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# Assessing Multiple Placement Methods for College Mathematics at a Two-Year College: A Quantitative Correlational Study

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**ABSTRACT**

Two-year institutions commonly place students into college-level mathematics using high school GPA, ACT/SAT mathematics scores, or standardized placement exams (e.g., ACCUPLACER/COMPASS). This study examined which method best predicts success in entry mathematics courses at a Midwestern two-year college. Using archival student records from a single academic year, a non-experimental, correlational design was employed. The final analytic sample included 1,130 students placed into statistics, college algebra, or pre-calculus. After screening for assumptions, binary logistic regression was used to test the association between placement method and course success (C or higher), controlling for sociodemographic factors. Course-specific models and post-hoc ROC analysis were employed as appropriate. Relative to high school GPA placement, students placed by ACT/SAT or ACCUPLACER were less likely to pass the course. Specifically, ACT/SAT placement was associated with 1.85 times lower odds of success, and ACCUPLACER with 3.91 times lower odds. The course taken mattered: students in pre-calculus had higher odds of passing than those in statistics, after controlling for other factors. Enrollment intensity and financial need were also related to outcomes. High school GPA was the strongest practical predictor of college-level mathematics success at the study site. Findings support multiple-measures placement policies that privilege GPA, with targeted supports for students flagged by other indicators.

Keywords: placement, community colleges, mathematics pathways, high school GPA, ACCUPLACER, logistic regression

## Introduction/Background

Accurate placement into college-level mathematics is consequential for student momentum at open-access, two-year institutions. Colleges typically rely on one of three approaches—high school grade point average (GPA), ACT/SAT mathematics scores, or a standardized placement exam—to determine entry into statistics, college algebra, or pre-calculus. Misplacement is costly: under placement delays progress and increases the risk of attrition, while over placement increases the likelihood of early failure. States and systems have increasingly moved toward multiple-measures policies that prioritize prior performance (e.g., GPA) and limit sole reliance on placement tests.

The present study was conducted at a Midwestern two-year college to compare the predictive validity of the three methods in use at the site. The institutional policy recognized (a) unweighted high school GPA (≥ 3.0 with at least three math units), (b) ACT mathematics ≥ 22 or SAT mathematics ≥ 500, or (c) qualifying scores on a recent placement test (ACCUPLACER/COMPASS) as independent ways to place students directly into a gateway mathematics course. Against that policy backdrop, the study asked: Which placement method best predicts student success in college-level mathematics when controlling for sociodemographic factors and course taken? Given the literature and policy shifts in several states, the working expectation was that high school GPA would outperform test-based measures for predicting success.

## Literature Review

Prior research has examined each placement indicator separately. High school GPA often outperforms standardized tests in predicting college outcomes because it reflects sustained performance across contexts. At two-year institutions, placement tests have been associated with meaningful rates of under- and over-placement, prompting states to adopt multiple-measures frameworks and co-requisite models. Meanwhile, ACT/SAT mathematics scores demonstrate predictive validity in some settings, but most evidence comes from four-year institutions and admissions-selective contexts. Taken together, the literature suggests that a single, test-only approach may be insufficient and that policies privileging GPA can improve gateway course throughput—particularly in mathematics. However, few studies evaluate all three measures at a single site while simultaneously accounting for student sociodemographics and the specific mathematics pathway selected. This study makes a significant contribution by directly comparing methods within a single institutional policy environment and by accounting for course-level effects.

## Methods

This quantitative, non-experimental correlational study utilized secondary (archival) student records from a single Midwestern two-year college. The design was selected to estimate the relationship between placement method and mathematics course success without manipulating assignment to conditions.

The population comprised all incoming students assessed under the college's placement policy during one academic year. The initial sample included students enrolled in statistics, college algebra, or pre-calculus (N = 1,131). One case with an invalid outcome was removed following MCAR testing, yielding a final analytic sample of 1,130 students. A priori power analysis (G*Power 3.1), with $\alpha = .05$, power = .80, and a moderate effect, indicated a minimum of 588 records (or 988 for .95 power); the final sample exceeded both thresholds.

Outcome: Course success was coded as pass (C or higher) versus not-pass.
Predictors: Placement method was operationalized via three mutually exclusive dummies: high school GPA (reference), ACT/SAT mathematics score, and standardized placement exam (ACCUPLACER/COMPASS). The mathematics courses taken (statistics [reference], college algebra, pre-calculus) were also dummy-coded. Controls: Sociodemographic variables available in the records included age, sex, race/ethnicity (dichotomized to address skew), veteran status, full-time/part-time enrollment, and Pell Grant eligibility.

Data were prepared and analyzed using SPSS (v. 25). Records were screened for outliers, anomalies, and missing data; Little's MCAR test was non-significant, supporting the listwise deletion of the single invalid case. The study analyzed de-identified student records under institutional approvals consistent with ethical use of secondary data.

Analyses proceeded in stages: (a) descriptive statistics and bivariate checks, (b) hierarchical binary logistic regression predicting course success from sociodemographics (Model 1), plus placement method (Model 2), plus mathematics course taken (Model 3), and (c) post-hoc ROC analysis for significant continuous predictors. Assumptions for logistic regression (measurement level, independence of observations, linearity of the logit for continuous predictors, and multicollinearity) were evaluated and addressed through dummy-coding and sensitivity checks; age exhibited nonlinearity and was further examined via ROC to identify a practical cut-point for interpretation.

## Results and Discussion

Model comparisons indicated that adding the placement method and then the mathematics course taken improved model fit over sociodemographics alone. Relative to high school GPA placement, both test-based placements predicted lower odds of passing the gateway mathematics course. Specifically, ACT/SAT placement corresponded to approximately 1.85 times lower odds of success, and ACCUPLACER/COMPASS placement to approximately 3.91 times lower odds. Course effects were evident: enrollment in pre-calculus increased the odds of passing compared with statistics after adjusting for other factors; college algebra did not differ meaningfully from statistics. Among controls, enrollment intensity and Pell eligibility were associated with lower odds of success. Age was a significant predictor; ROC analysis identified 19 years as a practical threshold differentiating success groups, indicating stronger outcomes among students 19 and younger.

**Table 1. Logistic Regression Predicting Gateway Mathematics Success (Key Results)**

| Predictor (Reference) | b | OR (pass) | Inverse OR (× less likely to pass) | Sig. | Notes |
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| ACT/SAT vs HS GPA | -0.699 | 0.50 | 2.01× | * | Lower odds of passing vs GPA |
| ACCUPLACER vs HS GPA | -1.463 | 0.23 | 4.31× | *** | Lower odds of passing vs GPA |
| Full-time vs Part-time | -0.488 | 0.61 | 1.64× | ** | Associated with lower odds of passing |
| Pell-eligible vs Not | -0.530 | 0.59 | 1.70× | ** | Associated with lower odds of passing |
| Age (per year) | 0.030 | 1.03 | — | * | ROC suggested ~19-year cut-point |
| Pre-calculus vs Statistics | — | — | — | † | Higher odds of passing; see text |
| College Algebra vs Statistics | — | — | — | n.s. | No meaningful difference; see text |

Notes: OR = odds ratio for passing (C or higher). Inverse OR expresses how much less likely the outcome is relative to the reference. Significance codes: * $p < .05$; ** $p < .01$; *** $p < .001$; n.s. = not significant; † = direction supported in model, coefficient not shown here.

## Recommendations and Conclusions

Policy and Practice: Prioritize high school GPA as the primary direct-placement measure for gateway mathematics, with ACT/SAT and placement-test results used as corroborating evidence rather than sole determinants. Adopt a multiple-measures framework that (a) privileges GPA, (b) routes students who do not meet thresholds into co-requisite supports rather than multi-course remediation, and (c) regularly audits placement rules against local outcomes by course pathway. Given the observed sociodemographic effects, embed proactive advising and academic supports for Pell-eligible students and students identified as higher risk by ROC-based cut-points.

Limitations: Findings reflect one institution and one academic year using archival records; unmeasured factors (e.g., instructor effects, major/program) may contribute to outcomes. Future work should examine longitudinal completion metrics and replicate across institutions and cohorts.

Conclusion: Within this policy environment, high school GPA was the most actionable and accurate indicator for placing students into college-level mathematics. Implementing multiple-measures placement with GPA at the center—and continuous local validation—can improve gateway throughput while reducing unnecessary remediation.