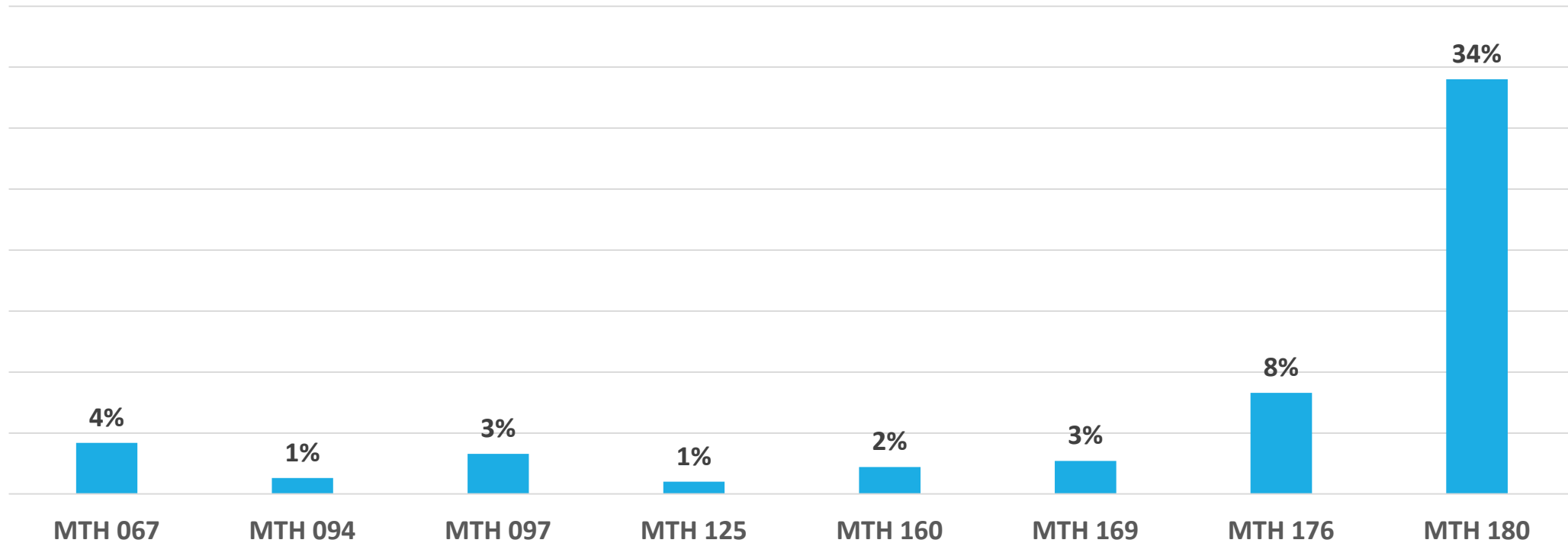
Correlation between ALEKS score and course grade:
Low strength of relationship

Percentage of variation of course grade explained by ALEKS score

Course	Percentage
MTH 067	4%
MTH 094	1%
MTH 097	3%
MTH 125	1%
MTH 160	2%
MTH 169	3%
MTH 176	8%
MTH 180	34%

Placement Accuracy Rate and Error Rate

Placement accuracy rates (College Board, ACT, CCRC)
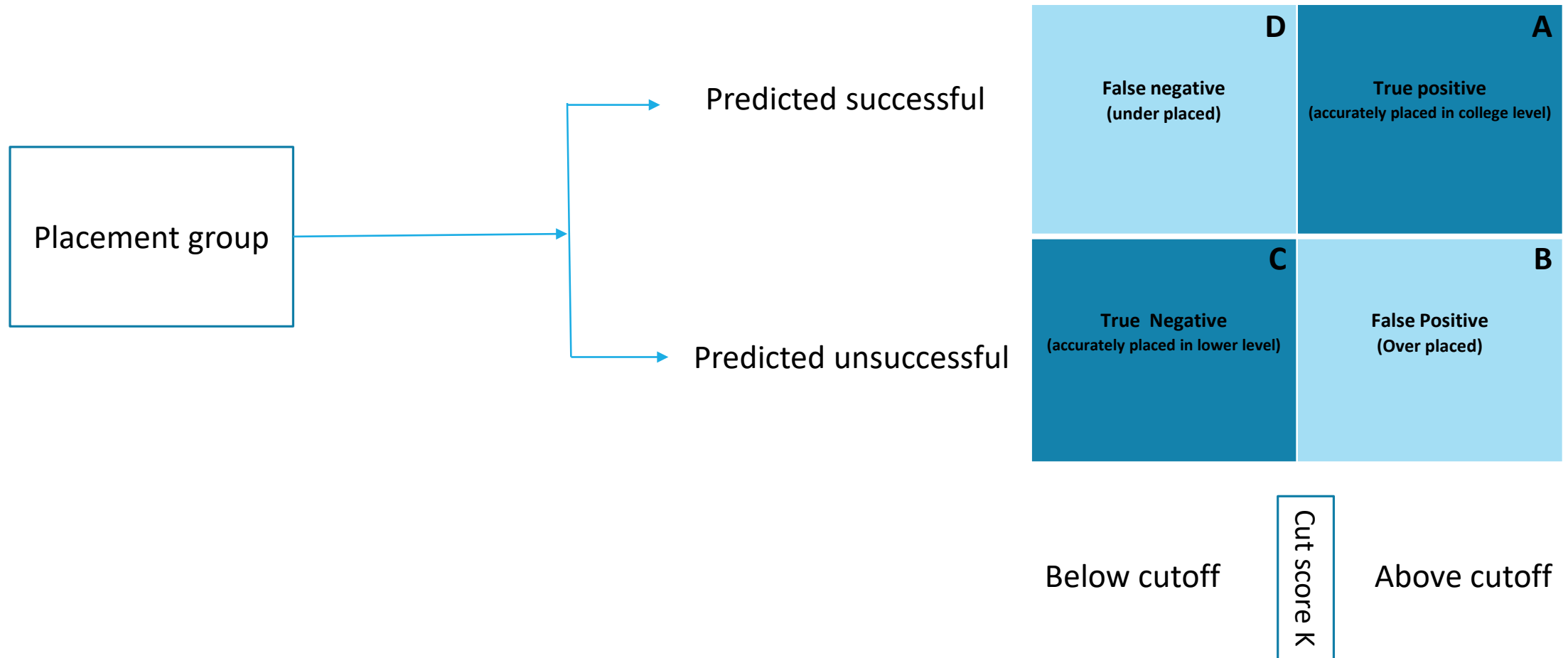
Decision model (Sawyer, 1989,1996)

No placement rule can avoid making some mistakes

Accuracy rate -> correct decision

Error rate -> incorrect decision

　　　　underestimate/overestimate

A decision model: 4 possible outcomes

Placement group

Predicted successful

Predicted unsuccessful

D False negative (under placed)	**A** True positive (accurately placed in college level)
C True Negative (accurately placed in lower level)	**B** False Positive (Over placed)

Below cutoff   Cut score K   Above cutoff

Procedure

Step	Sample	Variable	Model	Results
1.	<u>Estimation sample</u> ALEKS students enrolled in a reference math course in first semester: MATH 169: Inter. Alg. (n = 75) MATH 176: College. Alg.(n =52) MATH 180: Pre-Calculus (n = 33)	ALEKS scores Final grades: (Earn B or higher Earn C or higher)	<u>Logistic Regression</u> $P(x) = P(Y=1\|X=x) = (1 + e^{-\alpha-\beta x})^{-1}$ *Where Y = 1 if student is successful, 0 if a student is unsuccessful* *X is the student's Alek test score*	Prediction equation (<u>intercepts</u> α and <u>regression coefficient</u>s β)
2.	Placement sample: Entire ALEKS group: n = 1290	Only ALEKS scores	Extrapolation to score below cut score to get pred. probability of success for each of test score value.	**Est. Proportions of 4 placement outcomes** (Accuracy rate, Error rate)

MATH 169: Predicted proportion of students associated with 4 possible outcomes, using current WCC cut score

Grade of B or higher

D (underplaced)	A
.43	.18 Correctly placed
C	B (overplaced)
.33 Correctly placed	.065

Accuracy rate = .18+.33 = .51

Error rate = .065+.43 = .49

Grade of C or higher

| D (underplaced)	A
.48	.20 Correctly placed
C	B (overplaced)
.28 Correctly placed	.043

Accuracy rate = .20+.28 = .48

Error rate = .043 +.48 = .52

Summary of Predicted proportion of students associated with 4 possible placement outcomes using current cut score, by course

| Criteria of Success	Correlation (r)	A	B Overplaced	C	D Underplaced	Correct classification	Incorrect classification
MATH 169	0.16						
B or higher		0.18	0.065	0.33	0.43	0.51	0.495
C or higher		0.2	0.043	0.28	0.48	0.48	0.523
MATH 176	0.29						
B or higher		0.022	0.053	0.6	0.37	0.622	0.423
C or higher		0.023	0.0038	0.56	0.41	0.583	0.4138
MATH 180	0.58						
B or higher		0.007	0	0.939	0.0528	0.946	0.0528
C or higher		0.0073	0	0.569	0.423	0.57625	0.423

Accuracy rate curves for MATH 169, MATH 176, MATH 180
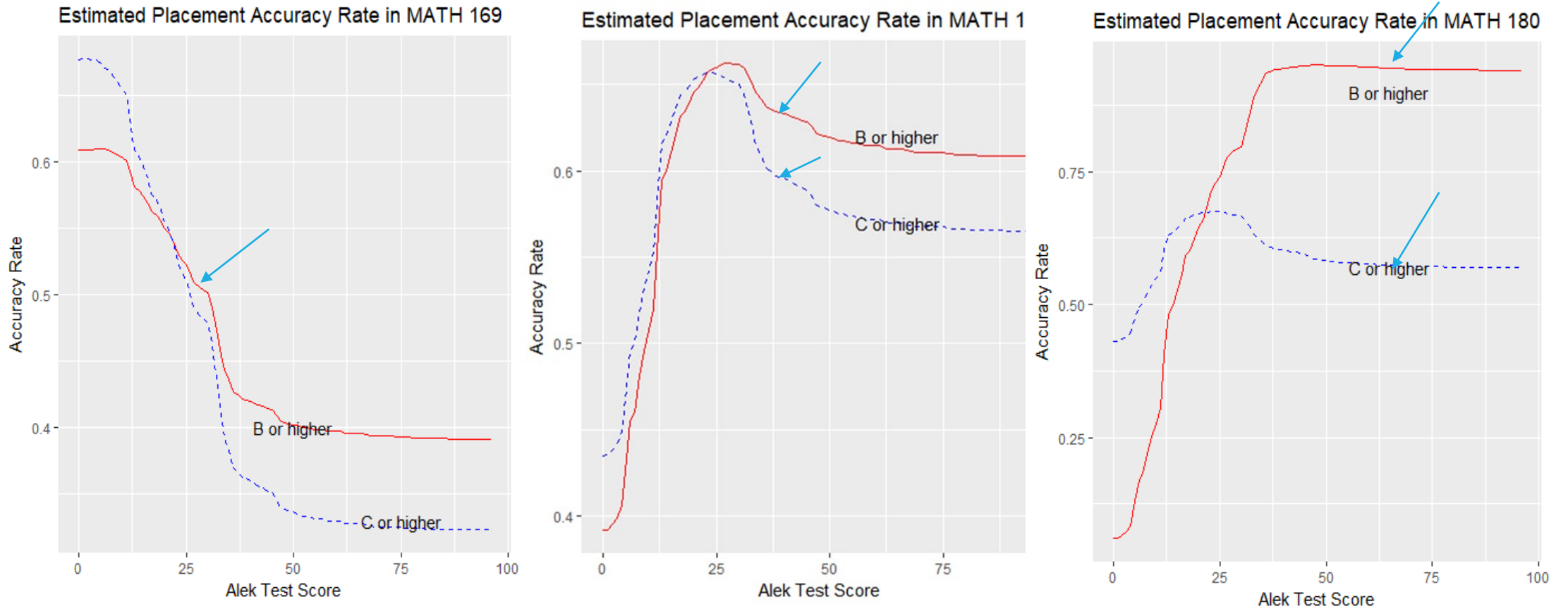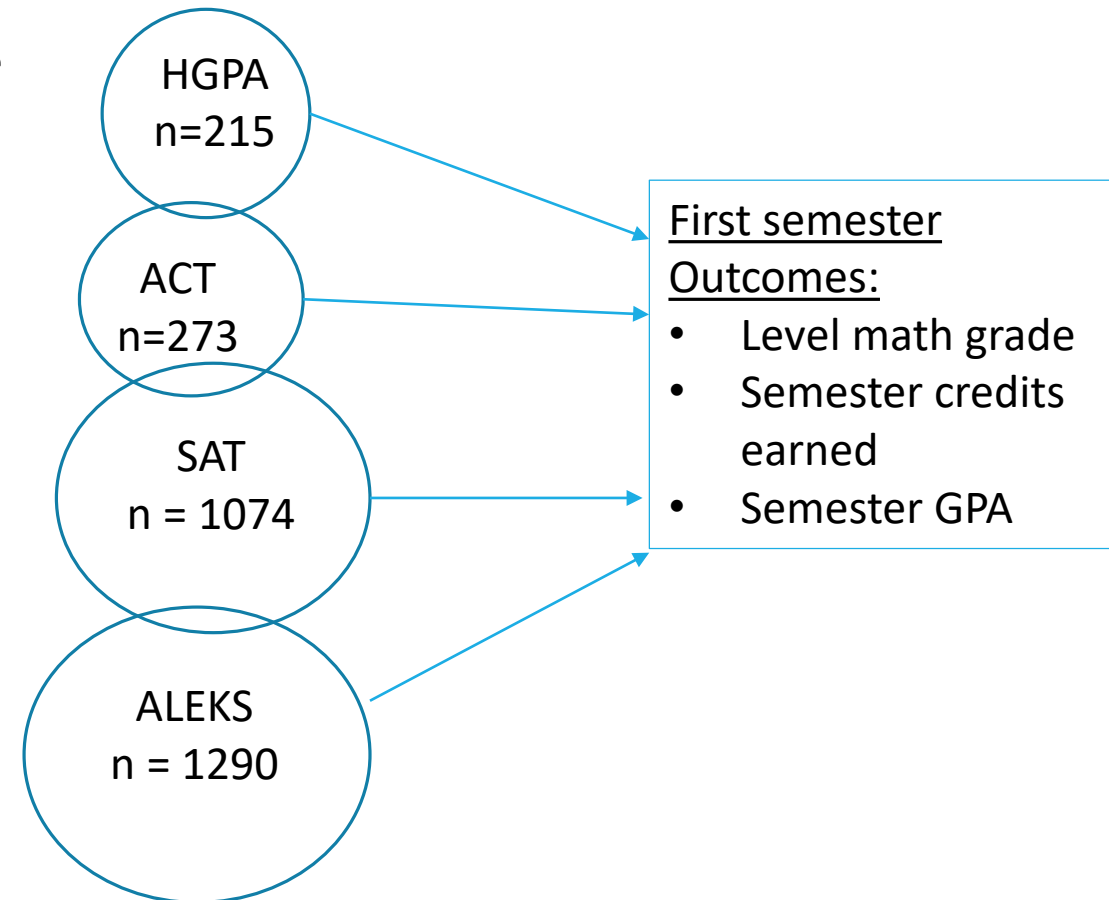
Relationship to placement outcomes

- Accuracy rate positively associated with bivariate correlation coefficient between test score and course grade.

- Low proportion of students below cut score increases TRUE POSITIVE RATE (students who score above cut off and are predicted to be successful in the course)

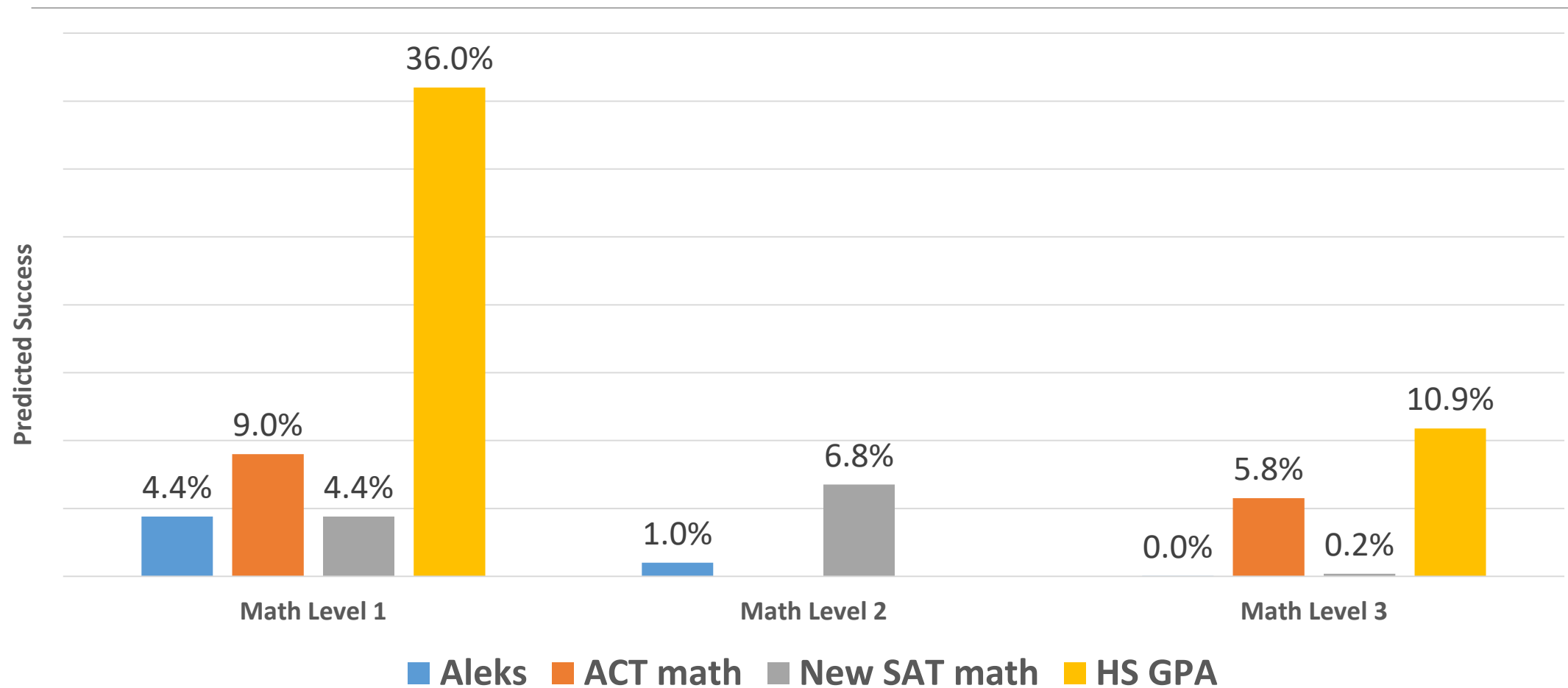# Relationship to placement outcomes
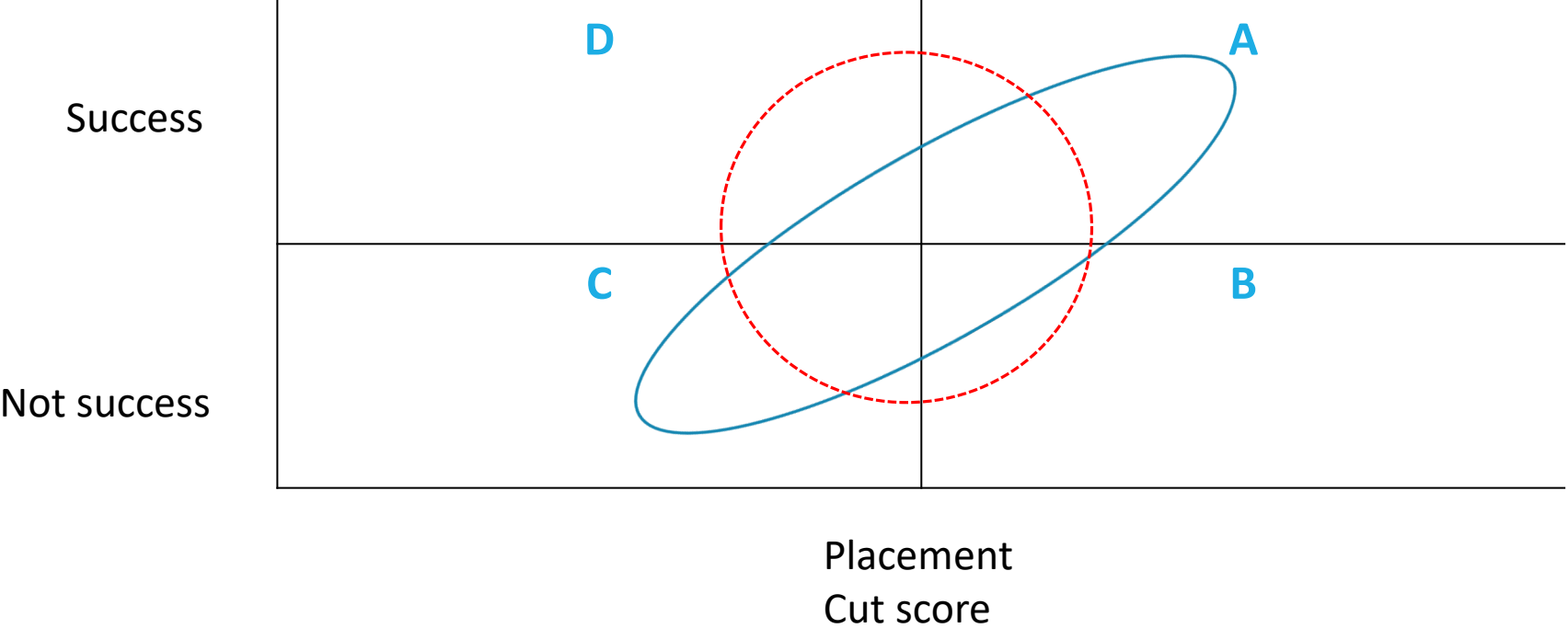
# Explore the association of other test scores with math/college performance

- Matched ACT math, SAT math, or HSGPA score with first semester outcome data (3 semesters)
- Bivariate linear regression models
- Estimated Coefficients of determination (Percent of variability of outcome variable explained by a test score)
- Limitation:

Not have enough students with multiple test scores

HGPA
n=215

ACT
n=273

SAT
n = 1074

ALEKS
n = 1290

First semester Outcomes:
- Level math grade
- Semester credits earned
- Semester GPA

Percent of variance of math grades explained by each of test scores

Percent of variance of college performance (Semester Credits earned, GPA) explained by each of test scores
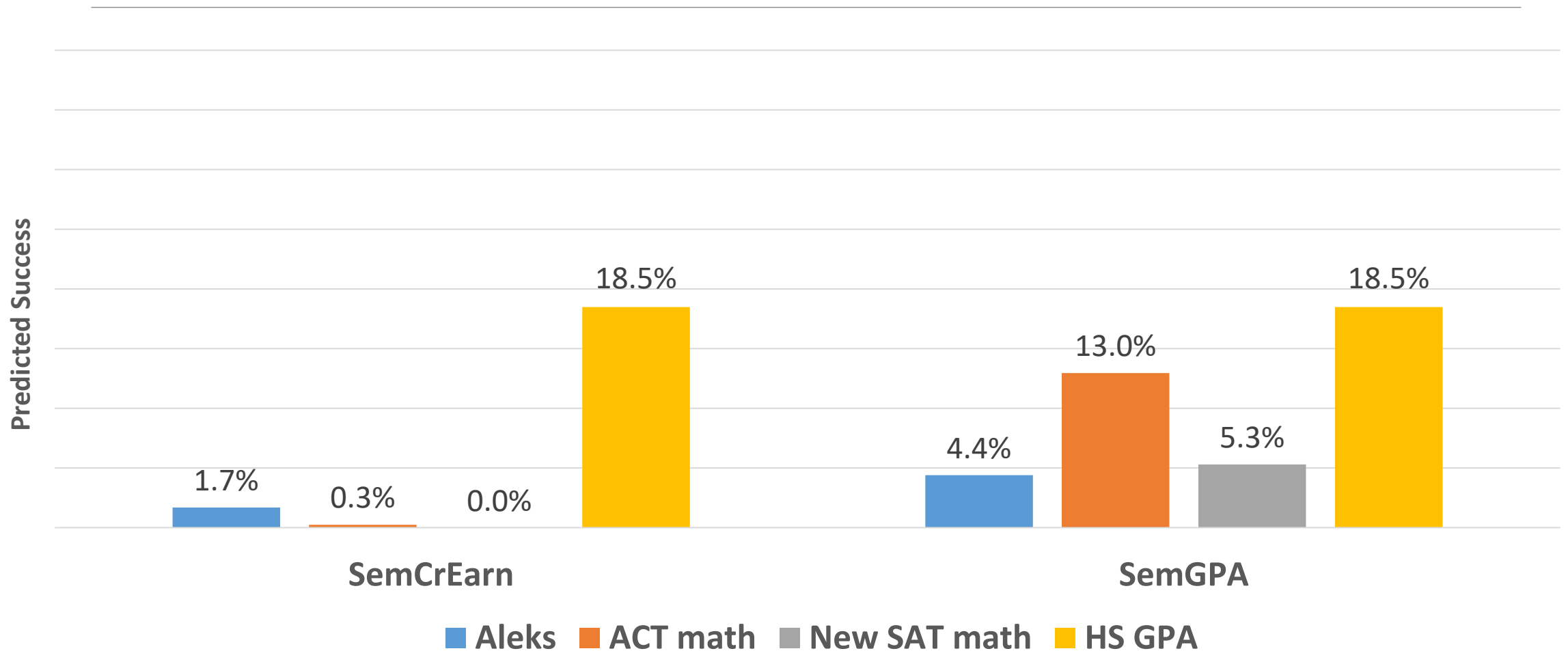
6. Conclusions

Results consistent with national studies
- Low predictive capability for math grade in developmental courses
- Accuracy rates for course placement are not high (except MTH180 w.r.t. B criteria)
- Accuracy rate for B criterion is better than C criterion
- Many students placed below their capabilities

High school GPA potentially a better predictor for math and college performance (need more data to confirm)

Results of analysis of COMPASS is similar to those of ALEKS

6. Discussion

Approaches to improve the accuracy for course placement
- ◦ Consider multiple measures (MM) for placement
  - ◦ More information ---> better prediction
  - ◦ Comm. Colleges have been using MM:
    - ◦ California
    - ◦ North Carolina
    - ◦ Virginia
    - ◦ Michigan: Mid Michigan Comm. College

Approaches to improve the effectiveness of developmental education

Discussion