Curriculum Associates RESEARCH

Predicting Algebra Readiness

Mathematics

Research Summary, January 2024

Introduction

Algebra readiness plays a critical role in shaping students' academic and life trajectories. The purpose of this study was to understand how the combined and unique contributions of previous Mathematics domain performance are related to future overall mathematics performance, specifically algebra readiness. Student mathematics performance was tracked using data from the *i-Ready Diagnostic* between the 2020–2021 through 2022–2023 school years for five cohorts of students in Grades 2–6.

Study Overview

This study was designed to address the following research question:

> How does the **domain-level performance** in mathematics in **Grades 2, 3, 4, 5, and 6** predict **overall mathematics performance** two years later in **Grades 4, 5, 6, 7, and 8**, respectively?

Student mathematics performance was tracked using data from the *i-Ready Diagnostic* over two years for five cohorts of students in Grades 2–6. Two performance-level standards were used to classify students as "algebra ready." Students were classified as "on track" to being algebra ready by the end of Grade 8 if they end the year with a Mid or Above Grade Level placement for their chronological grade. A student is classified as algebra ready if they meet or exceed a score of 541 on the Diagnostic for Mathematics in Grades 5 and above, which represents a Mid On Grade Level placement for a Grade 8 student. See Table 3 in the full technical report for cohort-specific placement-level standards.

i-Ready

Findings

Using linear regression and descriptive analyses of student placement patterns, this longitudinal analysis found that Mathematics domain placements in Year 1 (i.e., winter 2021) of the study were predictive of overall mathematics scores in Year 3 (i.e., spring 2023) across cohorts.

Table 1: Grade 5 Placement by Domain in Year 1 and Placement by Overall Mathematics in Grade 7 (Year 3)

Year 1 (Winter 2021)				Year 3 (Spring 2023) Overall Math Placement Distribution					
Cohort	**Domain**	**Domain Placement**	**Number of Students**	**Algebra Ready**	**Mid or Above Grade Level**	**Early On Grade Level**	**One Grade Level Below**	**Two Grade Levels Below**	**Three or More Grade Levels Below**
Grades 5 → 7	Overall Placement	Mid or Above Grade Level	14,422	62%	77%	20%	3%	.3%	.2%
		Early On Grade Level	22,034	19%	33%	44%	20%	2%	1%
		One Grade Level Below	38,449	3%	7%	26%	46%	12%	10%
		Two Grade Levels Below	11,722	1%	1%	5%	31%	24%	38%
		Three or More Grade Levels Below	10,935	.3%	.4%	1%	8%	11%	79%
	Number and Operations	Mid or Above Grade Level	23,002	45%	59%	29%	10%	1%	1%
		Early On Grade Level	19,673	14%	24%	40%	29%	4%	3%
		One Grade Level Below	41,357	3%	6%	20%	41%	15%	18%
		Two Grade Levels Below	5,202	1%	1%	6%	25%	20%	49%
		Three or More Grade Levels Below	8,328	.3%	1%	2%	10%	10%	77%
	Algebra and Algebraic Thinking	Mid or Above Grade Level	15,779	50%	64%	25%	9%	1%	1%
		Early On Grade Level	22,875	20%	32%	38%	24%	3%	3%
		One Grade Level Below	38,871	5%	9%	26%	41%	13%	12%
		Two Grade Levels Below	9,511	1%	1%	6%	31%	22%	40%
		Three or More Grade Levels Below	10,526	.3%	1%	1%	10%	12%	76%
	Measurement and Data	Mid or Above Grade Level	27,281	41%	55%	31%	12%	1%	1%
		Early On Grade Level	16,223	12%	21%	37%	33%	6%	4%
		One Grade Level Below	31,418	4%	8%	24%	41%	13%	13%
		Two Grade Levels Below	9,694	1%	2%	10%	33%	21%	34%
		Three or More Grade Levels Below	12,946	1%	1%	3%	15%	14%	67%
	Geometry	Mid or Above Grade Level	13,723	50%	64%	26%	9%	1%	1%
		Early On Grade Level	17,648	24%	36%	36%	23%	3%	2%
		One Grade Level Below	35,271	8%	14%	30%	37%	10%	9%
		Two Grade Levels Below	12,895	2%	4%	15%	39%	18%	24%
		Three or More Grade Levels Below	18,025	1%	2%	6%	21%	15%	57%

For example, in the Grade 5 cohort, 15% of all students are algebra ready by the end of Grade 7, with an additional 7% on track. For students with an overall Mid or Above Grade Level placement, 62% were algebra ready, and an additional 15% were on track, while only 19% of students with an overall Early On Grade Level placement were algebra ready, with an additional 14% on track to be algebra ready.

Further, we found that all domains are important for future algebra success, suggesting a holistic approach to teaching mathematics. For example, in the Grade 5 cohort, students who placed Mid or Above Grade Level in all four domains in winter of Year 1 were predicted to have an overall mathematics score of 550 by the end of Year 3 (i.e., spring of Grade 7). That baseline exceeds the performance-level standard for being categorized as algebra ready.

If a Grade 5 student is Mid or Above Grade Level in at least three domains and Early On Grade Level in one domain in winter 2021, their predicted Grade 7 spring 2023 mathematics score (e.g., 541 or higher) would remain algebra ready. However, if a Grade 5 student is Early On Grade Level in three domains and Mid or Above Grade Level in one domain, their predicted Grade 7 mathematics score is not on track for algebra readiness. The model's R^2 was .61, indicating that the model explained about 61% of the variance in Grade 7 scores.

Table 2: Predicting Grade 7 Overall Reading Score Based on Grade 5 Mathematics Domain Placements

Overall Combination	Mid or Above Grade Level	Early On Grade Level	Predicted Overall Mathematics Score in Grade 7	Difference from Baseline
All Domains Mid or Above Grade Level	NO + AL + MS + GEO		550	0
Three Mid or Above Grade Level domains and One Early On Grade Level Domain	NO + AL + GEO	MS	543	-7
	NO + AL + MS	GEO	543	-7
	NO + MS + GEO	AL	542	-8
	AL + MS + GEO	NO	541	-9
Two Mid or Above Grade Level Domains and Two Early On Grade Level Domains	NO + AL	MS + GEO	536	-14
	MS + GEO	NO + AL	533	-17
One Mid or Above Grade Level Domain and Three Early On Grade Level Domains	NO	AL + MS + GEO	527	-23
	GEO	NO + AL + MS	525	-25
All Domains Early On Grade Level		NO + AL + MS + GEO	518	-32

Note: NO, AL, MS, and GEO refer to Number and Operations, Algebra and Algebraic Thinking, Measurement and Data, and Geometry domains, respectively. The difference from baseline when multiple domains are added may differ slightly from the sum of the differences reported for individual domains due to rounding. More precise point estimates and all combinations of domains can be found in Appendixes A and B of the full technical report.

While prior performance was predictive of future performance, in all cohorts, we also found the percentage of students who ended Year 3 on track or algebra ready is higher than the predicted percentage. In other words, this study shows that students' starting placement does not predetermine their end placement, especially for the earlier grades. While we do not know what students' experiences were between Year 1 and Year 3, these trends suggest that using previous performance to provide students with appropriate, targeted, and effective instruction can perhaps accelerate students' mathematics trajectories toward algebra readiness.

Full Report References

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