



COLORADO DEPARTMENT *of* EDUCATION

Impact of 2010-2011 ESEA Mathematics and Science Partnerships in Colorado

Submitted to:

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Acronyms Used in This Report

| | | | |
|-------------------|-----------------------------------------------------------|--------|---------------------------------------------------------------------------|
| (MS) ³ | Mesa State x Math & Science x Middle School | LMT | Learning Mathematics for Teaching |
| APR | Annual Performance Report | M | Mean |
| CDE | Colorado Department of Education | MOSART | Misconceptions-Oriented Standards-Based Assessment Resources For Teachers |
| CSAP | Colorado State Assessment Program | MGP | Median Growth Percentile |
| DPS | Denver Public Schools | MSP | Mathematics and Science Partnerships |
| DTAMS | Diagnostic Teacher Assessments in Mathematics and Science | N | Number |
| ECS | Eagle County Schools | NWEA | Northwest Evaluation Association |
| EL | English Learners | PD | Professional Development |
| ESEA | Elementary and Secondary Education Act | PLC | Professional Learning Community |
| FRM | Free and Reduced Meals | SASID | State Assigned Student Identifier |
| HR | Human Resource(s) | SPED | Special Education |
| IHE | Institute of Higher Education | STEM | Science, Technology, Engineering and Mathematics |
| LEA | Local Education Agency | STEP3 | Science Teachers Educational Partnership of Pikes Peak |
| LER | Local Evaluation Report | TCK | Teacher Content Knowledge |

Executive Summary

Introduction to the Colorado MSP Program

Title II, Part B of the Elementary and Secondary Education Act (ESEA), also referred to as the Mathematics and Science Partnerships (MSP), provides the opportunity for school districts to partner with faculty from Institutes of Higher Education (IHE) to offer Professional Development (PD) to the districts' math and science teachers. Local Educational Agencies (LEAs) apply for this competitive grant with the ultimate purpose of increasing the math and/or science performance of students through the increased content knowledge and improved teaching skills of classroom teachers. The Colorado Department of Education (CDE) has been awarding MSP grants to high-need LEAs since 2003-2004 and evaluating the effectiveness of the program in more recent years. The current report summarizes the evaluation findings from 2010-2011 program implementation.

In the 2010-2011 implementation year, 8 active partnerships representing 23 LEAs and 7 IHEs engaged in MSP-funded PD. One partnership was in its first year while the rest of the partnerships were in years 2 through 4 of implementation. Some partnerships offered math or science PD while others offered PD in both content areas. In sum, 17,826 students were taught by 323 MSP participants during the 2010-2011 school year. **Because the program targets high needs schools, the demographics of the students taught by MSP participants differed from statewide demographics in terms of race, language proficiency, and poverty.**

Program Evaluation Methodology

As a condition of grant participation, grantees provide CDE with student- and teacher-level data to be used in the statewide program evaluation. With this information, along with student state assessment data and teacher human resources (HR) data, CDE is able to evaluate the program's reach and effectiveness in Colorado. The program's impact on teacher content knowledge is evaluated using teacher content knowledge assessments (TCK) administered by each grantee before and after PD. Changes in teachers' practices are evaluated qualitatively through the use of classroom observations, surveys, and interviews.

Program Evaluation Results

Teacher

The program's impact on TCK was evaluated using scores from pre- and post-tests. While many of the TCK tests were nationally normed and standardized, some were locally developed. Of teachers with both pre- and post-test scores, **three grantees that had used nationally normed and standardized tests had significant increases in TCK.**

Student

Program impact on students taught by MSP-funded PD participants varied. In general, students taught math by teachers who received MSP-funded math PD had a lower increase in proficiency level and a lower Median Growth Percentile (MGP) than did students from the same schools whose teachers did not participate in MSP-funded PD. Nonetheless, some partnerships had greater success. For example, **students of teachers who participated in the Mesa State College MSP outperformed their comparison group in increases in proficiency level from the year prior to MSP to the year of participation. Students taught by Eagle County Schools MSP participants had higher growth than the other students in the same schools.**

Similar general trends existed in the science programs. Students taught by MSP science PD participants also had lower science proficiency levels than did students from the same schools whose teachers did not participate in MSP-funded PD. However, **students taught by Jefferson County and Westminster MSP participants**

significantly outperformed their comparison groups in terms of proficiency on science CSAP the year of MSP¹.

Relationship between Teacher Performance and Student Performance

There was variability in the relationship between teacher gains in content knowledge and student performance. For math participants, the correlation between post-test scores and their students' MGP was significantly positively correlated for Mesa State MSP participants. Furthermore, **MSP participants for the past two years had better student performance data during the second year of participation (2011), compared the first year (2010), suggesting a practice effect** when students performance is analyzed more than one year post-PD. Also, among teachers who only participated in MSP PD for one of the past four years, those who participated two or three years ago, rather than the current or prior year, had better 2011 student performance.

Conclusions and Next Steps

Although significant overall trends for all students taught by 2010-2011 MSP participants were not detected, some specific positive trends were identified. It was confirmed that the **MSP-funded PD was reaching teachers from high-need schools**. On average, teachers who participated in MSP-funded PD had a positive gain in TCK as measured by pre- and post-tests, even though not all gains were statistically significant. Qualitative studies of the programs implemented by the grantees with the highest gains in TCK and increases in student performance will be conducted to highlight the more effective PD strategies. Similar analyses will be conducted on the 2012-2014 grantees to determine if similar trends will be detected.

¹ The state science assessment is only administered in the 5th, 8th, and 10th grades. Therefore, evaluation results are based on those grades only.

Introduction

Title II, Part B of the Elementary and Secondary Education Act, also referred to as the Mathematics and Science Partnerships (MSP) program, is intended to increase the academic performance of students in math and/or science by enhancing the content knowledge and teaching skills of classroom teachers. This grant provides districts and schools with the opportunity to partner with faculty from the science, technology, engineering, and/or mathematics (STEM) departments in institutions of higher education (IHEs). Partnerships must include IHE STEM faculty and at least one "high need²" local school district. Other partners may include public charter schools, other public schools, non-public schools, businesses, and nonprofit or for-profit organizations concerned with mathematics and science education.

The Reach of Colorado MSP Since 2003-2004

- 8 Cohorts
- 24 partnerships
 - 59 Districts
 - 3 BOCES
 - 10 Institutes of Higher Ed
- More than 850 Teachers have received math and/or science professional development

MSP programs provide enhanced and ongoing professional development (PD) for math and science teachers with the goal of increasing teachers' subject matter knowledge and promoting the effective use of research-based teaching methods.

Background of the Colorado MSP Program

The first Colorado MSP grant was awarded in 2003-2004. Grants have been awarded for three year increments contingent upon successful completion of grant requirements each year. By 2010-2011, Colorado had funded 8 cohorts with 24 partnerships, 59 districts, 3 BOCES, more than 850 teachers, 10 IHEs, and 14 additional partners. Grant awards have ranged from \$72,000 to \$350,000.00 per grantee per year, with an average yearly award of \$209,700. Grantees that have participated for 3 years have been awarded approximately \$600,000.00 across the 3 years³. In sum, more than \$14 million had been awarded to partnerships in Colorado by 2010-2011. Colorado has funded partnerships that have conducted PD offerings in math, science, or both. Partnerships have been encouraged to design PD that is likely to improve *both* content knowledge and pedagogical effectiveness of math and/or science teachers.

Program Evaluation

MSP grantees are required to conduct a local evaluation and submit data to the Colorado Department of Education (CDE) for its statewide program evaluation at the end of the grant implementation year. CDE uses that data, along with other available data, to evaluate, to the extent possible, the reach and effectiveness of the programs implemented during the implementation year. The statewide evaluations are lagged due to the time required to collect, process, and prepare the data for evaluation purposes.

The current report summarizes the evaluation findings from 2010-2011 program implementation and includes grantees from Cohorts 4 through 7. Grantees vary in their initial implementation year (e.g., in 2010-2011, Cohort 7 was in its first year of implementation whereas Cohort 6 was in its second year). The 2009-2010 report is available on the CDE website⁴.

² Each time that a Request for Proposals was published by CDE, the definition of "high need" district was tailored to meet the needs of Colorado schools and districts at that time.

³ This total does not include the current grantees that have not yet completed their 3 years in program, or the 4th year grantees awarded an additional competitive award.

⁴ The 2009-2010 evaluation was conducted by external evaluators, OMNI Institute, and the full report is available on the CDE website www.cde.state.co.us/sites/default/files/documents/fedprograms/dl/dper_evalrpts_20092010msp.pdf

Literature Review

Prior researchers have determined that PD is most effective when it targets content knowledge and pedagogical skills of teachers concurrently (Garet et al, 2001). A national study of MSP-funded PD strategies and practices indicated that the more effective MSP programs implemented a minimum of 50 hours of PD (ABT Associates Inc, 2012). Additional research has examined factors that contribute to successful district-university partnerships. Findings indicate that partners should have defined leadership roles, discuss and agree upon the goals of the partnership, and reexamine their responsibilities on a continuous basis (Fishman et al, 2003). Ultimately the ownership of the PD implementation should transfer from the university partner to the district(s) thus increasing the likelihood of sustainability (Scherer, 2006).

Evaluation Questions

The evaluation questions addressed in the report include determining (1) if targeted recipients (Math and science teachers in high needs schools) were reached by the program; (2) if participating teachers increased their content knowledge from before to after program participation; and (3) if changes in content knowledge translated into increased student performance and if so, how many years post-PD the increase in student performance occurred.

Methodology

At the conclusion of every implementation year, each grantee submits to CDE a Local Evaluation Report (LER) that summarizes the program implementation, findings, and conclusions, as well as a the Annual Performance Report (APR) that is submitted to the U.S. Department of Education on behalf of the grantees. The APR contains details regarding program implementation, successes, challenges, and the effects of the partnership on TCK and teaching practices, as well as student performance. As part of the grant requirements, each grantee also submits to CDE a list of teachers involved in the MSP-funded math or science PD and a list of the math and/or science students taught by those teachers. This data, joined with other data available to CDE, are used to conduct a statewide evaluation of the impact on students taught by participating teachers.

The most commonly reported success among partnerships was “improved connection between IHEs and districts / schools.”

Program Reach: LEAs and IHEs

In the 2010-2011 implementation year, 8 partnerships were funded by Colorado MSP grants. It was the fourth⁵ and final year of funding for 4 grantees and the first year for 1 of the grantees. Funding ranged from \$150,750 to \$350,000 per grantee per year. These partnerships consisted of 23 Local Educational Agencies (LEAs) and 7 Institutes of Higher Education (IHEs).

TABLE 1: The 2010-2011 Colorado MSP Grantees

| MSP Lead Partner (Fiscal Agent) | MSP Name | Cohort | PD Focus | IHE & Other Partners | Local Educational Agencies |
|----------------------------------|---------------------------------------------------------------------------|--------|----------------|---------------------------------------|------------------------------------------------------------------------------|
| Mesa State College | Mesa State x Math & Science x Middle School ((MS) ³) | 4 | Math & Science | Mesa State College | Garfield 2, Montrose 1J, Mesa Valley 51, West End 2 |
| Weld County 6 School District | Weld County School District 6 MSP Grant | 4 | Math & Science | Univ of Northern Colo: MAST Institute | Weld County School District (Greeley) 6 |
| Jefferson County School District | Northeast Front Range Mathematics/Science Partnership to Increase Teacher | 4 | Math & Science | University of Colorado: Denver | Jefferson County R-1, Adams 12 Five Star Schools, Brighton 27J, Englewood 1, |

⁵ MSP partnerships are typically funded for 3 years. With special permission from the USDE, CDE awarded fourth year funding to a cohort of grantees based on their successes in the first three years.

| Competence in Content, II | | | | Mapleton 1 | |
|-------------------------------|-----------------------------------------------------------------------------------------------------|---|---------|----------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| Colorado College | Science Teachers Educational Partnership of Pikes Peak (STEP3) | 4 | Science | Colorado College | Academy 20, Colo Spgs 11, Fountain 8, Manitou Spgs 14, Widefield 3, Harrison 2, Cheyenne Mtn 12, Lewis-Palmer 38, Roaring Fork 1 |
| Pueblo County School District | Southern Colorado Math Partnership | 5 | Math | Colorado State University: Pueblo | Pueblo County 70 |
| Eagle County School District | ECS' Math Science Partnership Eagle County 50 | 6 | Math | University of Denver, Math Solutions | Eagle County RE 50 |
| Denver Public Schools (DPS) | Urban Partnership for Improving Elementary Science | 6 | Science | University of Denver | Denver County 1 |
| Westminster 50 | Energizing K-5 Instruction: A Partnership to Improve Elementary Mathematics and Science Instruction | 7 | Science | Colorado School of Mines, National Renewable Energy Laboratory | Westminster 50 |

The 23 LEAs ranged in location and size.

- Seven (30.4%) of the districts are in the Denver metropolitan and eleven (47.8%) are urban-suburban districts.
- In the implementation year, these districts had a total student enrollment of 407,815, ranging from 347 to 85,938 students per district, and had an average enrollment size of 17,731 students.
- Math PD participants teaching math in the implementation year (N = 75) represented 7.4% of all math teachers in those districts, ranging from 0.8% to 74.4% per district.
- Science PD participants teaching science in the implementation year (N = 83) represented 5.1% of all science teachers in those districts, ranging from 0.0% to 42.9% per district.

Program Reach: Professional Development Participants

Most MSP-funded PD was provided to teachers. However, a few other instructional staff, such as paraprofessionals, also participated in the PD; therefore, the term participant(s) is used instead of teacher(s). In 2010-2011, partnerships provided MSP-funded PD to 323 participants. More than 55% (179) were participating in MSP PD for the first time. The number of participants receiving PD ranged from 19 to 59 per grantee.

Table 1: 2010-2011 MSP Grantees, the Number of Years of PD for Participants, and Total Number of Participants

| MSP Lead Partner | 1 Year of PD N (% within grantee) | 2 Years of PD N (% within grantee) | 3 Years of PD N (% within grantee) | 4 Years N (% within grantee) | Total Number of Participants |
|-------------------|--------------------------------------|---------------------------------------|---------------------------------------|---------------------------------|------------------------------|
| Mesa State | 11 (44.0%) | 14 (56.0%) | 0 (0%) | 0 (0%) | 25 |
| Weld County 6 | 23 (41.1%) | 8 (14.3%) | 6 (10.7%) | 19 (33.9%) | 56 |
| Jefferson County | 36 (73.5%) | 11 (22.4%) | 2 (4.1%) | 0 (0%) | 49 |
| Colorado College | 28 (68.3%) | 7 (17.1%) | 6 (14.6%) | 0 (0%) | 41 |
| Pueblo County | 10 (20.4%) | 21 (42.9%) | 18 (36.7%) | N/A | 49 |
| Eagle County | 25 (100%) | 0 (0%) | N/A | N/A | 25 |
| DPS | 27 (45.8%) | 32 (54.2%) | N/A | N/A | 59 |
| Westminster 50 | 19 (100%) | N/A | N/A | N/A | 19 |
| All 2010-2011 MSP | 179 (55.4%) | 93 (28.8%) | 32 (9.9%) | 19 (5.9%) | 323 |

For the 323 participants, CDE received the following additional data which could be used for program evaluation:

- Human Resource (HR) and demographic data on 304 (94.1%) participants
- TCK pre- and post-test assessment data for 210 (65.0%) participants
- Student assessment data for 263 (81.4%) participants

TABLE 2: 2010-2011 MSP Participants – Teaching Assignments⁶

| Participants with HR Data | N | % of Total |
|---------------------------|----|------------|
| Special Education | 22 | 7.2% |
| Math | 77 | 25.3% |

Of the 304 participants with HR data, the average teaching experience was 8.9 prior years, with a minimum of 0 years and a maximum of 37. Participants’ teaching assignments varied and content areas other than math and science. In the implementation year, 25% of participants taught only math; 29% taught only science; 87% taught regular education courses; 34% taught general elementary courses, and 7% taught special education.

Of the 262 participants with degree data, 50 (19.1%) had a degree in math, 70 (26.7%) had a degree in science, 53 (20.2%) had a primary degree in elementary education, and 20 (7.6%) had a primary degree in special education.

Program Reach: Students of MSP Participants

In 2010-2011, 17,826 students were taught math or science by teachers who participated in MSP programs, ranging from 657 to 3,527 students per grantee. MSP math PD participants taught 9,161 (51.4%) math students and MSP science PD participants taught 11,802 (66.2%) science students⁷.

TABLE 3: 2010-2011 Student Demographics

| Demographic | MSP Students* | Statewide |
|-------------------------------|----------------|-----------------|
| N Total | 17,357 | 847,497 |
| N Male (%) | 8,956 (51.6%) | 434,412 (51.3%) |
| N EL (%) | 4,252 (24.5%) | 143,854 (17.0%) |
| N White (%) | 8,320 (47.9%) | 480,941 (56.8%) |
| N Hispanic / Latino (%) | 7616 (43.9%) | 268,099 (31.6%) |
| N Black/ African American (%) | 573 (3.3%) | 40936 (4.8%) |
| N FRM Eligible (%) | 9,091 (52.4%) | 340,389 (40.2%) |
| N Grades 6-8 (%) | 10,757 (62.0%) | 182,256 (21.5%) |
| N SPED (%) | 1,633 (9.4%) | 81,821 (9.7%) |
| N Title I (%) | 3,686 (21.2%) | 189,537 (22.4%) |

The program reached high need schools: a greater percentage of students eligible for free and reduced meals were taught by participating teachers when compared to state averages.

*Only students with demographic data available are included in this table

Of 17,826 students impacted by MSP in 2010-2011, 17,357 (97.4%) were matched to student level demographics data available to CDE. The demographics of the students served, for whom CDE had data, were compared to the statewide data.

⁶ Teachers can be duplicated across categories if they taught in more than one area that year.

⁷ It is possible for the same students to have been in both math and science courses taught by different participants. However, if a student had two math courses or two science courses for the same year, they were eliminated from analyses as it would be difficult split the change in performance between teachers (could not attribute change in performance to either teacher, therefore, did not include in either teacher’s data).

Professional Development Content

Three partnerships offered science PD, two offered math PD, and three offered both math and science. Three grantees specifically targeted middle school teachers, whereas two did not target a specific grade level. One grantee, Pueblo County, targeted special education teachers. In 2010-2011, partnerships provided between 30 and 130 hours of MSP funded PD.

TABLE 4: 2010-2011 Colorado MSP – Professional Development Content and Activities by Grantee

| MSP Lead Partner | PD Content | Types Of PD Activities | Targeted Participants | Contact Hours |
|------------------|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|---------------|
| Mesa State | Math & Science | Summer Institutes (four-day Summer Seminar, four Saturday workshops, two-week Summer Institute); PD during the academic school year - Professional Learning Community (PLC) | Middle School Math and Science Teachers | 108 |
| Weld County 6 | Math & Science | Monthly math/science content and pedagogical instruction delivered by STEM faculty at the IHE; monthly collaboration sessions provided by a district-supported instructional coach | Middle School Math and Science Teachers | 38 |
| Jefferson County | Math & Science | Summer Institutes; follow-up lesson study | K-12 Teachers | 125 |
| Pueblo County | Math | Technology Workshops; Pedagogy PD courses; co-teaching teams; PLCs | Secondary Special Education and Math; General Education Teachers | 30 |
| Eagle County | Math | 14-day training in Math and Pedagogy; Lesson Study; Instructional Coaching; Online Learning; PLCs | K-12 Math Teachers | 130 |
| Colorado College | Science | Summer Institutes; follow up sessions; on-site work; peer coaching; formation of a Leadership Institute | Middle School Science Teachers | 45 |
| DPS | Science | Summer Institutes with additional follow up activities | K-8 Teachers | 88 |
| Westminster 50 | Science | Summer Institutes with additional follow up activities with pre-service and in-service programs | K-5 Teachers | 75 |

Assessment of Program Impact on Teachers

Six grantees used nationally normed and standardized assessments to measure changes in TCK. The most commonly used was the Diagnostic Teacher Assessments in Mathematics and Science (DTAMS). Seven grantees also assessed changes in pedagogy as a result of participating in the MSP program. The most common forms of pedagogy assessment were surveys and classroom observation, with five grantees performing classroom observation and four performing pedagogy surveys. Additionally, Pueblo County conducted interviews.

The most commonly reported challenge among partnerships was related to “measurement and data collection” for the purpose of evaluation.

Assessment of Program Impact on Students

Participants’ math and science students were matched to the content area of PD. For example, participants who received math PD and taught math classes had their math students included in the evaluation. Participants’ students’ CSAP proficiency levels from 2009-2010 (the year

prior to participating in MSP) on the corresponding PD content area was compared to their proficiency levels the year of MSP participation (spring 2011 CSAP scores). Similarly, 2010-2011 Median Growth Percentiles (MGPs) for students of participating teachers were compared to the MGPs of students taught by non-MSP teachers at the same schools.

Relationship between Teachers TCK and Student Performance

The relationship between changes in pre-test to post-test scores on the TCK assessments and student MGPs and proficiency levels changes on CSAP was tested. Analyses were also conducted to determine if the relationship between the post-test score and students' performance was more significant. It was hypothesized that regardless of content knowledge gain score, the performance of students taught by teachers with higher post-test scores (i.e., higher content knowledge) would be higher than teachers with a lower TCK scores. For the math programs, the proportion of MSP participants in a school and district and the school and district MGP were also analyzed.

Results

Teacher Results: Changes in Teacher Content Knowledge

Math

The math TCK scores for Weld County 6 were unavailable because the tests were lost during transit. Of the remaining four grantees (Mesa State, Jefferson County, Pueblo County, and Eagle County) that implemented math PD, two displayed significant positive changes in participants' math content knowledge. **Eagle County pre- and post-tested participants on four sections of Learning Mathematics for Teaching (LMT) and these participants demonstrated significantly increased scores on three of the four sections. Mesa State participants also displayed significant increases in math teacher content knowledge.**

TABLE 5: 2010-2011 MSP Math Participants' Math TCK Assessment Results

| MSP Lead Partner | Assessment | Norm / Std | N | Pre-M | Pre-Median | Post-M | Post-Median | M Change | Median Change | Paired t-Test p Value |
|------------------|----------------------------------------------|------------|-----|-------------------|-------------------|--------|-------------|-------------------|-------------------|-----------------------|
| Mesa State | DTAMS Probability & Statistics version 3.3 | Yes | 10 | 14.40 | 13.00 | 29.90 | 30.00 | 15.50 | 15.00 | 0.001 ¹ |
| Jeff County | Professor Developed | No | 19 | 7.79 ^a | 8.00 ^a | 8.58 | 9.00 | 0.79 ^a | 0.00 ^a | 0.056 ³ |
| Pueblo County | NWEA Grade 12 Online Math Test | Yes | 24 | 279.79 | 281 | 281.13 | 283 | 1.33 | 0.50 | 0.452 |
| Eagle County | Elementary LMT Number Concepts & Operations | Yes | 17* | -0.13 | -0.02 | 0.86 | 0.83 | 0.99 | 1.04 | 0.001 ¹ |
| Eagle County | Elementary LMT Proportional Reasoning | Yes | 17* | -0.72 | -0.87 | -0.17 | -0.37 | 0.56 | 0.68 | 0.001 ¹ |
| Eagle County | Middle School LMT Num. Concepts & Operations | Yes | 7* | 0.13 | 0.24 | 1.44 | 1.19 | 1.31 | 0.95 | 0.010 ² |
| Eagle County | Middle School LMT Proportional Reasoning | Yes | 7* | 0.67 | 0.71 | 1.41 | 1.58 | 0.74 | 0.45 | 0.054 |

¹ Change is significant at the 0.01 level

² Change is significant at the 0.05 level

³ Wilcoxon Signed Rank Test p-value

^a Distribution of observed values violates normality at the 0.05 level

* The same group of grade level teachers took both tests

Science

Science TCK scores for Weld County 6 were unavailable because the tests were lost during transit. All remaining five grantees (Mesa State, Jefferson County, Colorado College, DPS, and Westminster 50) that implemented science PD had significantly increased science knowledge on at least one TCK test. **Two grantees (Mesa State and Colorado College) used nationally normed and standardized assessments on which their participants showed significant increases.** One grantee (DPS) had one normed and standardized test and two locally-developed tests and participants only showed significant increases on one of the locally developed assessments. The other grantees used only locally developed assessments, on which their participants showed significant increases in science content knowledge.

TABLE 6: 2010-2011 MSP Science Participants' Science TCK Assessment Results

| MSP Lead Partner | Assessment | Norm / Std | N | Pre M | Pre Median | Post M | Post Median | Change M | Median Change | Paired t-Test p Value |
|------------------|--------------------------------------------------|------------|----|--------------------|--------------------|-------------------|-------------------|----------|---------------|-----------------------|
| Mesa State | DTAMS Life Science version 4.2 | Yes | 9 | 37.56 | 37.00 | 43.44 | 41.00 | 5.89 | 3.00 | 0.077 |
| Jefferson County | Professor Developed | No | 19 | 12.47 ^a | 12.00 ^a | 22.58 | 23.00 | 10.11 | 10.00 | 0.001 ¹ |
| Jefferson County | Professor Developed | No | 17 | 23.47 | 21.00 | 26.59 | 26.00 | 3.12 | 2.00 | 0.006 ¹ |
| Colorado College | DTAMS Physical Science | Yes | 9 | 34.56 | 36.00 | 39.33 | 40.00 | 4.78 | 4.00 | 0.067 |
| Colorado College | Locally Developed | No | 16 | 17.69 ^a | 19.50 ^a | 20.19 | 21.00 | 2.50 | 2.00 | 0.009 ¹ |
| DPS | Mulford & Robinson's Chemical Concepts Inventory | No | 14 | 3.00 | 2.50 | 3.36 | 3.00 | 0.36 | 0.25 | 0.393 |
| DPS | Professor Developed | No | 17 | 3.53 | 3.50 | 5.44 ^a | 6.50 ^a | 1.91 | 2.00 | 0.001 ¹ |
| DPS | MOSART 5-8 Earth Science | Yes | 22 | 17.73 | 17.50 | 18.64 | 19.00 | 0.91 | 0.50 | 0.113 |
| Westminster 50 | Locally Developed | No | 19 | 16.00 | 16.00 | 21.00 | 20.00 | 5.00 | 5.00 | 0.001 ¹ |

¹ Change is significant at the 0.01 level

^aDistribution of observed values violates normality at the 0.05 level

Student Results: Changes in Student Performance

Math

The 2011 student MGP of all 2010-2011 math MSP teachers was 41 compared to the statewide MGP of 50. **The student MGP of teachers participating in Mesa State and Eagle math PD had higher MGPs (53 and 56 respectively) than the state;** Jefferson County PD participants' students had an MGP equal to the state's.

A comparison group comprised all other (non-MSP) students from the same schools. The 8,120 students in the comparison group had a MGP of 51, significantly higher than the MSP student MGP of 41. By cohort, **Eagle County and Jefferson County both had higher MGPs than their comparison group**, though the differences were not statistically significant. The demographics of the treatment and comparison groups were similar to each other.

TABLE 7: 2010-2011 MSP Participants' MGP on 2011 Math CSAP

| MSP Lead Partner | N 2010-2011 Participants Matched To 2011 CSAP Data | N Matched MSP Students (N Schools) | MSP Student 2011 MGP | N Students In Comparison Group (N Schools) | Comparison Group 2011 MGP | p Value |
|-------------------|----------------------------------------------------|------------------------------------|----------------------|--------------------------------------------|---------------------------|---------|
| Mesa State | 8 | 469 (6) | 53.0 | 2,932 (6) | 53.0 | 0.483 |
| Weld County 6 | 32 | 2,945 (6) | 37.0 | 311 (6) | 55.0 | 0.001* |
| Jefferson County | 11 | 658 (8) | 50.0 | 3,606 (8) | 49.0 | 0.302 |
| Pueblo County | 30 | 2,374 (9) | 39.0 | 482 (9) | 48.0 | 0.001* |
| Eagle County | 12 | 772 (8) | 56.0 | 789 (8) | 52.0 | 0.087 |
| All 2010-2011 MSP | 93 | 7,218 (37) | 41.0 | 8,120 (37) | 51.0 | 0.001* |
| Statewide | | | | 388,292 | 50.0 | |

*Difference is significant at the 0.01 level

Science

The science CSAP is only administered to students in 5th, 8th, and 10th grades and, therefore, MGPs are not available. The proportion of MSP students proficient and advanced was compared to non-MSP students. Sixty 2010-2011 MSP science participants, representing 53 schools, were matched to 3,784 students' 2011 science CSAP data, of which 41.6% were proficient and advanced. The comparison group of non-MSP students from the same 53 schools consisted of 4,937 students of which 44.3% were proficient and advanced. The two groups were demographically similar to each other. **Jefferson County and Westminster both had a significantly larger proportion of MSP students proficient and advanced than their comparison groups.**

TABLE 8: Student Performance: Percent Proficient and Advanced on 2011 Science CSAP

| MSP Lead Partner | N MSP Students (N Schools) | % MSP Students Proficient and Advanced | N Comparison Students (N Schools) | % Comparison Group Proficient and Advanced | Independent t-Test p Value |
|-------------------|----------------------------|----------------------------------------|-----------------------------------|--------------------------------------------|----------------------------|
| Mesa State | 404 (5) | 45.05% | 504 (5) | 47.22% | 0.558 |
| Weld County 6 | 963 (6) | 24.92% | 141 (6) | 41.13% | 0.001* |
| Jefferson County | 923 (17) | 54.71% | 2,100 (17) | 43.76% | 0.001* |
| Colorado College | 923 (9) | 56.01% | 1,396 (9) | 58.67% | 0.221 |
| DPS | 468 (12) | 24.15% | 638 (12) | 22.57% | 0.589 |
| Westminster 50 | 103 (4) | 17.48% | 158 (4) | 5.06% | 0.002* |
| All 2010-2011 MSP | 3,784 (53) | 41.62% | 4,937 (53) | 44.28% | 0.014** |
| Statewide | | | 176,003 | 48.42% | |

*Difference is significant at the 0.01 level

**Difference is significant at the 0.05 level

Relationship between Teacher Results and Student Results

Math

Students of teachers with high changes in TCK, as measured by pre- and post-tests, were compared to students of teachers with no or low changes in TCK. As there were no significant differences between the two groups, the relationship between participants' student MGPs and TCK post-test scores was explored to determine if having a higher content knowledge, regardless of whether or not it had recently been changed, is related to higher student performance. A simple Pearson correlation was run for each TCK test between teachers' post-test scores and their student MGP. These correlations were also compared to the correlation between teachers' change scores and their

student MGP. Across the seven TCK tests, there was a positive correlation between all but one of the tests' post-test score and student MGP, one of which was statistically significant.

TABLE 9: Correlation between Teacher Content Knowledge and Student Math MGPs by Grantee

| TCK Test | Post-Test Score Correlation to Student MGP | Change Score from Pre-Test to Post-Test Correlation to Student MGP |
|----------------------------------------------------------|--------------------------------------------|--------------------------------------------------------------------|
| Mesa State: DTAMS Probability and Statistics Test | | |
| Pearson Correlation | .931* | 0.122 |
| p Value | 0.007 | 0.818 |
| N | 6 | 6 |
| Jefferson County: Professor Developed Test | | |
| Pearson Correlation | 0.382 | 0.04 |
| p Value | 0.246 | 0.907 |
| N | 11 | 11 |
| Pueblo County: NWEA Grade 12 Online Math Test | | |
| Pearson Correlation | 0.24 | -0.262 |
| p Value | 0.338 | 0.31 |
| N | 18 | 18 |
| Eagle County: LMT Elementary NCOP | | |
| Pearson Correlation | 0.365 | -0.429 |
| p Value | 0.546 | 0.471 |
| N | 5 | 5 |
| Eagle County: LMT Middle School NCOP | | |
| Pearson Correlation | 0.196 | 0.59 |
| p Value | 0.674 | 0.163 |
| N | 7 | 7 |
| Eagle County: LMT Elementary PROP | | |
| Pearson Correlation | 0.65 | -0.371 |
| p Value | 0.235 | 0.538 |
| N | 5 | 5 |
| Eagle County: LMT Middle School PROP | | |
| Pearson Correlation | -0.161 | 0.225 |
| p Value | 0.729 | 0.627 |
| N | 7 | 7 |

*Correlation is significant at the 0.01 level

Science

As with the math MSP participants, students of teachers with high changes in TCK, as measured by pre- and post-tests, were compared to students of teachers with no or low changes in TCK. There were no significant trends or findings.

The Effects of Continuous Participation in Mathematics and Science Partnerships

Math

All grantees' participating teachers had higher math MGPs in 2011 than in 2010. Although the population includes all participants from both years, the participants who have math CSAP data in 2010 and 2011 are not necessarily the same, and the groups of students comprising the 2010 MGP and 2011 MGP are not the same. For the 180 participants participating both years, 123 had 2010 math CSAP data with a student MGP of 41, and 86

were matched to 2011 math CSAP data with a student MGP of 45. This difference between student MGPs was significant and the same trend held for each of the five partnerships providing math PD.

TABLE 10: 2009-2010 MSP Math Participants Also Participating in 2010-2011 – Student MGP on 2010 Math CSAP and 2011 Math CSAP

| MSP Lead Partner | N 2009-2010 Math Participants With 2010 CSAP Data | Student 2010 MGP (N MSP Students) | N 2009-2010 Math Participants With 2011 CSAP Data | Student 2011 MGP (N MSP Students) | Mann-Whitney U Test P Value |
|--------------------------|---------------------------------------------------|-----------------------------------|---------------------------------------------------|-----------------------------------|-----------------------------|
| Mesa State | 22 | 50.0 (1,342) | 15 | 55.0 (925) | 0.002* |
| Weld County 6 | 28 | 33.0 (2,966) | 19 | 40.0 (1,889) | 0.001* |
| Jefferson County | 14 | 47.0 (773) | 13 | 51.0 (919) | 0.015** |
| Pueblo County | 30 | 38.0 (2,086) | 24 | 40.0 (1,643) | 0.263 |
| Eagle County | 29 | 55.0 (834) | 15 | 59.0 (630) | 0.334 |
| All 2010-2011 MSP | 123 | 41.0 (8,001) | 86 | 45.0 (6,006) | .001* |

*Difference is significant at the 0.01 level

**Difference is significant at the 0.05 level

The effects of MSP participation were examined further through student performance in the years following participants' completion of PD. Participants from prior years who only participated in one year of math PD were compared to those whose first year of math PD was the current year. Each teacher was matched to the students they taught during 2010-2011 school year and those students' corresponding 2011 math CSAP MGPs. In general, **single year participants from prior years had higher student MGPs than the 46 participants participating for the first time in 2010-2011, but not for all participants and not for all years.** A similar pattern existed for Mesa State's single year participants and a different pattern emerged for Jefferson County's single year participants, whose 2007-2008 students had a significantly lower student MGP than single year participants from the other three years.

TABLE 11: One Year Only Math PD Participants – Student MGP on 2011 Math CSAP

| MSP Lead Partner | 2007-08 Participants | | 2008-09 Participants | | 2009-10 Participants | | 2010-11 Participants | | Mann-Whitney U Test p Value |
|--------------------------|--------------------------------|----------------------|--------------------------------|----------------------|--------------------------------|----------------------|--------------------------------|----------------------|-----------------------------|
| | N Teachers with 2011 CSAP Data | MGP (N MSP Students) | N Teachers with 2011 CSAP Data | MGP (N MSP Students) | N Teachers with 2011 CSAP Data | MGP (N MSP Students) | N Teachers with 2011 CSAP Data | MGP (N MSP Students) | |
| Mesa State | 4 | 64.0 (230)a | 3 | 63.5 (164)a | 5 | 52.0 (410)b | 2 | 46.0 (165)b | 0.001* |
| Weld County 6 | N/A | N/A | 0 | N/A | 0 | N/A | 13 | 32.5 (1,180) | N/A |
| Jefferson County | 6 | 44.0 (339)b | 13 | 54.0 (1,018)a | 8 | 52.0 (549)a | 11 | 50.0 (658)a | 0.002* |
| Pueblo County | N/A | N/A | 0 | N/A | 0 | N/A | 8 | 37.0 (731) | N/A |
| Eagle County | N/A | N/A | N/A | N/A | 14 | 60.0 (665) | 12 | 56.0 (772) | N/A |
| All 2010-2011 MSP | 10 | 53.0 (569)a | 16 | 56.0 (1,182)a | 27 | 56.0 (1,624)a | 46 | 41.0 (3,506)b | 0.001* |

Difference between the MGP of groups marked 'a' and the MGP of groups marked 'b' is significant at the 0.01 level

*Difference is significant at the 0.01 level

Science

A similar pattern emerged across all partnerships; **single-year participants from prior years had better student performance on the 2011 science CSAP compared to participants from the most recent years, but not for all participants and not for all years.**

TABLE 12: One Year Only Science PD Participants – Proportion of Students Proficient and Advanced on 2011 Science CSAP

| MSP Lead Partner | 2007-08 Participants | | 2008-09 Participants | | 2009-10 Participants | | 2010-11 Participants | | Pearson Chi-Square Test p Value |
|------------------|--------------------------------|------------------------------------------|--------------------------------|------------------------------------------|--------------------------------|------------------------------------------|--------------------------------|------------------------------------------|---------------------------------|
| | N Teachers with 2011 CSAP Data | % Proficient / Advanced (N MSP Students) | N Teachers with 2011 CSAP Data | % Proficient / Advanced (N MSP Students) | N Teachers with 2011 CSAP Data | % Proficient / Advanced (N MSP Students) | N Teachers with 2011 CSAP Data | % Proficient / Advanced (N MSP Students) | |
| Mesa State | 0 | N/A | 3 | 41.59% (226) | 1 | 74.77% (107) | 3 | 43.84% (219) | N/A |
| Weld 6 | 0 | N/A | 0 | N/A | 0 | N/A | 5 | 23.95% (618) | N/A |
| Jeff County | 6 | 51.61% (498) ^b | 6 | 57.63% (675) ^a | 4 | 42.13% (216) ^c | 12 | 52.04% (686) ^b | 0.001* |
| Colo College | 0 | N/A | 0 | N/A | 0 | N/A | 5 | 48.27% (433) | N/A |
| DPS | N/A | N/A | N/A | N/A | 9 | 17.59% (290) | 6 | 28.57% (161) | N/A |
| Westminster 50 | N/A | N/A | N/A | N/A | N/A | N/A | 4 | 17.48% (103) | N/A |
| All 2010-11 MSP | 6 | 51.61% (498) ^a | 9 | 53.61% (901) ^a | 14 | 36.22% (613) ^b | 35 | 39.37% (2,220) ^b | 0.001* |

The % Proficient/Advanced of groups marked 'a' is significantly higher than the % Proficient/Advanced of groups marked 'b' which is significantly higher than the % Proficient/Advanced of groups marked 'c', at the 0.01 level

*Difference is significant at the 0.01 level

Conclusions and Next Steps

Among the multitude of analyses performed for this year's evaluation, several findings emerged to help guide the MSP program and next year's evaluation.

- **The MSP requirement of targeting high-need students is being met:** Comparison groups of non-MSP students in MSP schools were created for each partnership and the 2010-2011 MSP as a whole. In relation to their comparison groups and the state as a whole, students taught by MSP participants in 2010-2011 had higher rates of students eligible for free and reduced cost meals and classified as EL.
- **3 of 8 grantees demonstrated significant gains in at least one nationally normed/standardized teacher content knowledge assessment:** Mesa State participants demonstrated significant gains on a math and science version of DTAMS, Eagle County participants showed significant gains on the LMT, and Colorado College participants showed significant gains on the DTAMS physical science. Additionally, Jefferson County, DPS, and Westminster participants showed significant gains on TCK tests that were not nationally normed and standardized assessments.
- **Mesa State, Jefferson County, and Eagle County demonstrated gains in student performance in relation to comparison groups and other grantees:** While, in aggregate, students taught by 2010-2011 MSP participants did not outperform the state or the comparison group, three of the grantees' students

did. In math, students taught by both Mesa State and Eagle County participants had a MGP greater than the state average. For science, students of Jefferson County participants were more likely to score proficient and advanced on the 2011 science TCAP than were a comparison group of students.

- **The performance of students taught by both math and science MSP participants suggests a lag in effective implementation of learned PD concepts:** Students of math participants for the past two years had a significantly higher 2011 MGP than 2010 MGP. The same was true for students of science participants who participated for the past two. Furthermore, students of single-year math participants from one to three years ago had a 2011 MGP significantly higher than students of current year participants. A similar trend emerged for single-year science participants.
- **Next Steps:** Based on the analyses of the 2010-2011 data, multiple ideas were generated for future years' evaluations.
 - **Further examine the relation between post-test TCK scores and student performance:** There was a significant positive correlation at Mesa State between a teacher's TCK post-test score and their student MGP. Five of the other six correlations between TCK post-test score and student MGP were positive. This relationship had not been explored in prior years' evaluations, so will continue to be tracked in future years to see if this trend persists.
 - **Examine how participants' level of teaching experience relates to levels of, and gains in, teacher content knowledge and student performance:** With the wide range and variability in participants' level of experience in the classroom, CDE is interested in exploring how years of teaching experience may relate to participants' receptiveness to the PD and effectiveness in implementing what was learned as a result of PD.
 - **Perform a case study on the more successful partnerships:** While the more successful partnerships have been identified through the evaluation process, qualitative studies to determine common characteristics among successful programs have been limited. Similarly, the less successful partnerships will be analyzed in future evaluations for commonalities, and compared to the characteristics of successful partnerships.

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