Data Into Action

California Mathematics & Science Partnership
CaMSP Statewide Evaluation

Public Works
Pasadena, CA

About CaMSP

- A competitive grant program to implement innovative professional development programs through the Mathematics and Science Partnership Program under Title II, Part B, of No Child Left Behind Act of 2001, which ended in June 2017.
- Administered by the Science, Technology, Engineering and Mathematics (STEM) Office of the California Department of Education.
- Key Features of Programs funded under the CaMSP Initiative included:
  - Partnership Driven
  - Teacher Quality
  - Challenging Courses and Curricula
  - Evidence-Based Design and Outcomes
  - Institutional Change and Sustainability.

About Public Works

- Founded in 1998, Public Works is a nonprofit in Pasadena dedicated to working with communities, government, schools and parents by providing services and resources to educate and inform children, youth and families.

- Public Works served as the statewide evaluator of CaMSP since 2003 and a local evaluator to multiple partnerships in previous cohorts. Beginning in 2014, PW served as both the statewide evaluator and the local evaluator for the partnerships.

Public Works Role in Evaluation

- **Statewide Evaluation:** The impact of 60 hours of intensive and 24 hours of follow-up from a research PD model have on teacher and student outcomes.
  - Participating Teacher Survey, Partner Survey, Site Visits, Teacher Content Assessment, Student Outcome Study Using Statewide Assessments

- **Local Evaluation:** Develop local evaluation questions designed to prove the local PD model was effective in terms of teacher and student outcomes.
  - Teacher Surveys, Student Surveys, Classroom Observation, Lesson Study, and PLC Tools and Protocols, Coaching Logs, Lesson Plan Rubrics, Teacher Portfolios, Action Research, Student Notebooks, Benchmark Exams, etc.

Scope of CaMSP

- **From 2003 to 2017, 147 CaMSP partnerships through 13 separate cohorts serving teachers in grades 3 to 8 for science and 3 to Algebra I for mathematics including Research and Demonstration Cohorts.**
- 50 County Offices Served, 953 Districts, 5,423 schools
- 19,483 Participating teachers and 1,086,582 Students
- 55 current projects in different stages of implementation:
  - 20 Cohort 10 partnerships in year 3 of STEM learning
  - 12 Cohort 11 partnerships in year 2 of STEM learning
  - 12 Cohort 12 partnerships in year 2 of math or science learning
  - 11 Cohort 13 partnerships in year 1 of math, science or STEM learning

Scope of CaMSP in 2015-16 Evaluation

- **Cohort 10 was completing the second grant cycle of activities in 2015-16, while Cohorts 11 and 12 were completing the first grant cycle.**

Cohort	Total # of Partnerships	Total # of District Partners	Range of # of District Partners (smallest to largest # of districts)	Total # of Teachers Targeted	# of Partnerships Selecting Mathematics	# of Partnerships Selecting Science
Cohort 10*	20	108	1-22	1,110	16	15
Cohort 11**	12	80	1-28	746	8	7
Cohort 12	12	58	1-17	989	7	6
Total	**44**	**246**		**2,845**	**31**	**28**

*Note that 14 of 20 Cohort 10 partnerships selected engineering as a supporting discipline and 17 selected technology.
** Note that 9 of 12 Cohort 11 partnerships selected engineering as a supporting discipline and another 9 partnerships selected technology.

Context for CaMSP Program

- Reauthorization of ESEA signed December 2015 under Every Student Succeeds Act (ESSA) rethinking of accountability systems and opportunities for professional learning supports.
- California continued to implementation of new standards in mathematics and science and prepare for Smarter Balanced Assessment in mathematics and English language arts; new state assessment in science developed by the state.
- Transition to support of professional development to integrate science, technology, engineering and mathematics (STEM) beginning in 2014.
- Transition to centralized local evaluation and technical assistance to support partnership data collection, teacher content testing and reporting under Public Works beginning in 2014.

ESSA Criteria for Quality Professional Development

- **Sustained:** taking place over an extended period; longer than one day or a one-time workshop.
- **Intensive:** focused on a discreet concept, practice or program.
- **Collaborative:** involving multiple educators, educators and coaches or set of participants grappling with the same concept or practice and in which participants work together to achieve shared understanding.
- **Job-embedded:** a part of the ongoing, regular work of instruction and related to teaching and learning taking place in real time in the teaching and learning environment.
- **Data-driven:** based upon and responsive to real time information about the needs of participants and their students.
- **Classroom-focused:** related to the practices taking place during the teaching process and relevant to instructional process.

These definitions were developed by Frontline Research & Learning Institute based on the terms used in ESSA for their report titled *Bridging the Gap, Paving the Pathway from Current Practice to Exemplary Professional Learning*, 2016, authored by Elizabeth Combs and Sarah Silverman.

Key Features that drive CaMSP initiatives and measurement…

- Partnership driven
- Teacher quality
- Challenging courses and curricula
- Evidence-based design and outcomes
- Institutional change and sustainability

CaMSP Partnership-Driven...

- ...combined **locally customized professional development models based on research** and recognized strategies to support teacher learning and classroom implementation with a longer-term horizon to improve and reflect on what worked.
- ...provided opportunities **for mathematics, science, engineering and technology discipline professors** to be involved in larger scale professional development for K-12 teachers.
- ...partnerships offered **access to rich professional learning opportunities throughout the school year** supporting teacher retention in the program and job-embedded approaches to learning.
- ...**benefited rural areas with little access** to sustained professional learning support.

CaMSP Teacher Quality included…

- Multiple Classroom Follow-up Approaches
  - Coaching, Lesson Study, Professional Learning Communities (PLCs), and Communities of Practice (CoP)
- Content Focus and Linkages to Math and/or Science Standards in Intensives
  - Including the Standards of Mathematical Practices (SMPs) from CCSS-M, NGSS Engineering Practices, and Integrated STEM Learning.
- Use of Technology and Integration of Engineering
  - Wide use of technology – for management, teaching, or collaboration – throughout projects and support for learning new applications, however more common in Cohort 10 than 11 or 12.

CaMSP Challenging Courses & Curricula supported…

- STEM products or curricula
- Partnerships created:
  - new single-disciplinary (math hands-on activity)
  - interdisciplinary (math and engineering lesson or series)
  - multi-disciplinary (multi-week project integrated across STEM disciplines) curriculum using a number of approaches or models
  - 5E Lessons and Units, Mathematics-focused Lesson Design, Project-Based Learning, and Curriculum Aligned Approaches.

Evidence-based Design & Outcomes supported…

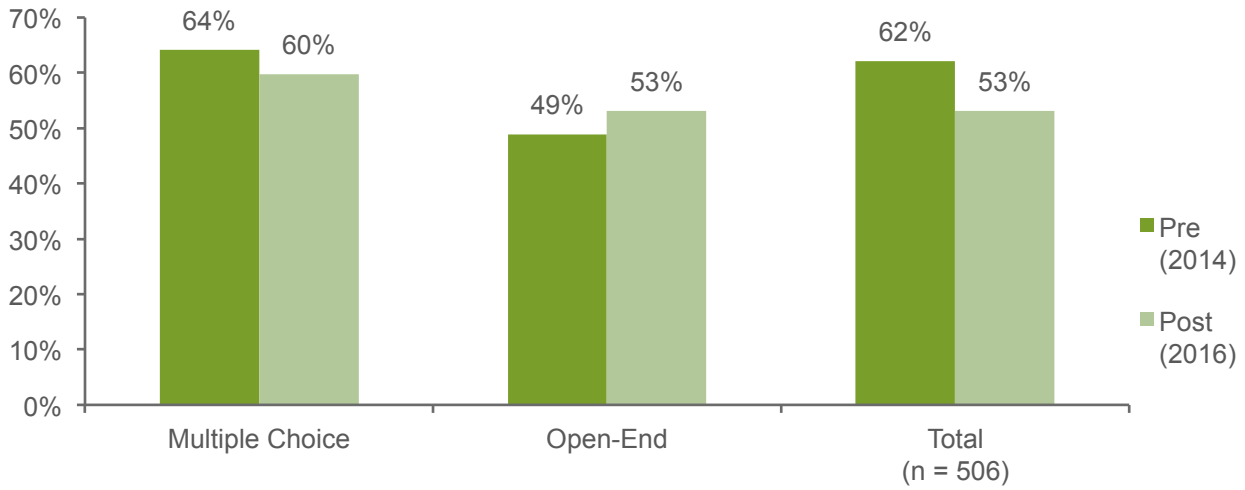
- **A Statewide Evaluation Framework:**
  - Online teacher attendance database that included demographic and teaching information used by partnerships to report on attendance and teacher participation for CDE year to date or YTD reports.
  - Annual student outcome data request and analysis for student outcome GPRA.
  - Annual partner survey, teacher survey, site visits to partnerships, telephone interviews of partnership directors and a matched/ treatment control study of student outcomes.

Evidence-based Design & Outcomes supported…

- **A Local Partnership Evaluation Framework:**
  - An initial evaluation plan design meeting, at least two annual follow-up meetings, customized instrumentation to measure project priorities, data collection and analysis.
  - PW provided all the evaluation-related reporting that is required at the state and federal levels for each partnership (state quarterly reports and annual evaluation report and evaluation under APR).
  - Centralized administration of the teacher content assessment under PW's evaluation activities in mathematics and/or science.

Teacher Content Assessment Results: Science

- **Cohort 10:**
  - **Multiple Choice:** teachers *did not perform as well* on the post-assessment relative to the pre-assessment ($p < .001$).
  - **Open-end or constructed response:** teachers *performed slightly better* on the post-assessment relative to the pre-assessment ($p < .001$).
  - Analysis of the **total percent correct** on the TCAS revealed that teachers *did not perform as well on the post-assessment* as they had on the pre-assessment overall ($p < .001$).



Teacher Content Assessment Results: Science

- **Cohort 11:**
  - **Multiple Choice:** teachers *significantly improved* their performance from pre- to post-assessment ($p < .001$).
  - **Open-end or constructed response:** teachers performed *slightly better* on the post-assessment relative to the pre-assessment ($p < .001$).
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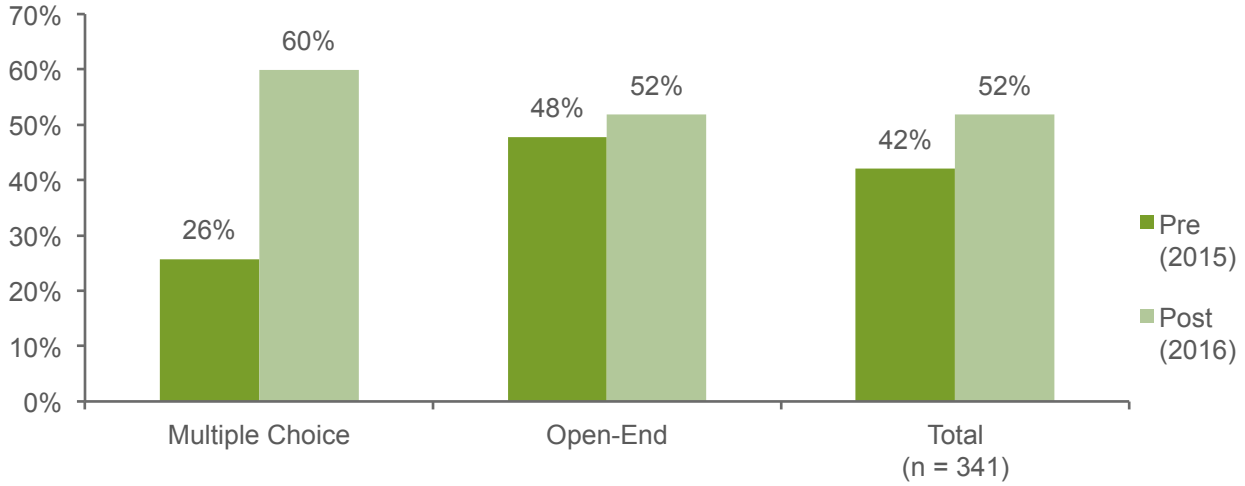
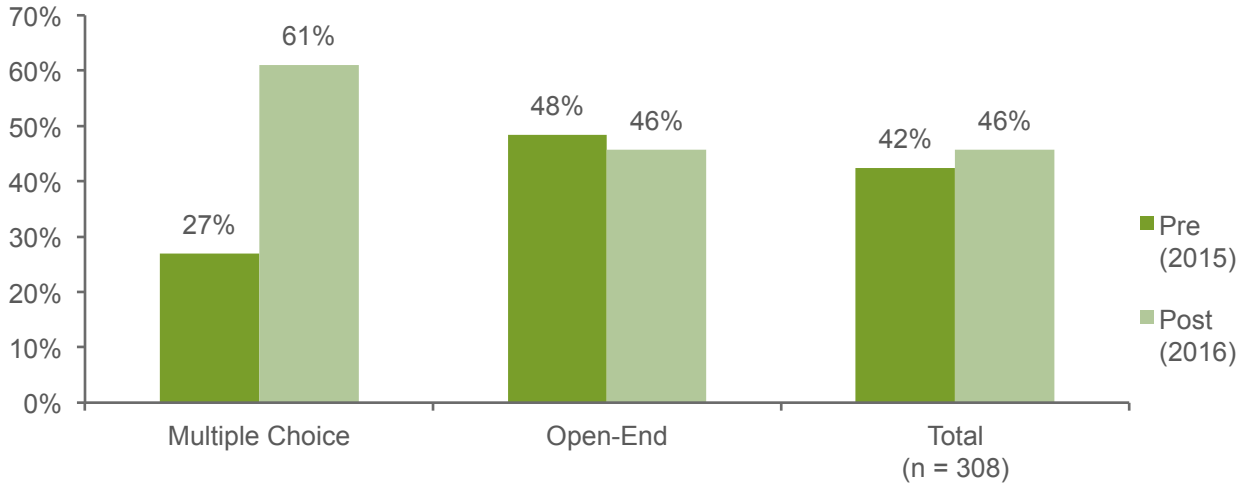


Teacher Content Assessment Results: Science

- **Cohort 12:**
  - **Multiple Choice:** teachers *significantly improved* their performance from pre- to post-assessment ($p < .001$).
  - **Open-end or constructed response:** teachers *performed slightly worse* on the post-assessment relative to the pre-assessment ($p < .001$).
  - Analysis of the **total percent correct** on the TCAS revealed that teachers *performed better* on the post-assessment relative to the pre-assessment overall ($p < .001$).

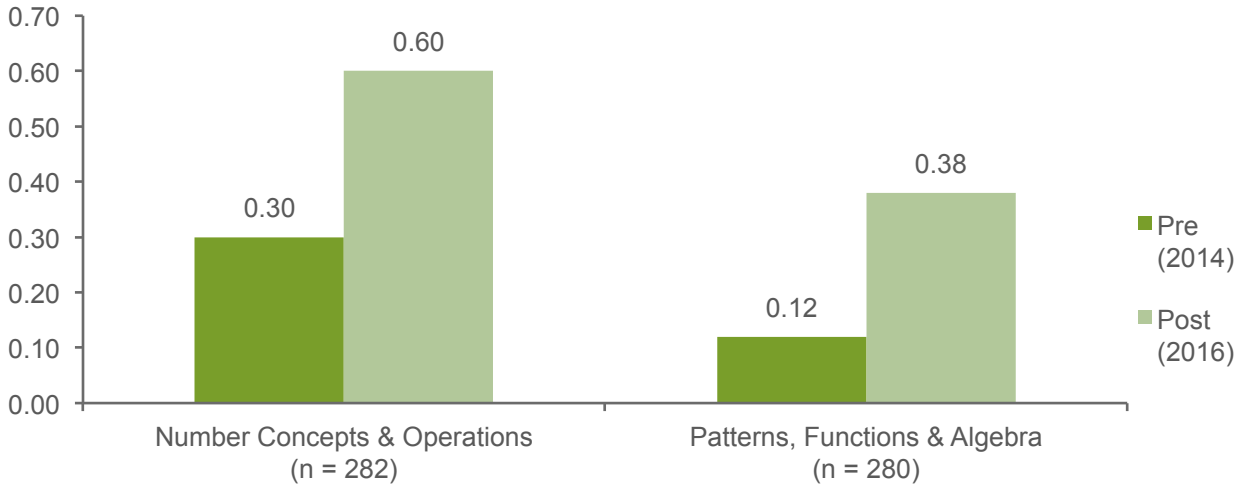


Teacher Content Assessment Results: Science

- **Findings:**
  - In general, **Cohort 10** teachers *performed better* on the pre-assessment relative to the post-assessment overall.
  - Grade level appeared to have an impact on teacher performance in **all Cohorts**, as *secondary teachers demonstrated greater gains* from pre- to post-assessment relative to elementary teachers across the cohorts.
  - For **Cohort 11** teachers, *every partnership in this cohort improved* from pre- to post-assessment on both sections of the assessment and overall.
  - **Cohort 12** teachers also *improved overall* as well as on the multiple choice portion of the TCAS.
  - **Cohort 10** teachers *performed better* on the constructed response items from pre- to post-assessment but *scores declined* for **Cohort 12** teachers on this portion of the TCAS.

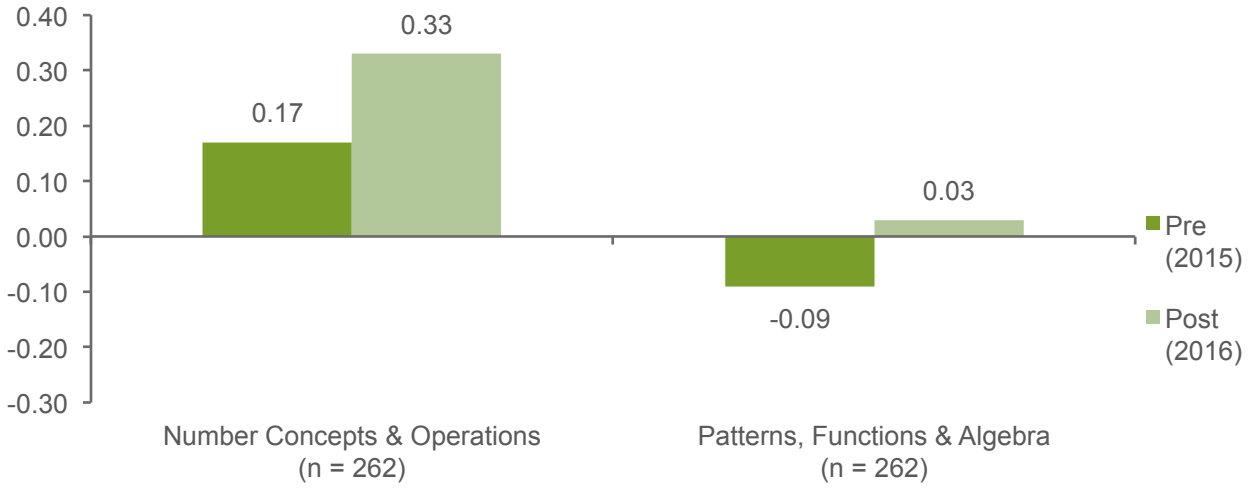
Teacher Content Assessment Results: Mathematics

- **Cohort 10:**
  - **Number Concepts and Operations:** teachers across Cohort 10 had *significantly improved* scores from pre- to post-assessment ($p < .001$).
  - **Patterns, Functions, and Algebra:** teachers showed *significant improvements* from pre- to post-assessment on this portion of the exam as well ($p < .001$).



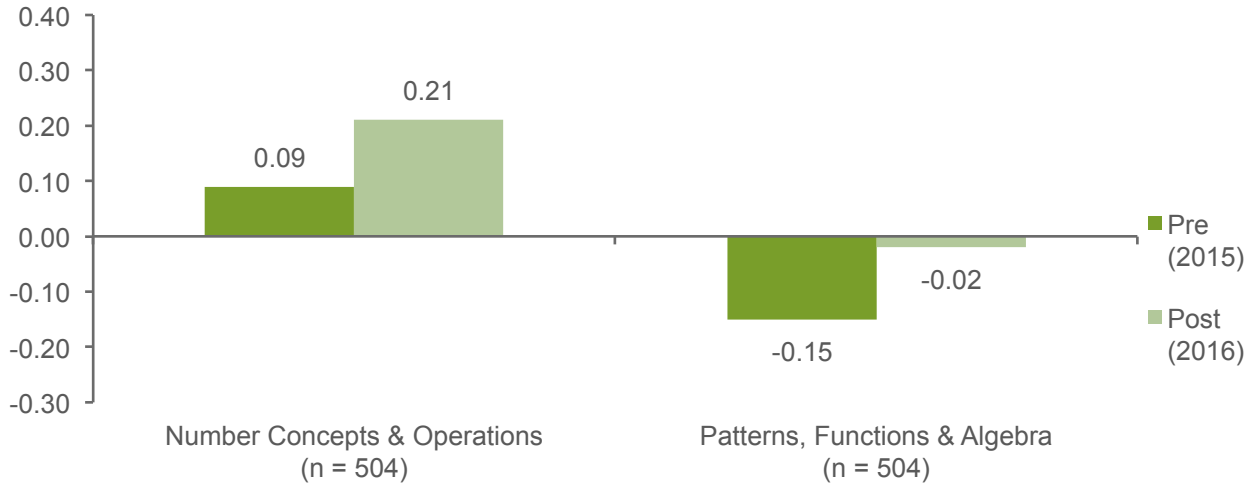
Teacher Content Assessment Results: Mathematics

- **Cohort 11:**
  - **Number Concepts and Operations:** teachers across Cohort 10 had *significantly improved* scores from pre- to post-assessment ($p < .001$).
  - **Patterns, Functions, and Algebra:** teachers showed *significant improvements* from pre- to post-assessment on this portion of the exam as well ($p < .01$).



Teacher Content Assessment Results: Mathematics

- **Cohort 12:**
  - **Number Concepts and Operations:** teachers across Cohort 10 had *significantly improved* scores from pre- to post-assessment ($p < .001$).
  - **Patterns, Functions, and Algebra:** teachers showed *significant improvements* from pre- to post-assessment on this portion of the exam as well ($p < .001$).



Teacher Content Assessment Results: Mathematics

- **Findings:**
  - Teachers *improved their performance* on the Number Concepts & Operations portion of the LMT from pre- to post-administration to a statistically significant degree in **all Cohorts**. The same was true for the Patterns, Functions & Algebra portion of the LMT.
  - Multiple comparison analyses were conducted on years teaching, education level and grade level taught, which *there were differences* in **Cohorts 10 & 12**. For Cohort 11, there were no statistically significant differences on these factors.
  - **Cohort 10** *elementary teachers improved at a greater rate* than secondary teachers on the the Patterns, Functions & Algebra portion, likely because their baseline was substantially lower.
  - In **Cohort 12**, there was an interaction on grade level and performance on the Number Concepts & Operations section of the LMT, with *elementary teachers showing greater improvement* from pre- to post-assessment.

2016 CaMSP Statewide Student Outcome Study Methodology

- **Matched-Comparison Design:** Using a matched-comparison design, PW compared the outcomes of students of CaMSP treatment teachers to a control group of teachers matched by years of teaching, grade level taught and educational level within the partnership's participating school districts.
- **Definition of Treatment:** Participating teachers who had completed 84 hours of professional development each year (60 intensive hours and 24 hours of classroom follow-up) were included in the treatment group.
- **Student Data:** Rosters of students taught by treatment and matched control teachers were combined with student demographic data, and SBAC and CST results (scaled scores and achievement/proficiency levels).
- **Matching Procedure:** A matching procedure called "Coarsened Exact Matching" or CEM was used to create sub-samples of treatment and control students from each partnership and at each grade level. These smaller sub-samples included only matched control students who were "virtual twins" of treatment students.
- **Student matching characteristics included:** *ethnicity, language classification, socioeconomic status, special education, and prior achievement in mathematics (2014-15 achievement level).*

2016 Student Outcome Study Results: Science

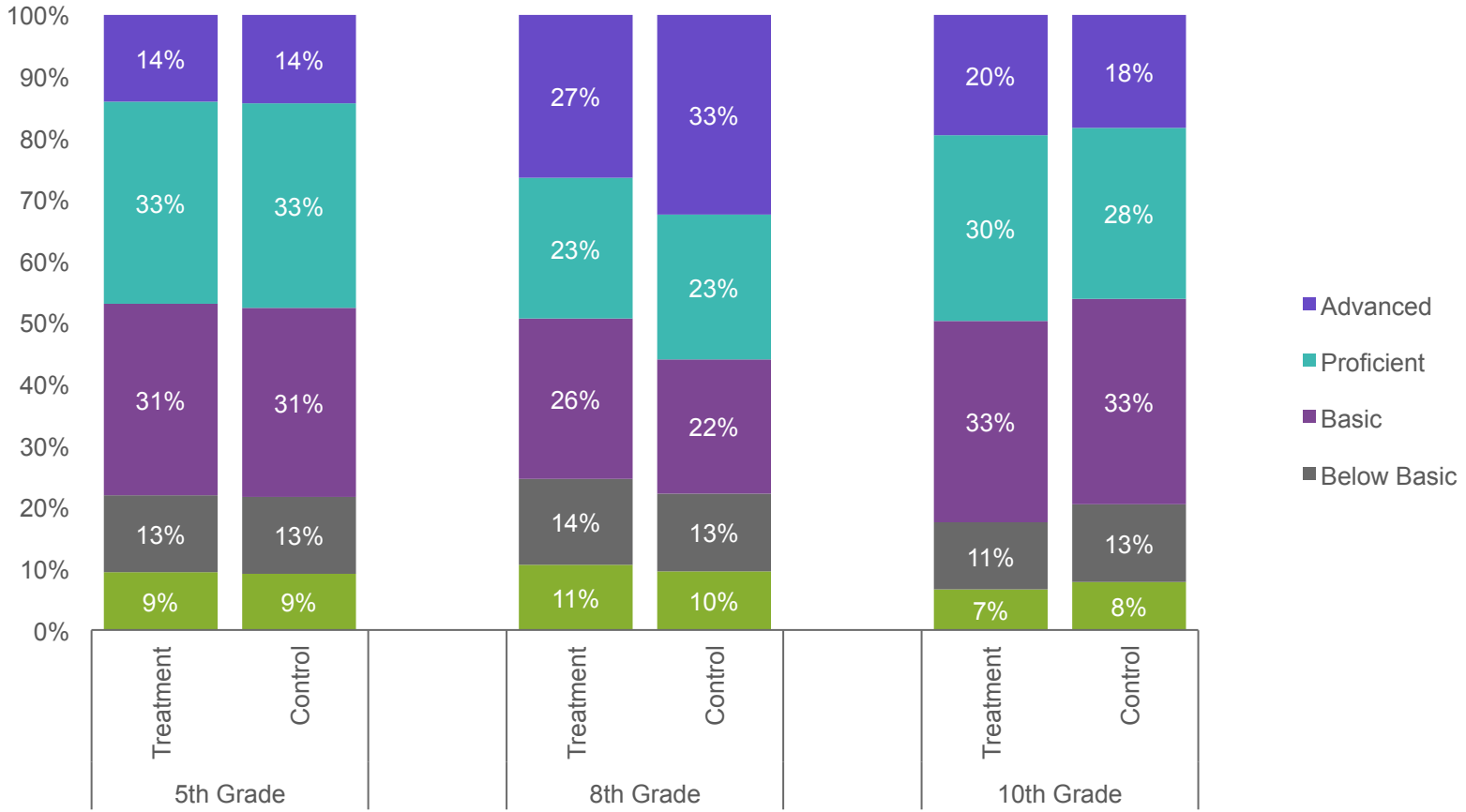
- **Cohort 10:**
  - 15,508 students of 290 treatment teachers
  - 17,550 students of 286 control teachers
  - 19,814 students *after matching* were included in the study
  - **Treatment students** *performed about the same* as the matched control students on 5th grade science CSTs, as shown below. However, matched *control students scored higher* than treatment students in 8th grade and *treatment students scored higher* than control students in 10th grade. The differences in both 8th and 10th = grades were statistically significant. Proficiency levels at each grade level are shown on the next slide.

		Average Scaled Scores			% Proficient or Advanced		
Grade Levels	n (per group)	Treatment	Control	Difference	Treatment	Control	Difference
5th	1,048	347	348	-1	47%	48%	-1%
8th	4,457	359	369	-10***	49%	56%	-7%***
10th	4,402	351	347	4***	50%	46%	3%**

*$p \leq .05$, **$p \leq .01$, ***$p \leq .001$

2016 Student Outcome Study Results: Science

- **Cohort 10: Proficiency Levels**



2016 Student Outcome Study Results: Science

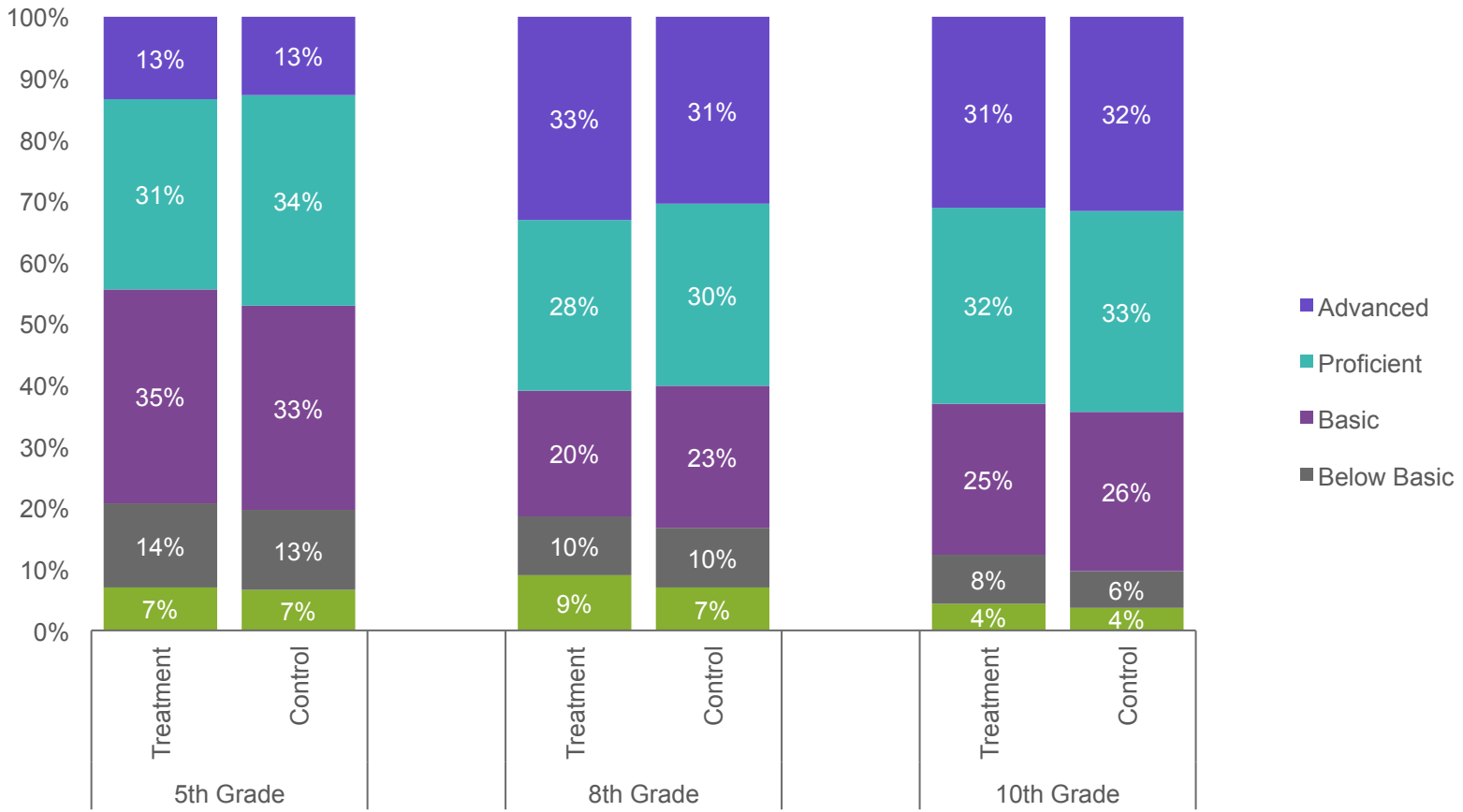
- **Cohort 11:**
  - 6,956 students of 142 treatment teachers
  - 7,558 students of 121 control teachers
  - 8,672 students *after matching* were included in the study
  - **Treatment students** *performed about the same* as the matched control students in terms of proficiency levels for 5th, 8th and 10th grade science CSTs, shown below. There *were no statistically significant differences* between students in the treatment and control groups in the Cohort 11 science partnerships overall. Proficiency levels at each grade level are shown on the next slide.

		Average Scaled Scores			% Proficient or Advanced		
Grade Levels	n (per group)	Treatment	Control	Difference	Treatment	Control	Difference
5th	867	346	348	-2	44%	47%	-3%
8th	2419	372	371	1	61%	60%	1%
10th	1050	368	372	-3	63%	64%	-1%

$^{*}p \leq .05$, $^{**}p \leq .01$, $^{***}p \leq .001$

2016 Student Outcome Study Results: Science

Cohort 11: Proficiency Levels



2016 Student Outcome Study Results: Science

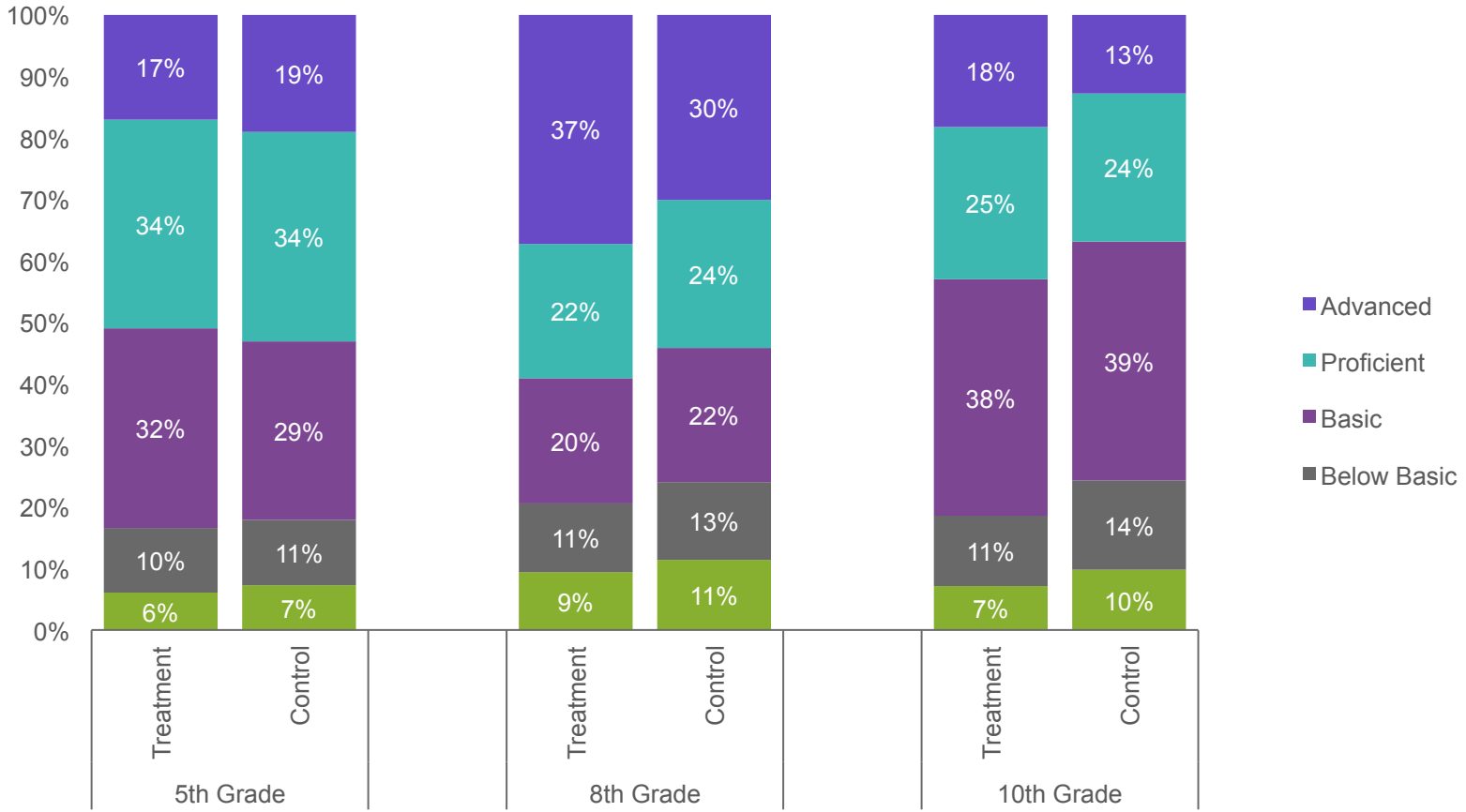
- **Cohort 12:**
  - 6,226 students of 129 treatment teachers
  - 7,105 students of 145 control teachers
  - 6,950 students after matching included in the study database
  - **Treatment students** *performed about the same* as the matched control students on 5th grade science CSTs, as shown below. In 8th grade, however, *treatment students scored significantly higher* than control students on average. In 10th grade, *treatment students also significantly outperformed* control students. Proficiency levels at each grade level are shown on the next slide.

		Average Scaled Scores			% Proficient or Advanced		
Grade Levels	n (per group)	Treatment	Control	Difference	Treatment	Control	Difference
5th	1515	355	357	-1	51%	53%	-2%
8th	1539	382	367	15***	59%	54%	5%**
10th	421	346	339	8*	43%	37%	6%

*$p \leq .05$, **$p \leq .01$, ***$p \leq .001$

2016 Student Outcome Study Results: Science

Cohort 12: Proficiency Levels



2016 Student Outcome Study Results: Mathematics

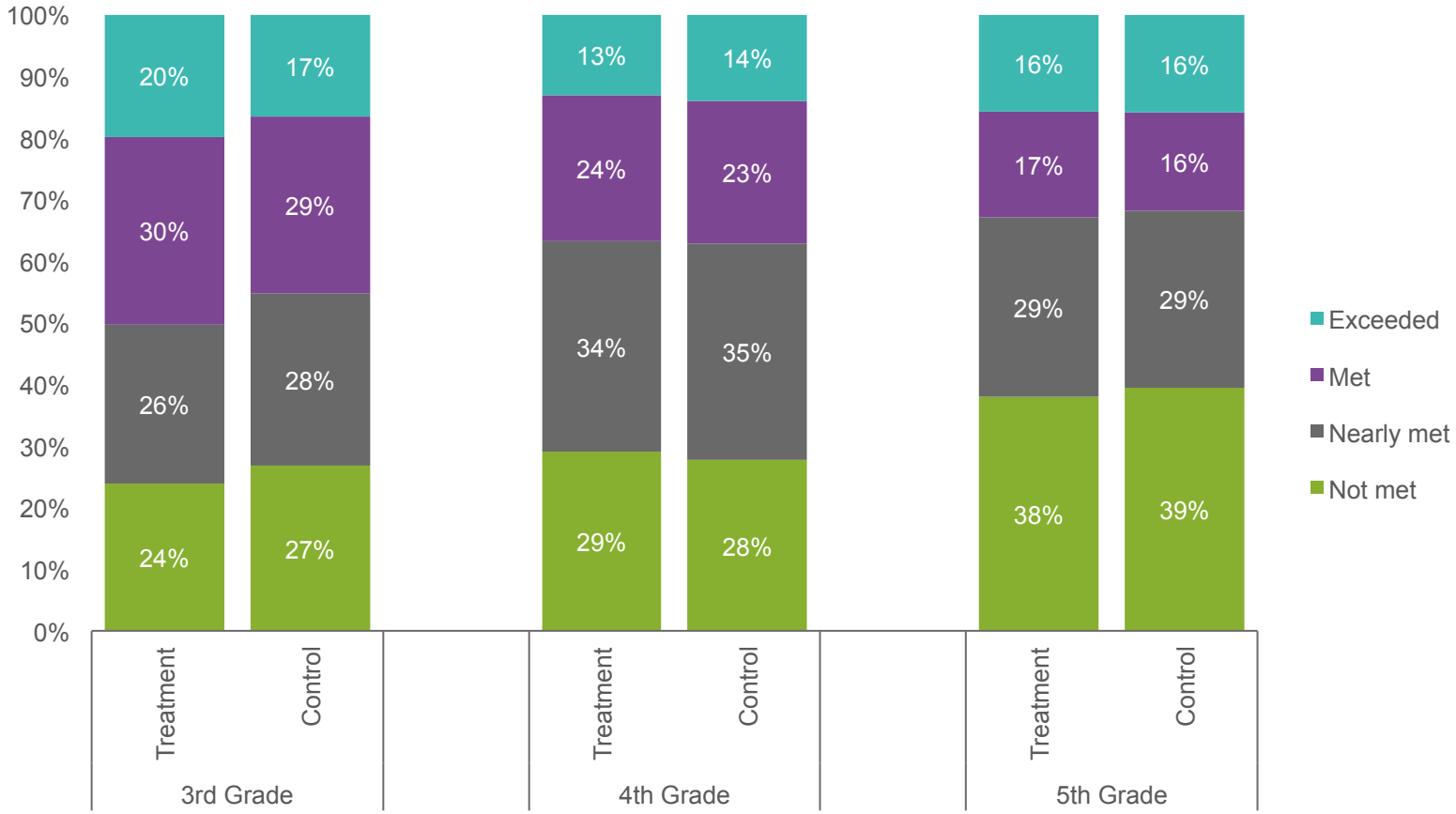
- **Cohort 10:**
  - 24,165 students of 530 treatment teachers
  - 39,957 students of 620 control teachers
  - 35,436 students *after matching* were included in the study
  - **Treatment students** in year 2 *performed the same,* on average, as the matched control students in 4th, 5th and 6th grades. In 3rd and 7th grades, *treatment students significantly outperformed* control students, and vice versa in 8th and 11th grades.

		Average Scaled Scores			% At or Exceeded Standards		
Grade Levels	n (per group)	Treatment	Control	Difference	Treatment	Control	Difference
3rd	1,626	2436	2427	9***	50%	45%	5%**
4th	1,984	2457	2460	-3	37%	37%	0%
5th	1,835	2484	2484	0	33%	32%	1%
6th	2,649	2501	2503	-2	32%	33%	-1%
7th	3,398	2533	2528	5*	38%	36%	2%
8th	2,850	2542	2554	-12***	36%	40%	-4%**
11th	3,376	2575	2592	-17***	33%	40%	-7%***

*$p \leq .05$, **$p \leq .01$, ***$p \leq .001$

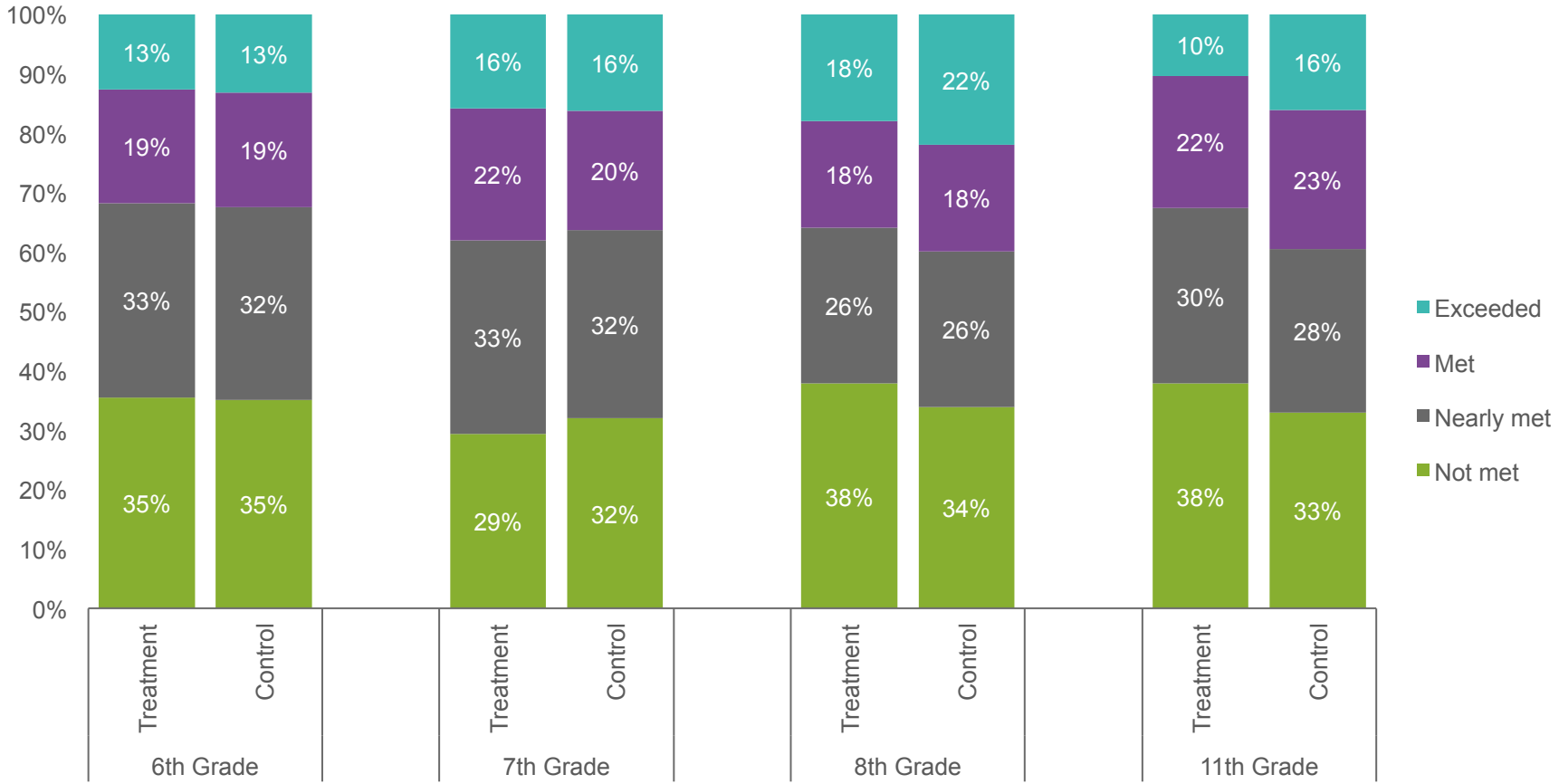
2016 Student Outcome Study Results: Mathematics

- **Cohort 10: Achievement Levels (3-5)**



2016 Student Outcome Study Results: Mathematics

- **Cohort 10: Achievement Levels (6-8, 11)**



2016 Student Outcome Study Results: Mathematics

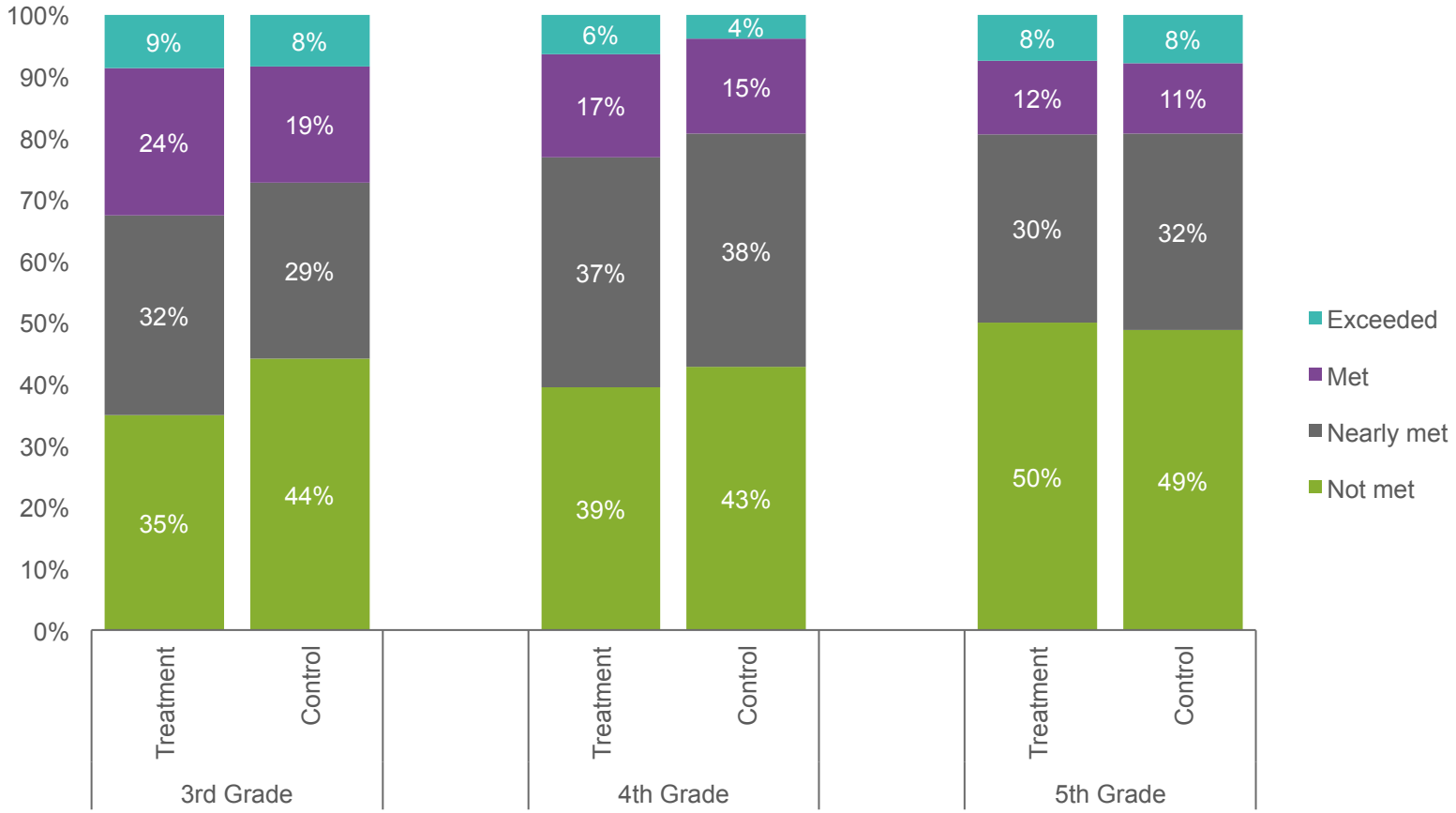
- **Cohort 11:**
  - 11,426 students of 255 treatment teachers
  - 12,704 students of 323 control teachers
  - 14,490 students *after matching* were included in the study
  - **Treatment students** in year 1 *performed the same,* on average, as the matched control students in 5th, 6th and 8th grades. In 3rd and 4th grades, *treatment students significantly outperformed* control students, and vice versa in 7th and 11th grades.

		Average Scaled Scores			% At or Exceeded Standards		
Grade Levels	n (per group)	Treatment	Control	Difference	Treatment	Control	Difference
3rd	763	2404	2393	11**	33%	27%	6%*
4th	692	2433	2426	7*	23%	19%	4%
5th	784	2460	2456	4	20%	20%	0%
6th	1506	2485	2488	-3	24%	27%	-3%*
7th	1679	2505	2515	-10***	26%	31%	-5%**
8th	1687	2512	2517	-5	24%	27%	-3%
11th	134	2539	2581	-42***	18%	37%	-19%***

*$p \leq .05$, **$p \leq .01$, ***$p \leq .001$

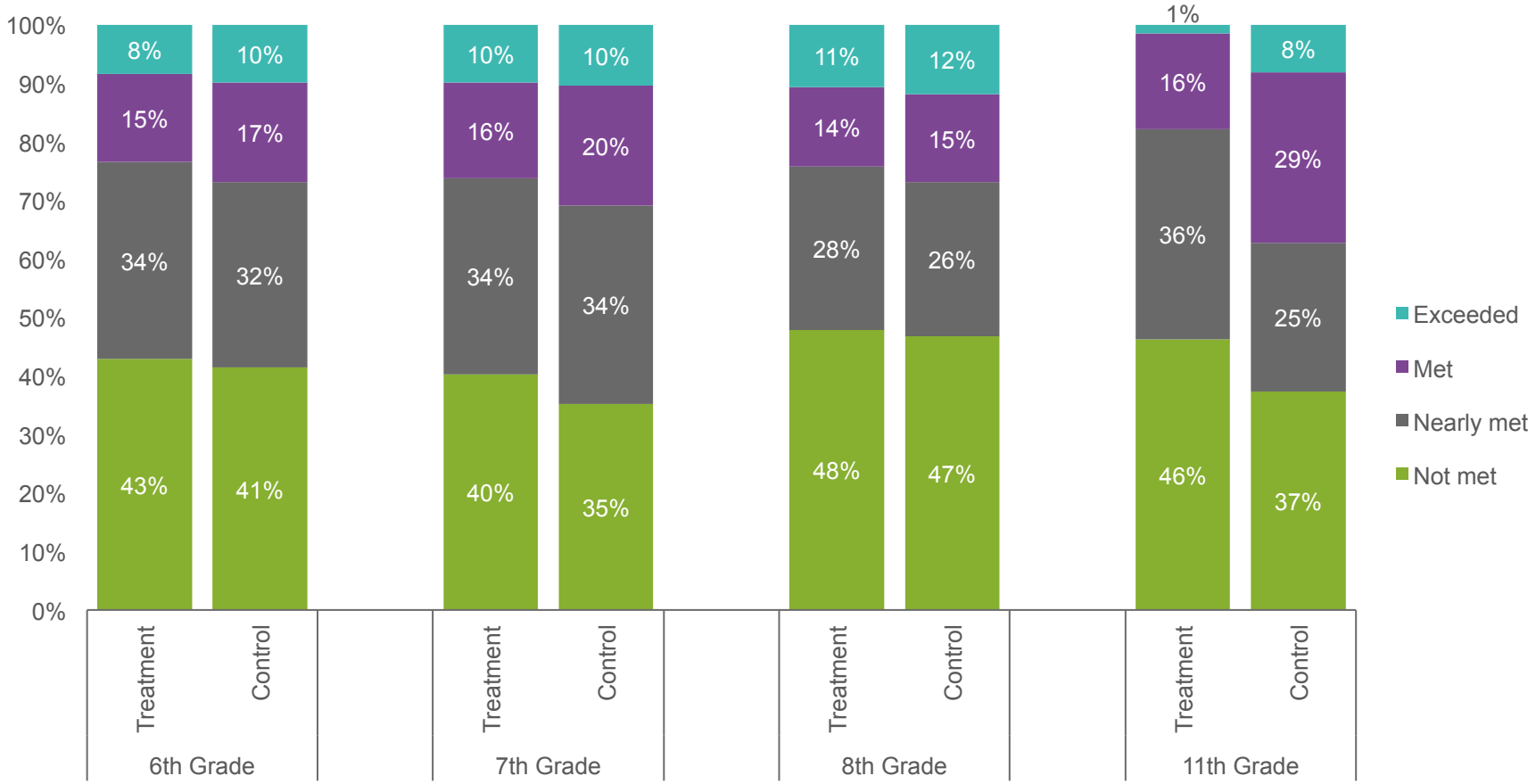
2016 Student Outcome Study Results: Mathematics

- **Cohort 11: Achievement Levels (3-5)**



2016 Student Outcome Study Results: Mathematics

- **Cohort 11: Achievement Levels (6-8, 11)**



2016 Student Outcome Study Results: Mathematics

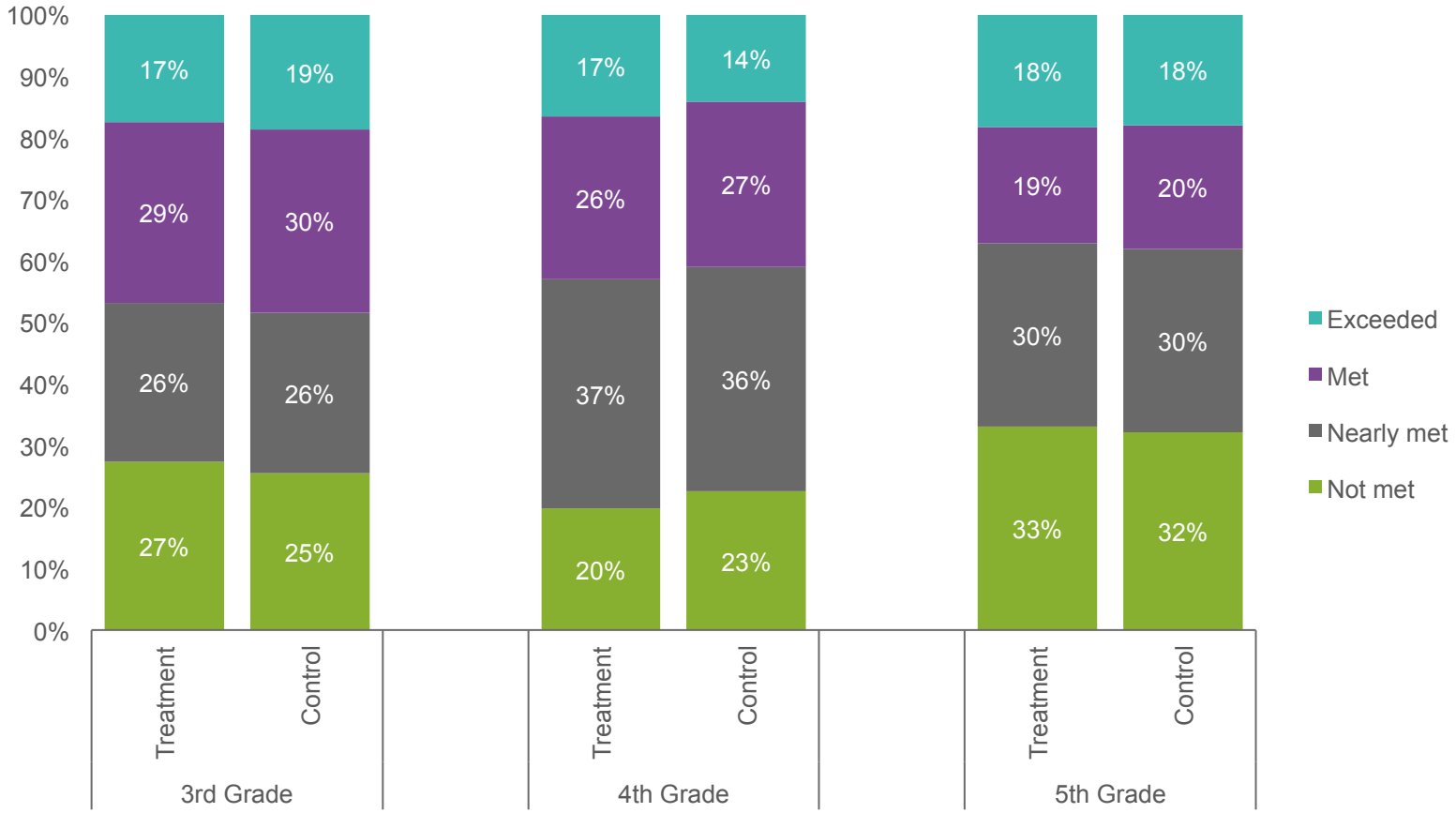
- **Cohort 12:**
  - 13,823 students of 338 treatment teachers
  - 24,123 students of 491 control teachers
  - 20,520 students *after matching* were included in the study
  - **Treatment students** in year 1 *performed the same,* on average, as the matched control students in 3rd, 5th, and 6th grades. In 4th grade, *treatment students significantly outperformed* control students, and vice versa in 7th, 8th, and 11th grades.

		Average Scaled Scores			% At or Exceeded Standards		
Grade Levels	n (per group)	Treatment	Control	Difference	Treatment	Control	Difference
3rd	1273	2427	2431	-4	47%	48%	-2%
4th	1198	2473	2467	7*	43%	41%	2%
5th	1261	2497	2495	2	37%	38%	-1%
6th	2118	2499	2499	-1	30%	30%	0%
7th	1993	2491	2498	-7*	23%	22%	1%
8th	1927	2508	2528	-20***	22%	31%	-8%***
11th	490	2543	2589	-46***	25%	38%	-13%***

***$p \leq .05$, **$p \leq .01$, ***$p \leq .001$**

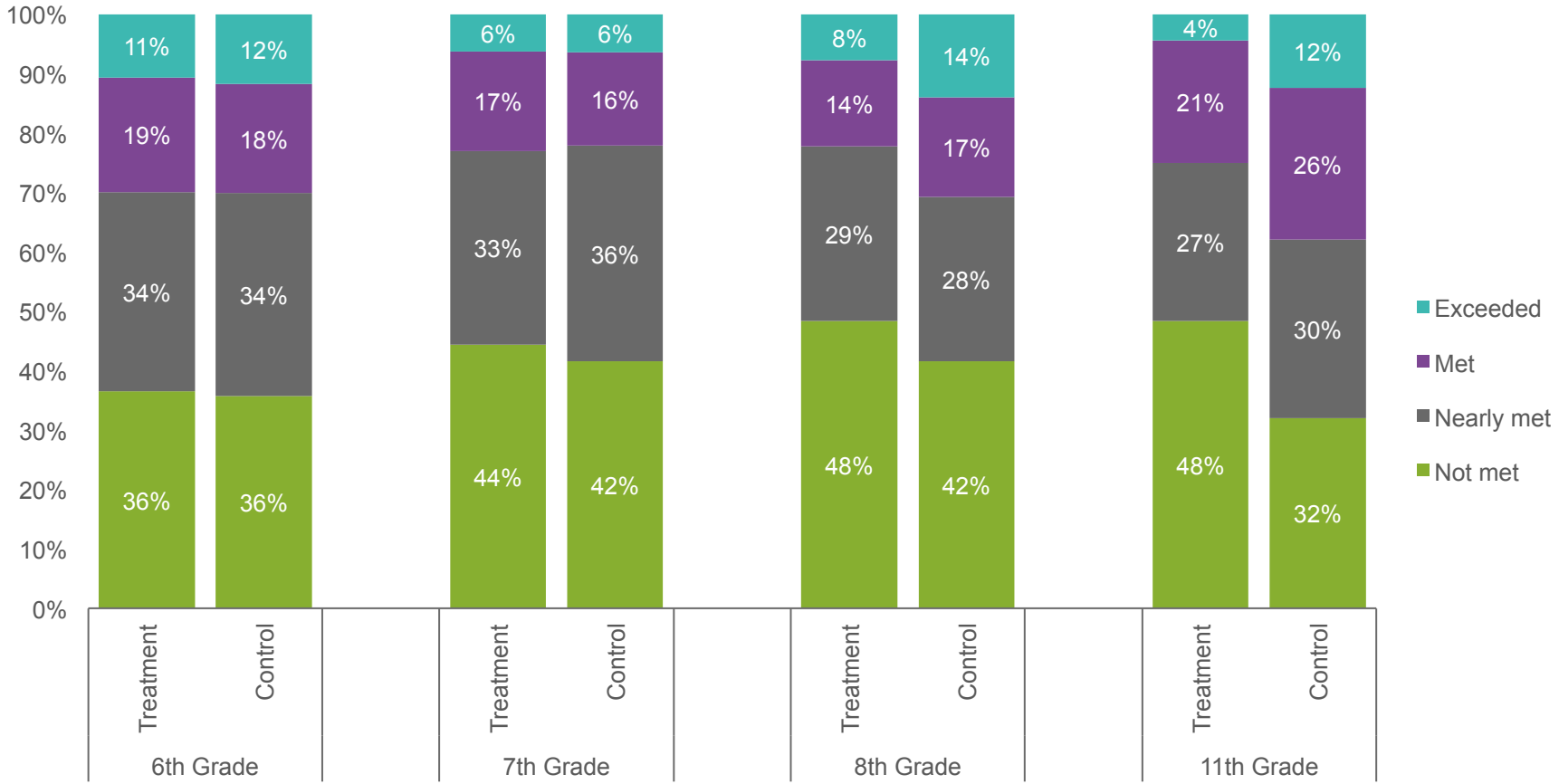
2016 Student Outcome Study Results: Mathematics

- **Cohort 12: Achievement Levels (3-5)**



2016 Student Outcome Study Results: Mathematics

- **Cohort 12: Achievement Levels (6-8, 11)**



Lessons Learned: for the Transition to Evidence-Based Professional Development under ESSA

- Evaluation at both a state and local level provided different perspectives on implementation. Beginning with Cohort 10, the state and local evaluation components of CaMSP were more centrally coordinated under PW.
- CaMSP blended both statewide requirements with local research questions regarding teachers and students. With this and subsequent cohorts, individual local evaluation plans were developed collaboratively and included a variety of methods.
- The requirement to measure teacher content knowledge proved one of the more challenging aspects of the evaluation, as nothing had been developed for science content knowledge of teachers.
- California Standards Test (CSTs) provided a consistent measure of student outcomes throughout most of the implementation of CaMSP and allowed for a large scale quasi-experimental outcome study design.

Looking Back: Lessons Learned in Partnership-Driven and Institutional Change to Support Evidence-Based Professional Learning Systems

- CaMSP Professional Development Highlights and Approaches to Learn From:
  - Classroom follow-up support and teacher leadership in the form of coaching, lesson study, professional learning communities and communities of practice.
  - Content focus and linkages to mathematics and science standards in intensive summer and school-year professional development.
  - Use of technology and integration of engineering in professional development supported integrated STEM.
  - Emergence of unique approaches to support teachers including a badging system, sharing of teacher-created videos for professional dialogue and critique, evening seminars with university professors.
  - Time for curriculum and unit development and experimentation to support transitions to new standards in mathematics, science and integrated STEM including 5E's, Anchor Tasks, Project-based Learning

Moving Forward: CaMSP Contributions and Areas to Focus in Establishing Evidence-Based Professional Learning Systems

- Themes emerged under each of three key feature areas (Teacher Quality, Challenging Courses and Curricula, and Evidence-Based Design and Outcomes) which captured the individuality and unique aspects of CaMSP projects as they grappled with the best ways to serve and maintain the cohort of participants for the long term.

- These different approaches had many elements in common, primarily because of the stable structure and framework of the program, but CaMSP also allowed for much variation and creativity at the local level.

- Positive variation and innovative approaches existed because of the particular implementation team's expertise and prior experience, the partners involved, the needs of the particular group of teachers they were working with, and the creative approaches that were encouraged by this combination of factors.