EVALUATION OF NCLB TITLE II, PART B: MATH AND SCIENCE PARTNERSHIP

EVALUATION YEAR THREE REPORT

SUBMITTED TO THE COLORADO DEPARTMENT OF EDUCATION

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FOR FURTHER INFORMATION, PLEASE CONTACT:

KATE FRANCE SMILES, M.P.P.
303-839-9422, EXT. 196
ksmiles@omni.org

MELISSA RICHMOND, PH.D.
303-839-9422, EXT. 166
mrichmond@omni.org

Prepared by OMNI Institute

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Evaluation of NCLB Title II, Part B: Math and Science Partnership
2009-2010 Academic Year Data

EXECUTIVE SUMMARY

Background

OMNI Institute (OMNI) was contracted to assist the Colorado Department of Education (CDE) in its evaluation of the Math and Science Partnership (MSP) program, Title II, Part B of No Child Left Behind (NCLB). MSP programs are intended to increase the academic achievement of students in mathematics and/or science by providing professional development (PD) opportunities to classroom teachers to enhance their content knowledge and pedagogical skills. Evaluation goals this year included:

- Continuing evaluation efforts from previous years describing MSP programs, teacher participants, students, and successes and challenges;
- Examining the relationship, if any, between changes in teacher content knowledge and student achievement;
- Assessing whether there was an association between number of years teachers participated in an MSP program and student achievement; and
- Exploring whether MSP teacher participants become more effective in their teaching over time, as evidenced by their cohorts of students demonstrating higher achievement across years (teachers remain constant but student groups change each year).

It is important to note that there were many data limitations that precluded our ability to fully answer the evaluation questions outlined above. Our goal was to conduct an exploratory evaluation to begin to address the questions to the extent possible and to inform on-going efforts to enhance MSP evaluation activities. Results of analyses linking MSP teacher participants to student achievement should be interpreted with particular caution.

Methodology

Eleven MSPs from cohorts 4, 5, and 6 were included in analysis for this report. OMNI employed a mixed methods approach including qualitative and quantitative analyses to evaluate the MSP program. Key quantitative data sources included: MSP Participant List (PL) maintained by CDE; the Automated Data Exchange (ADE); and the Colorado Student Assessment Program (CSAP). A variety of steps, including identification of invalid or missing data and removal of duplicate cases, were taken to prepare quantitative data for analysis. The table below presents the number of teachers, by cohort, included in each phase of the data preparation process.

Cohort	MSP Teachers on PL	2009-10 PL Teachers with ADE Demographic Data		2009-10 PL Teachers with Pre/Post Test Data		PL Teachers in Student ADE File		PL Teachers Matched to Students with CSAP Data	
		N	(%)	N	(%)	N	(%)	N	(%)
07-08	268	n/a	n/a	n/a	n/a	149	(56%)	147	(55%)
08-09	480	n/a	n/a	n/a	n/a	303	(63%)	300	(63%)
09-10	681	569	(84%)	461	(68%)	480	(71%)	472	(69%)
Overall	871	n/a		n/a		525	(60%)	517	(59%)

Multiple qualitative data sources, including MSP applications, Annual Performance Reports (APRs) and Local Evaluation Reports (LERs) from various years, were examined as well. Based on review and analysis by two researchers, common themes and notable variations across MSPs were identified.

MSP Descriptive Information

MSP Programs

The professional development activities offered varied by MSP. Two MSPs offered a Summer Institute Only; four partnerships offered Summer Institutes with additional or follow-up activities; and the remaining five partnerships provided activities that did not fit into the first two categories. Four MSPs focused only on math, four only on science, and three addressed both subjects.

MSP Program Successes and Challenges

MSPs described a range of successes and challenges experienced during the 2009-10 academic year. Successes described by MSPs fell into the following nine categories:

- Teachers incorporating/expanding use of key pedagogical techniques (9 MSPs);
- Increased teacher enthusiasm (4 MSPs);
- Increased teacher confidence (9 MSPs);
- Enhanced use/understanding of data (2 MSPs);
- Increased teacher content knowledge (11 MSPs);
- Increased collaboration/networking (11 MSPs);
- Increased teacher leadership (2 MSPs);
- Increased/strong teacher participation (5 MSPs); and
- Improved data collection/evaluation (5 MSPs).

Challenges generally fell into three broad categories:

1) Implementation challenges – those challenges associated with the design/implementation of PD activities:
   - Lack of time/scheduling conflicts (4 MSPs);
   - Rural geographic setting (2 MSPs);
   - Lack of teacher participation/engagement (3 MSPs);
   - Lack of LEA administrator support (1 MSP);
   - Limited engagement/cooperation among MSP partners (2 MSPs);
   - Concerns about MSP impact on teacher/student knowledge or practice (5 MSPs); and
   - Other implementation challenges (2 MSPs).

2) Evaluation challenges – those challenges associated with measurement, data collection, and/or evaluation design:
   - Measurement and data collection (10 MSPs); and
   - Evaluation design (3 MSPs).

3) Systemic challenges – those challenges that exist outside of the MSP but appear to have relatively direct bearing on MSP goals and activities:
   - Teacher turnover and low morale (3 MSPs);
   - Lack of alignment between teacher and administrator philosophies (1 MSP); and
   - Other systemic challenges (4 MSPs).

MSP Teacher Participants

Select demographic characteristics of 2009-10 MSP teacher participants were examined. Key findings include:

- There were 681 teacher participants during 2009-10. MSPs served anywhere from 9 to 172 teachers

in a given year, and the Jefferson County MSP had the most teacher participants (n=172).

- The number of school districts participating in a single MSP in 2009-10 varied from 1 to 9.
- About one-third of the 2009-10 teacher participants had degrees in math or science. Weld had the largest proportion (74%) of teacher participants with degrees in math or science.
- Among all 2009-10 teacher participants, the median years of teaching experience was 8. Teachers from Fort Lewis had the greatest median experience, followed by Colorado College and CSU.

MSP Teacher Participants' Students

Overall, students taught by 2009-10 MSP teacher participants were about equally likely to be male as female; more likely to be White, followed by Hispanic; and most likely to be in 6th, 7th, or 8th grade. Additionally, half of the students taught were eligible for free or reduced lunch, and 13% had limited or no English proficiency.

Teacher Content Knowledge & Student Achievement

Evaluation activities examined two key questions with respect to teacher participant content knowledge:

1) Which MSPs had participants that, as a group, demonstrated statistically significant change between content knowledge pre- and posttest in 2009-10?
2) What was the relationship between the *degree* of change between content knowledge pre- and posttest and student achievement? Did students taught by teachers demonstrating relatively large gains between pre- and posttest perform better on CSAP tests in math and/or science than those taught by teachers demonstrating little or no change?

Teacher Assessment Strategies

Teacher content knowledge assessment tools and classroom observation protocols used by each MSP were identified based upon 2009-10 APR and LER documents. The most frequently employed nationally recognized teacher knowledge test was the Diagnostic Teacher Assessments in Mathematics and Science (DTAMS) (n = 4). Several MSPs used locally developed tests (n = 4) to assess teacher knowledge. Most of the MSPs reported using observation to assess teacher practice in the classroom (n = 9). Four of these MSPs used nationally recognized protocols such as the Horizon Classroom Observation Protocol or Oregon Teacher Observation Protocol to assess teachers in the classroom. One reported using a modified version of a nationally normed tool.

Teacher Participant Content Knowledge Test Results

All MSPs assessed teacher content knowledge as a part of their individual MSP evaluation in 2009-10, and about two-thirds of the 2009-10 teacher participants had matching pretest and posttest scores. A paired samples t-test was conducted to compare pretest and posttest scores within each MSP that had at least 10 teachers with matching pre and posttest scores within a subject area. Statistically significant increases ($p<.05$) in teacher knowledge test scores from pretest to posttest were found for nearly all of the MSPs examined. Specifically, only two MSPs had changes between pre- and posttest that were not statistically significant. These findings indicate that most MSPs have had a positive impact on teachers' content knowledge.

Teacher Participant Content Knowledge Change & Student Achievement

Exploratory analyses were conducted to assess whether teachers that demonstrated clear gains in content knowledge had students with better achievement outcomes than teachers that demonstrated little to no gains in content knowledge. Four MSPs were included in these analyses. For two MSPs (one in each subject area), the students taught by "clear change" teachers performed better on CSAP than did those students taught by "little to no change" teachers. However, for the other two MSPs, students taught by "little to no change" teachers performed better than those taught by "clear change" teachers. Overall, no

clear pattern emerged from these analyses. It is important to note that sample sizes for teachers in each analysis group were very small and, as such, results should be interpreted with caution.

Years of Teacher MSP Participation & Student Achievement

Evaluation activities also explored the relationship between the number of years of MSP participation and student achievement. Specifically, student achievement data were analyzed to identify differences among teachers in the following groups:

- Single Year vs. Multiple Years – Comparing teachers with one year of MSP exposure to those with either two or three years of exposure *(two groups)*;
- One vs. Two vs. Three Years – Comparing teachers with one year of MSP exposure to those with two years and those with three years *(three groups)*;
- Timing of Exposure:
    - One Year of Participation – Comparing only those teachers with one year of MSP exposure, but varying the timing of that year; *(three groups)*; and
    - Two Years of Participation – Comparing only those teachers with two years of MSP exposure, but varying the timing of those years (consecutive vs. divided) *(three groups)*.

Statistical analyses were conducted only when an MSP had teachers present in each of the sub-groups described; and teachers in each sub-group could also be matched to at least 20 students with CSAP data in the relevant subject (either math or science).

Key findings for math teachers include:

- Single Year vs. Multiple Years – Five MSPs demonstrated statistically significant differences. Student median growth percentile rankings were higher for multiple- vs. single-year teachers for four MSPs (in one MSP, the opposite was found).
- One vs. Two vs. Three Years – Three MSPs demonstrated statistically significant differences among the three groups, though the patterns of difference varied by MSP.
- Timing of Exposure – Available data precluded us from drawing conclusions about patterns among teachers with either one-year or two-years of MSP participation.

These findings support the hypothesis that multiple years of MSP math PD has a positive impact on student achievement. However, additional analysis is needed to better understand the specific dimensions of this relationship.

For science, few statistically significant differences among groups were observed. Lack of significant findings may simply be the result of smaller samples sizes, as the science CSAP is only administered to students in the 5th, 8th, and 10th grades.

Teacher Effectiveness Over Time (Changes in Achievement of Cohorts of Students Taught by the Same Teacher)

A final set of analyses examined whether teachers became more effective over time as evidenced by higher student achievement among cohorts of their students from one year to the next, with students changing each year. Sufficient data were available only for 2008-09 teacher participants. Statistically significant findings are presented in the table below.

2008-09 MSP Participants	08-09 Students		09-10 Students
Two Math MSPs	Median Growth Percentile Ranking	<	Median Growth Percentile Ranking
One Math MSP	Median Growth Percentile Ranking	>	Median Growth Percentile Ranking
Two Science MSPs	% Proficient/Advanced	<	% Proficient/Advanced

The implications of these findings are unclear. While the data available do indicate that teacher participants from some MSPs may have had an increasingly positive impact on student achievement from one year to the next, it is unclear whether student achievement results from only two years are part of a larger, long-term trend, or simply reflect normal variation among years. Furthermore, the extent to which the characteristics of students taught by MSP participants vary from year to year is unknown.

Conclusions and Future Direction

The data available for the current evaluation of the MSP program presented several challenges. Key limitations should be considered when interpreting the findings of this exploratory evaluation, including:

- The "nested" structure of the MSPs was not reflected in the analyses conducted, and analyses of links between teacher characteristics and student achievement did not model variation at both the teacher- and student-level;
- Sample sizes across groups differed widely for many analyses, and, in some instances, the number of teachers reflected in the student-level analyses was very small;
- Multiple statistical tests were conducted on the outcome variables, which can result in obtaining significant findings by chance;
- Confounding MSP variables, such as school district characteristics, teacher characteristics, and student characteristics were not considered in the analyses; and
- Missing data may also have influenced the findings.

Based on findings from this year, evaluation activities in the future could include the following:

- Analysis of changes in pedagogical practice and their relationship with student achievement, to the extent that MSPs collect and report quantitative teacher observation results;
- Continued tracking of student achievement among students taught by 2008-09 teacher participants to enable analysis of trends in student achievement over time;
- Identification and study of a select number of MSPs that appear to have implemented promising, innovative, and/or unique approaches to examine the specific strategies and practices being used by these MSPs; and
- Consider the use of Hierarchical Linear Modeling in future years to address the nested structure of the MSP program.

Evaluation of NCLB Title II, Part B: Math and Science Partnership

2009-2010 Academic Year Data

Prepared by OMNI Institute
May 2011

Background

OMNI Institute (OMNI) was contracted to assist the Colorado Department of Education (CDE) in its evaluation of the Math and Science Partnership (MSP) program, Title II, Part B of No Child Left Behind (NCLB). MSP programs are intended to increase the academic achievement of students in mathematics and/or science by providing professional development (PD) opportunities to classroom teachers to enhance their content knowledge and pedagogical skills.

The first goal of the evaluation was to continue evaluation efforts from previous years describing MSP programs, teacher participants, students, and successes and challenges. The second goal focused on the following three key questions, identified in collaboration between OMNI and CDE:

1) What is the relationship, if any, between changes in teacher content knowledge and student achievement?
2) To what extent does student achievement vary based on the number of years and patterns of participation among MSP teachers? Specifically:
    a) Do teachers that participated in multiple years of MSP programming have students with higher achievement than teachers that participated in a single year of MSP? And, does this vary between teachers with two- and three-years of participation?
    b) Among one- and two-year teachers, how does the timing of participation relate to student achievement?
3) Is there evidence that MSP teacher participants become more effective in their teaching over time, as evidenced by their cohorts of students demonstrating higher achievement across years (teachers remain constant but student groups change each year)?

Consistent with these goals, this report first outlines the methodological approach employed during the course of the evaluation. Evaluation findings are then presented in four sections: Section One provides descriptive information about MSP programs, teacher participants, and students, including a summary of key challenges and successes experienced by MSPs; Section Two explores the relationship between teacher participant content knowledge and student achievement; Section Three examines the relationship between the number of years (and the specific patterns) of MSP participation and student achievement; and Section Four briefly explores academic achievement among students taught by MSP teacher participants over multiple years, with the teachers remaining constant but the student population taught changing each year. The report concludes with a summary of findings, implications and recommendations for the future.

It is important to note that there were many limitations to the data that precluded the ability to fully answer the evaluation questions outlined above. These limitations are noted throughout the report. Our goal was to conduct an exploratory evaluation to begin to address the questions to the extent possible and

to inform on-going efforts to enhance MSP evaluation activities. Results of analyses linking MSP teacher-participants to student achievement should be interpreted with particular caution.

Methodology

Eleven MSPs from cohorts 4, 5, and 6 were included in analysis for this report (see Table 1 below). OMNI employed a mixed methods approach including qualitative and quantitative analyses to evaluate the MSP program. Details regarding the cleaning, preparation, and analysis of all data sources are provided below.

Table 1: MSPs and Cohorts, 2009-10

MSP Name	Cohort
Mesa State	4
Weld	4
Fort Lewis	4
Jefferson County	4
DPS (1)	4
Fort Morgan	4
CSU	4
Colorado College	4
Southern Colorado	5
Eagle	6
DPS(2)	6

Quantitative Data Sources

MSP Cleaning and Data Preparation

All data for the MSP analysis were provided to OMNI by CDE. Four different quantitative data sources were used:

1) MSP Participant List (PL) – provides data on individual MSP teacher participants for all three years examined (2007-08, 2008-09, and 2009-10) and includes key variables such as: teacher identification numbers, districts, schools, subject area of MSP PD received, and teacher content knowledge pre- and posttest scores;
2) Teacher HR/Automated Data Exchange (ADE) – provides demographic information about MSP teacher participants in the 2009-10 year;
3) Student ADE – provides demographic information about students taught in 2009-10 by MSP teacher participants; and
4) Colorado Student Assessment Program (CSAP) – provides student achievement data in math and science for students taught by MSP teacher participants.

Of note, these data sources included data for teachers that participated in MSP PD during at least one of three academic years: 2007-08, 2008-09, and 2009-10.

A series of steps were taken to clean and prepare the 2009-10 data for analysis, including removal of invalid and duplicate data. Key aspects of the cleaning process included the following:

1) The PL originally included 910 teachers; 39 of them could not be confirmed as participants in any year. As a result, a total of 871 unique teachers from the Participant List were included in further analysis.
   - Of these 871 teachers, 268 participated in 2007-08, 480 participated in 2008-09, and 681 participated in 2009-10.
   - Generally, teachers were designated as having received either math or science professional development, with 290 science teachers and 597 math. Sixteen teachers were identified as having received both math and science PD at some point during the three years examined.
2) Demographic data were available from the Automated Data Exchange for 569 (84%) of the 681 2009-10 teacher participants on the Participant List. *These are the teachers included in teacher demographic tables presented in Section 1 of this report.*
3) Content knowledge test data for the 681 2009-10 teacher participants on the PL were examined to identify those teachers with test data for both pretest and posttest. Of note, one of the larger MSPs (Fort Lewis) had no available matching pre/posttest data for any of its 2009-10 teachers.
   - Overall, matching pre/posttest data were available for 461 (68%) of the 681 2009-10 teachers on the Participant List.[1] *These are the teachers included in analyses examining changes in teacher content knowledge (Section 2 of this report).*
4) Students were matched with their teachers based on teacher and student ID numbers, as well as subject area (e.g., teachers receiving math PD were matched only to students enrolled in math courses with them), and duplicate teacher-student pairs were removed from the file. A total of 517 (59%) of the 871 teacher participants could be matched to students. Table 2 below presents the breakdown of teachers with student data, by cohort year.
5) CSAP data from 2009-10 were then linked to students matched to MSP teacher participants. Note that CSAP is administered only to students in grades 3-12, so student achievement data presented in this report includes only students in those grades. Overall, nearly 90% of students matched to MSP teacher participants could be matched with CSAP data. No teachers were removed from the file during this process (i.e., all teachers had some students with CSAP data).
6) The final, cleaned file containing data for MSP teacher participants matched to students with CSAP data included 517 teachers (472 in 2009-10, 300 in 2008-09, and 147 in 2007-08). *The teachers and students present in this file were included in analyses examining the relationship between the number of years of MSP participation and student achievement presented in Section 3 of this report, as well as in student demographics presented in Section 1.*

[1] Teachers from three MSPs (DPS(1), Eagle, and Jefferson County) had multiple complete sets of pre/posttest data for 2009-10. Analysis of teacher content knowledge presented in Section Two includes the first set of pre/posttest data for these teachers. Additional sets of pre/post test data were analyzed separately for these MSPs and results are presented in Appendix C.

Table 2: Teacher Participants in Each Phase of Data Cleaning/Preparation

Cohort	MSP Teachers on PL	2009-10 PL Teachers with ADE Demographic Data		2009-10 PL Teachers with Pre/Post Test Data		PL Teachers in Student ADE File		PL Teachers Matched to Students with CSAP Data	
		N	(%)	N	(%)	N	(%)	N	(%)
07-08	268	n/a	n/a	n/a	n/a	149	(56%)	147	(55%)
08-09	480	n/a	n/a	n/a	n/a	303	(63%)	300	(63%)
09-10	681	569	(84%)	461	(68%)	480	(71%)	472	(69%)
Overall	871	n/a		n/a		525	(60%)	517	(59%)

Qualitative Data Sources

Multiple qualitative data sources were examined to supplement the quantitative data sources described above. During the previous evaluation year, MSP applications, Annual Performance Reports (APRs) and Local Evaluation Reports (LERs) from various years were examined to identify information on teacher content knowledge assessments, MSP activities, reported impacts of MSP activities on changes in teacher content knowledge, and MSP challenges and successes. For the current report, the 2009-10 APRs and LERs from all eleven MSPs were reviewed to update the information presented in Year 2. One researcher first reviewed all new APRs and LERs to identify information relevant to topics addressed during Year 2 qualitative analysis, as well as new information regarding described challenges and/or successes. The information gathered during this process was then analyzed by a second researcher. Based on this review, common themes and notable variations across MSPs were identified. Each of the three data sources is described further in Appendix A. Table 3 summarizes the documents and years included in the analysis.

Table 3: Qualitative Analysis Data Sources

MSP Name	Cohort	MSP Application	2007-08 LER	2008-09 LER	2009-10 LER	2007-08 APR	2008-09 APR	2009-10 APR
Mesa State	4	✓	✓	✓	✓	✓	✓	✓
Weld	4	✓	✓	✓	✓	✓	✓	✓
Fort Lewis	4	✓	✓	✓	✓	✓	✓	✓
Jefferson County	4	✓	✓	✓	✓	✓	✓	✓
DPS (1)	4	✓	✓	✓	✓	✓	✓	✓
Fort Morgan	4	✓	✓	✓	✓	✓	✓	✓
CSU	4	✓	✓	✓	✓	✓	✓	✓
Colorado College	4	✓	✓	✓	✓	✓	✓	✓
Southern Colorado	5	✓		✓	✓		✓	✓
Eagle	6	✓			✓			✓
DPS(2)	6	✓			✓			✓

Section 1: MSP Descriptive Information

MSP Programs

The professional development activities offered varied by MSP. On the APR, each partnership was asked to choose from the following three categories:

a) Summer Institute Only;
b) Summer Institute with additional or follow-up activities; or
c) Activities other than Summer Institutes only or Summer Institutes with follow-up activities.

As can be seen in Table 4 below, two MSPs (DPS (1) and DPS (2)) indicated that they offered a Summer Institute Only. Four partnerships (Colorado State, Fort Lewis, Jefferson County, and Mesa State) indicated that they offered Summer Institutes with additional or follow-up activities. Of note, two MSPs (Southern Colorado and Weld) changed the type of MSP activity offered between this year and last.

The remaining five partnerships indicated that they provided activities that did not fit into the first two categories. Table 4 presents detailed information about the programming provided by each MSP, the target(s) of PD activities, and the number of participant contact hours, based on MSP LERs and APRs.

Table 4: MSP PD Activities and Targets

MSP Name	Professional Development Subject	Type of Professional Development Activities from APR	Type of program/activity/ instruction from LER	Primary Target from APR	Additional Primary Target Information from LER	Contact Hours
Mesa State	Math/Science	Summer Institutes with additional or follow-up activities	2-week Summer Institute; 2 online courses; 2 weekend workshops; capstone event; ongoing structured support for teachers; development of, and training on how to use, hands-on math and science kits; PLC	Individual Teacher	Middle school math and science teachers	120
Weld County	Math/Science	Activities other than Summer Institutes only or Summer Institutes with follow up activities	Monthly math/science content and pedagogical instruction delivered by STEM faculty at the IHE; monthly collaboration sessions provided by a district-supported instructional coach	Schools	Middle school math and science teachers	31
Fort Lewis	Math	Summer Institutes with additional or follow-up activities	4-day Summer Institute; 4 strands: mentorship, general PD, connected mathematics program, math content; mini-workshops; smart board workshops	Individual Teacher	K-12 math teachers and special education teachers and paraprofessionals	32
Jefferson County	Math/Science	Summer Institutes with additional or follow-up activities	2-week Summer Institutes with follow-up sessions; Articulation team of teacher leaders and IHE faculty to discuss recommendations for aligning secondary/postsecondary education	Individual Teacher	Middle school math and science teachers	125

Table 4: MSP PD Activities and Targets

MSP Name	Professional Development Subject	Type of Professional Development Activities from APR	Type of program/activity/ instruction from LER	Primary Target from APR	Additional Primary Target Information from LER	Contact Hours
DPS (1)	Science	Summer Institutes only	Summer research internships to increase teachers' scientific knowledge through hands-on experience in inquiry-based research; working in laboratories; brown bag lunches; seminars; poster session	Individual Teacher	K-12 science teachers	180
Fort Morgan	Math	Activities other than Summer Institutes only or Summer Institutes with follow-up activities	Summer Math Academy; Math Coaches; mandatory PD for all K-12 math instructional staff	Schools	K-12 math teachers	28
CSU	Science	Summer Institutes with additional or follow-up activities	Science content graduate students (Fellows) in middle school classrooms; middle school teachers involved in university research projects; monthly PD workshops throughout the academic year; teachers mentored in grant writing	Individual Teacher	Middle school science teachers	96
Colorado College	Science	Activities other than Summer Institutes only or Summer Institutes with follow up activities	Traditional Summer Institute followed by implementation during academic year and meetings; Academic Year Institute with on-going implementation; workshops; courses; use of notebooks	Individual Teacher	Middle school science teachers	60
Southern Colorado	Math	Activities other than Summer Institutes only or Summer Institutes with follow up activities	Summer Academy in Mathematics; online courses; co-teaching teams (math & special needs); PLCs; workshops	Individual Teacher	Middle and high school math and special needs teachers	38

Table 4: MSP PD Activities and Targets

MSP Name	Professional Development Subject	Type of Professional Development Activities from APR	Type of program/activity/ instruction from LER	Primary Target from APR	Additional Primary Target Information from LER	Contact Hours
Eagle	Math	Activities other than Summer Institutes only or Summer Institutes with follow up activities	Math Academy; mathematics lesson study; learning circles; summer academy; coaching, mentoring and study groups	Individual Teacher	K-12 math teachers	115
DPS(2)	Science	Summer Institutes only	Science Institutes, curricular lessons	Individual Teacher	4th-7th grade teachers	60

Partnerships can provide PD in either math or science, or a combination of both. As can be seen in Table 4 above, four MSPs focused only on math, four only on science, and three addressed both subjects

MSP Program Successes and Challenges

The following discussion outlines key successes, as well as challenges or barriers, reported by the eleven MSPs in cohorts 4, 5, and 6 in their 2009-10 APRs and LERs.

Successes

All of the programs reported several successes that they believe can be attributed to MSP participation. Key types of successes, as well as the number of MSPs reporting them, are described below. Of note, some of the successes cited below mirror challenges described subsequently, indicating that some opportunities may exist for learning across MSPs. Table 5 summarizes these successes, along with the MSPs reporting them. Additional details are provided immediately following this table.

Table 5: MSP Reported Successes 2009-10

Success	Mesa State	Weld	Fort Lewis	Jefferson County	DPS (1)	Fort Morgan	CSU	Colorado College	Southern Colorado	Eagle	DPS (2)	Number of MSPs
Teachers Incorporating/Expanding Use of Key Pedagogical Techniques	✓	✓	✓	✓	✓		✓	✓	✓		✓	9
Increased Teacher Enthusiasm			✓		✓			✓	✓			4
Increased Teacher Confidence	✓	✓	✓		✓		✓	✓	✓	✓	✓	9
Enhanced Use/Understanding of Data	✓								✓			2
Increased Teacher Content Knowledge	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	11
Increased Collaboration/Networking	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	11
Increased Teacher Leadership	✓				✓							2
Increased/Strong Teacher Participation		✓	✓		✓			✓		✓		5
Improved Data Collection/Evaluation					✓	✓	✓	✓	✓	✓		6

- **Teachers Incorporating/Expanding Use of Key Pedagogical Techniques**
  - Nearly all (9) MSPs reported increased use of teaching techniques addressed during PD activities. While two of these MSPs offered general statements about teacher participants' use of "best practice instruction" and new instructional practices, eight also described specific strategies or techniques including:
    a. Inquiry-based instruction (6 MSPs)
    b. Use of technology for instruction (4 MSPs)
    c. Notebooking (2 MSPs)
- **Increased Teacher Enthusiasm from Teacher Participants**
  - Four MSPs specifically reported greater interest in and enthusiasm about MSP opportunities on the part of teacher participants. For example, teachers in the Colorado College MSP submitted final comments indicating that they "were very excited about both the content and the pedagogical knowledge that they gained over the course of the workshop."

- **Increased Teacher Confidence**
  - Eight MSPs reported that MSP teacher participants reported having greater confidence in their knowledge and/or teaching upon completion of MSP activities.
- **Enhanced Use/Understanding of Data**
  - Two MSPs reported that they helped teacher participants to more effectively understand and use student achievement data to inform instruction. For example, the Southern Colorado MSP, which used the NWEA MAP as the test of teacher content knowledge, reported that "prior to taking the test themselves, many teachers were unaware of how the test was individually administered and scored, although they had knowledge of the basics. Following taking the test twice themselves, teachers have expressed an increased respect for the value of the test results. Teachers, working in collaborative groups, have expressed an interest in breaking down the student NWEA data following fall testing and using the results of that data to formulate the direction of their own classroom teaching…"
- **Increased Teacher Content Knowledge**
  - All MSPs reported some degree of content knowledge gain among teacher participants. However, some indicated that the amount of gain for some individual teachers, as well as across all teacher participants was less substantial than intended. Teacher content knowledge results are discussed in further detail in Section 2 of this report.
- **Increased Collaboration/Networking**
  - All MSPs reported strengthened collaboration among and/or within MSP partner organizations. Specifically, seven MSPs described greater collaboration among K-12 educators, such as co-teaching or professional learning communities. Collaboration among K-12 partners appears to be taking place both within schools or districts, as well as across schools and/or districts. Additionally, 9 MSPs described strong collaboration between K-12 stakeholders and IHE faculty. In one of these MSPs, this collaborative relationship has informed the development and review of a local assessment of mathematical and pedagogical content knowledge.
- **Increased Teacher Leadership**
  - Two MSPs reported having teacher participants that took on additional leadership roles within their schools or districts. For example, Mesa reported that "30 of 41 teachers who participated in the grant program have stepped forward or were invited to take on leadership roles in their schools, district, or state. Examples of the leadership roles that were reported include serving as serving as Professional Learning Community facilitator, serving as department chair, sponsoring after school math or science clubs, organizing the school science fair, and serving as a teacher mentor."
- **Increased Teacher Participation**
  - Five MSPs reported either increased or generally strong participation among eligible teacher participants. In one case, the MSP indicated that enrollment in the MSP was highly competitive and not all interested teachers were able to participate.
- **Improved Data Collection/Evaluation**
  - Six MSPs described success or enhancements with respect to data collection and MSP evaluation activities in the 2009-10 academic year. In some cases, MSPs reported the collection of more in-depth qualitative data from teacher participants, while others described the use of technology (e.g., supporting software and web-based questionnaires) to support MSP evaluation efforts.

Challenges

Consistent with the Year 2 evaluation report, MSP reported challenges are divided into the following three broad categories:

1) Implementation challenges – those challenges associated with the design/implementation of PD activities;
2) Evaluation challenges – those challenges associated with measurement, data collection, and/or evaluation design; and
3) Systemic challenges – those challenges that exist outside of the MSP but appear to have direct bearing on MSP goals and activities.

To the extent possible, challenges identified in last year's report are addressed, along with notable challenges from 2009-10. Table 6 below summarizes the types of challenges reported by the eleven MSPs. Additional details are provided immediately following this table.

Table 6: MSP Reported Challenges 2009-10

Challenge	Mesa State	Weld	Fort Lewis	Jefferson County	DPS (1)	Fort Morgan	CSU	Colorado College	Southern Colorado	Eagle	DPS (2)	Number of MSPs
Implementation Challenges												
Lack of Time/Scheduling Conflicts	✓								✓	✓	✓	4
Rural Geographic Setting	✓								✓			2
Lack of Teacher Participation/ Engagement				✓		✓		✓				3
Lack of LEA Administrator Support								✓				1
Limited Engagement/Cooperation Among MSP Partners									✓	✓		2
Concerns about MSP Impact on Teacher/Student Knowledge or Practice			✓		✓	✓			✓	✓		5
Other Implementation Challenges			✓							✓		2
Evaluation Challenges												
Measurement & Data Collection	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	10
Evaluation Design							✓	✓		✓		3
Systemic Challenges												
Teacher Turnover and Low Morale			✓			✓		✓				3
Lack of Alignment between Teacher and Administrator Philosophies						✓						1
Other Systemic Challenges	✓		✓			✓			✓			4

Implementation Challenges

The implementation and operation challenges experienced by the MSPs were primarily logistical, though some MSPs encountered relatively significant implementation barriers. MSPs described the following types of implementation challenges.

- **Lack of Time/Scheduling Conflicts**
  - Four MSPs reported challenges associated with either staff or teacher time for MSP activities and learning. The specific challenges varied somewhat, with one MSP expressing concern that teachers needed more time than was available to more fully integrate and apply their learnings; three MSPs reporting that MSP support staff (coordinators/directors) were less available to work with and observe teacher participants than was desirable; and two MSPs reporting that they encountered scheduling conflicts when planning MSP activities.
- **Rural Geographic Setting**
  - Two MSPs described challenges associated with the geographic characteristics of district(s) participating in MSP activities. In both cases, ensuring that all teacher participants had adequate access to MSP opportunities and resources, including IHE faculty, was cited as an on-going challenge.
- **Lack of Teacher Participation/Engagement**
  - Three MSPs reported challenges around recruiting and engaging teacher participants in MSP activities. One of these MSPs indicated that a "significant challenge has been 'getting the word out' to district middle level teachers" and that many teachers appear to be unaware of MSP opportunities available to them. A second MSP reported that it was not able to recruit as many participants as had been anticipated for one summer institute, and that participation was particularly low from for one LEA. Finally, a third MSP described resistance from some teachers that did not want to participate in a Summer Math Academy delivered outside of teacher content time. This same MSP also reported that some teacher participants were not fully cooperative with or engaged in MSP PD activities.
- **Lack of LEA Administrator Support**
  - One MSP explicitly reported challenges related to obtaining the support of LEA administrators for key aspects of the selected MSP approach. Specifically, this MSP indicated that, while data gathered via classroom observations appears to support the MSP approach, it is unclear whether these data (as opposed to quantitative test data) will be sufficient to garner support from LEA district administrators.
- **Engagement/Cooperation with IHE Faculty & Other Key Partners**
  - Two MSPs reported apparently significant disagreements among LEA and other key MSP partners. One of these MSPs indicated that many IHE faculty were unwilling to provide MSP coursework during the summer or participate in a math academy for LEA teachers. Additionally, this same MSP reported that IHE faculty were unwilling to providing PD coursework in the specific subject areas (Algebra and Geometry) needed by LEA teachers. Finally, a second MSP reported significant philosophical differences between the LEA and other MSP partners, including both the IHE and a contracted PD provider. Ultimately, this MSP opted to replace both partners for the 2010-11 year.
- **Concerns about MSP Impact on Teacher/Student Knowledge or Practice**
  - Five MSPs reported some degree of disappointing information regarding the impact of MSP

activities on teachers and/or students. Specifically, one MSP described each of the following five challenges:

a) student performance for at least one teacher participant was lower than anticipated;
b) classroom observation scores that were lower than desired;
c) based on test scores, target teachers did not appear to be benefitting from MSP programming as intended;
d) teachers' attitudes about their own practice and self-efficacy declined between pre- and post-test, though this MSP theorized that this may be attributable to an "implementation dip," as teachers work to integrate new techniques into their teaching; and
e) failure to achieve its goal relative to the number of teachers attaining highly qualified status after MSP participation.

- **Other Implementation Challenges**
  - One MSP also reported an identified need to modify the structure of its PD activities, based on feedback from participants. Specifically, all MSP teachers (K-12) participated in PD sessions together this year, and stakeholders identified a need to break these groups into two (K-5 and 6-12) in future years in order to tailor session content more specifically to the teachers in these two groups.
  - Another MSP indicated that, due to substantial teacher turnover, it was unable to fill the roles of "Teacher Trainers," which were intended to support training of other teachers and sustainability of PD activities.

Evaluation Challenges

Many MSPs also reported challenges regarding program evaluation activities. According to APRs and LERs, MSPs encountered the following categories of evaluation challenges.

- **Measurement/Data Collection**
  - Ten MSPs reported challenges associated with measuring and collecting data on teacher content knowledge, teacher pedagogical skill, and/or student achievement, and four of these cited challenges with both.
  - With respect to teacher content knowledge, concerns described included:
    a) identifying an effective measure of teacher content knowledge that accurately reflects the focus of MSP activities and/or supports necessary analysis (2 MSPs);
    b) ensuring that teachers actively participate in both pre- and post-testing to enable assessment of content knowledge changes (5 MSPs);
    c) obtaining adequate access to teacher content knowledge test results for purposes of evaluation and reporting (1 MSP); and
    d) scheduling pre- and post-tests relative to PD activities (2 MSPs).

    Additionally, four MSPs reported barriers to collecting data through classroom observation. Specifically, one encountered difficulty scheduling classroom visits and ensuring observation of lessons relevant to MSP PD content, while another reported inconsistent implementation of observation practices and protocols. Finally, one MSP had planned to use an already established district-wide observation protocol only to see the protocol changed after its initial use by the MSP.
  - With respect to student achievement, three MSPs expressed frustrations related to CSAP data, particularly the limited availability of science data. Two of these same MSPs also described challenges associated in simply obtaining CSAP data from participating districts.

One of these MSPs also described challenges related to accurately tracking teacher participants' students over the course of the year. Specifically, this MSP reported using both the NWEA and CSAP to test student content knowledge but that the individual students taught by some teacher participants changed during the course of the year. As a result, the group of students tested at pre-test differed from those tested at post-test on the NWEA, and the CSAP scores for an individual teacher's students reflect only some of the students taught by the teacher in that year. Two MSPs also expressed frustration about specific limitations with pre/post test data for students. Specifically, CSU reported struggling with the lack of a pre/posttest aside from the CSAP, and Eagle described challenges associated with the approach used to measure student progress in math, indicating that the use of a pre-existing benchmarking system was less effective than expected. To address this issue in future years, Eagle reported that it is exploring the use of a pre/post assessment in student self-efficacy in the area of mathematics as well as progress monitoring tools that are more aligned with MSP PD activities. Finally, one MSP did not report quantitative student achievement data and reflected an incorrect belief that analysis of student gains would be conducted by CDE.

- Aside from measurement focused specifically on teachers and students, one MSP expressed a unique concern about strategies to measure the quality and impact of collaboration among MSP partners. Specifically, this MSP reported that while it had "used an instrument known as 'Working Together' to examine factors that are established antecedents to positive collaboration, it does not address the impact of the project on the individual partner organizations itself" and it "continues to look for an additional measure in this area and hopes to have a quantitative scale in place for this upcoming year."

- **Evaluation Design**
  - Three MSPs reported challenges related to identifying and/or tracking appropriate comparison teachers over time. One of these MSPs cited the fact that because MSP teacher participants were self-selected, an experimental approach was not possible; as such, this MSP opted to utilize a Recurrent Institutional Cycle Design in an effort to enhance the rigor of evaluation activities. A second MSP described difficulties around engaging comparison teachers in PD activities and obtaining access to comparison teachers' classrooms for purposes of observation. Finally, a third MSP reported that, while they had intended to randomly assign teachers to MSP cohorts, "real-world constraints" prevented strict adherence to this model. Instead, some teachers were allowed to self-select into one cohort or the other and other teachers' contracts with the district were cancelled at the end of the year and, as a result, the district will not be able to continue to gather data from them into the future.

Systemic Challenges

Five of the MSPs (Fort Lewis, Fort Morgan, Southern Colorado, Mesa, and Colorado College) each mentioned challenges that extend beyond the scope of the MSP project, but are likely to have direct bearing on MSP activities and effectiveness. These more systemic challenges can be categorized as follows:

- **Teacher Turnover and Low Morale**
  - Three MSPs (Fort Lewis, Fort Morgan, and Southern Colorado) reported challenges

associated with teacher turnover and attrition at the LEA-level.

- **Lack of Alignment between Teacher and Administrator Philosophies**
  - At Fort Morgan there appeared to be misalignment between the administration and teachers regarding PD and classroom instruction. According to the External Evaluator *"The MSP project brought to light some troublesome elements related to teacher expectations and personal philosophy. The District has taken a position that values direct and explicit instruction while many teachers and professional development providers (including UNC) highly value instruction that is more "discovery" focused. A list of professional development expectations was produced and provided to all professional development providers to make explicit the professional development elements that are consistent with that articulated by the District Improvement Plan."* This same challenge was cited in the previous year's LER from Fort Morgan.
- **Other Systemic Challenges**
  - Two MSPs (Mesa and Fort Lewis) reported the recent implementation of new curriculum or curricular materials. In both cases, these changes appear to have limited the extent to which MSP teacher participants were able to learn from and implement MSP content and practices. However, one of these MSPs (Fort Lewis) indicated that it hired a facilitator to support the implementation of the curricular materials and professional growth among its teachers.
  - Additionally, two MSPs (Fort Morgan and Southern Colorado) described LEA-wide reviews or reorganization efforts and indicated that both hindered MSP effectiveness during the year. In Fort Morgan, one of the two participating LEAs recently underwent a "Comprehensive Appraisal for District Improvement" review, which generated findings believed to be in conflict with MSP activities. Similarly, the Southern Colorado MSP reported that its only LEA partner was engaged in a district reorganization during the course of the year. The only specific barrier reported as a result of this process was the delay of the implementation of a website related to the MSP. However, it seems reasonable to expect that an LEA reorganization may impact MSP in a variety of significant ways.

MSP Teacher Participants

There were 681 teacher participants during 2009-10. MSPs served anywhere from 9 to 172 teachers in a given year, and the Jefferson County MSP had the most teacher participants (n=172). Table 7 presents the number of teacher participants and proportion of all participants from each MSP.

Table 7: 2009-10 MSP Teacher Participants

MSP Name	Total N (%)	
Mesa State	41	(6%)
Weld	48	(7%)
Fort Lewis	117	(17%)
Jefferson County	172	(25%)
DPS (1)	9	(1%)
Fort Morgan	107	(16%)
CSU	34	(5%)
Colorado College	30	(4%)
Southern Colorado	40	(6%)

Table 7: 2009-10 MSP Teacher Participants

MSP Name	Total N (%)	
Eagle	30	(4%)
DPS (2)	53	(8%)
All MSPs	**681**	(100%)

School Districts Represented by MSP Teacher Participants

Table 8 presents the school districts participating in each MSP, as reflected in the 2009-10Participant List. As can be seen below, the number of school districts participating in a single MSP program in 2009-10 varied from 1 to 9.

Table 8: School Districts Participating in MSP Programs 2009-10

MSP Name	Districts (Names and Total #)		
Mesa State	Garfield RE2 MCVSD #51	Montrose RE1J Roaring Fork Re-1	4
Weld	Greeley/Evans 6		1
Fort Lewis	Archuleta Bayfield Cortez Dolores County Durango	Ignacio Mancos Montrose RE1J Norwood	9
Jefferson County	Adams 12 Adams 14 Brighton 27J Elizabeth Englewood	Jefferson County Mapleton St. Vrain Valley SD Weld Re-8-Ft. Lupton	9
DPS (1)	Denver Public Schools		1
Fort Morgan	Fort Morgan School District Re-3	Wiggins School District	2
CSU	Eaton RE2 Greeley/Evans 6	Poudre Windsor RE4	4
Colorado College	Canon City D11 D12	D14 D20 FFC8	6
Southern Colorado	Pueblo 70		1
Eagle	Eagle County School RE50		1
DPS (2)	Denver Public Schools		1

Note: Fort Lewis and Colorado College both had teachers associated with districts that were unspecified.

Math or Science Degree

About one-third of the 2009-10 teacher participants had degrees in math or science. Weld had the

largest proportion (74%) of teacher participants with degrees in math or science. Table 9 presents the number and proportion of teachers with degrees in math or science, overall and by MSP.

Table 9: Teachers with a Degree in Math or Science

MSP Name	Total Number of Teachers	Number of Teachers with Math or Science Degree (%)	
Mesa State	35	16	(46%)
Weld	46	34	(74%)
Fort Lewis	85	24	(28%)
Jefferson County	129	57	(44%)
DPS (1)	9	2	(22%)
Fort Morgan	107	9	(8%)
CSU	30	16	(53%)
Colorado College	23	13	(57%)
Southern Colorado	30	23	(77%)
Eagle	30	6	(20%)
DPS (2)	45	2	(4%)
All MSPs	569	202	(36%)

Teaching Experience

Years of teaching experience was also examined by MSP. Median years of experience, rather than the mean, were calculated because the teaching experience data were positively skewed. Among all 2009-10 MSP teacher participants, the median years of experience was eight. Teachers from Fort Lewis had the greatest median experience, followed by Colorado College and CSU. Table 10 contains descriptive statistics of the teachers' experience, overall and by MSP.

Table 10: Years of Teaching Experience

MSP Name	N	Mean	Standard Deviation	Median	Minimum	Maximum
Mesa State	35	10.7	9.3	7.0	1	35
Weld	46	9.0	9.3	5.5	0	31
Fort Lewis	85	11.9	8.7	12.0	0	42
Jefferson County	129	8.2	5.6	7.0	0	29
DPS (1)	9	4.7	7.2	0.0	0	20
Fort Morgan	107	11.3	9.7	9.0	0	36
CSU	30	12.8	9.4	10.0	1	31
Colorado College	23	11.0	6.7	11.0	2	28
Southern Colorado	30	11.5	7.7	9.5	1	31
Eagle	30	7.6	7.8	4.0	0	25
DPS (2)	45	7.9	7.8	7.0	0	35
All MSPs	569	10.0	8.3	8.0	0	42

MSP Teacher Participants' Students

The demographics of all students taught in 2009-10 by MSP teacher-participants in that year are presented below. As can be seen in Table 11, students taught by 2009-10 MSP teacher participants were about equally likely to be male as female; most likely to be White, followed by Hispanic; and most likely to be in 6th, 7th, or 8th grade. Additionally, half of the students taught were eligible for free or reduced lunch, and 13% had limited or no English proficiency. MSP-specific student demographic information is provided in Appendix B, but general patterns are summarized below:

- ***Gender*** – Students were slightly more likely to be male in most MSPs, with the exceptions of DPS(1), DPS(2), Colorado College, and Southern Colorado.
- ***Ethnicity*** – The largest proportion of students was white (between 58% and 75%) in eight of the eleven MSPs (Mesa, Fort Lewis, Jefferson County, DPS(1), CSU, Colorado College, Southern Colorado, and Eagle). The largest proportion was Hispanic in the three remaining MSPs (Weld (60%), Fort Morgan (50%), and DPS(2) (63%)).
- ***Student Grade*** – The grades of students taught varied among MSPs. The most common grade range was from 3rd to 10th grades, with four MSPs (Fort Lewis, Jefferson County, Fort Morgan, and Eagle) having 2009-10 affiliated students spanning each of these grades.
- ***Free/Reduced Lunch Eligibility*** – The proportion of students eligible for free or reduced lunch varied from 27% (DPS(1)) to 78% (DPS(2)).
- ***English Proficiency*** – In general, MSPs served a large proportion (between 59% and 97%) of students that were English only speakers. The two MSPs serving the largest proportions of students identified as either Not English Proficient or Limited English Proficient were Weld (24%) and DPS(2) (36%).

Table 11: 2009-10 Student Demographics – All MSPs

Demographic Characteristic	Number of Students	(%)
Gender		
Female	16516	(49%)
Male	17186	(51%)
Total	**33702**	(100%)
Ethnicity		
American Indian or Alaska Native	643	(2%)
Asian or Pacific Islander	651	(2%)
Black (non-Hispanic)	1110	(3%)
Hispanic	12665	(38%)
White (non-Hispanic)	18633	(55%)
Total	**33702**	(100%)
Grade		
3rd	520	(2%)
4th	1099	(4%)
5th	2055	(7%)
6th	7189	(24%)
7th	8152	(27%)
8th	6796	(23%)
9th	2182	(7%)
10th	1860	(6%)
Total	**29853**	(100%)
Free/Reduced Lunch Eligibility		
Unreported	4	(0%)
Not Eligible	15028	(50%)
Reduced Lunch Eligible	2647	(9%)
Free Lunch Eligible	12174	(41%)
Total	**29853**	(100%)
English Proficiency		
N/A	22979	(77%)
Not English Proficient	636	(2%)
Limited English Proficient	3320	(11%)
Fluent English Proficient	2917	(10%)
Total	**29852**	(100%)

Note: There were 3,849 students with missing grade data; 3,849 with missing free/reduced lunch eligibility data; and 3,850 with missing English proficiency data.

Section 2: Teacher Content Knowledge & Student Achievement

Evaluation activities in Year 3 examined two key issues with respect to teacher participant content knowledge:

1) Which MSPs had participants that, as a group, demonstrated statistically significant change between content knowledge pre- and posttest in 2009-10?
2) What is the relationship between the *degree* of change between content knowledge pre- and posttests and student achievement? Do students taught by teachers demonstrating relatively large gains between pre- and posttest perform better on CSAP tests in math and/or science than those taught by teachers demonstrating little or no change?

This section first describes MSP assessment efforts, including both content knowledge assessment tools and classroom observation protocols. The balance of the section presents results of analyses to address questions 1 and 2 above.

Teacher Assessment Strategies

Teacher content knowledge assessment tools and classroom observation protocols used by each MSP were identified based upon 2009-10 APR and LER documents. As can be seen in Tables 12 and 13 below, the most frequently employed nationally recognized teacher knowledge test was the Diagnostic Teacher Assessments in Mathematics and Science (DTAMS) (n = 4; Colorado College, Fort Lewis, Mesa State, and Weld). Several MSPs used locally developed tests (n = 4; Fort Morgan, CSU, Jefferson County, and DPS(2)) to assess teacher knowledge. Most of the MSPs reported using observation to assess teacher practice in the classroom (n = 9; Fort Lewis, Fort Morgan, Weld, Southern Colorado, Eagle, Colorado College, CSU, DPS(1), and DPS(2)). Four of these MSPs (Fort Morgan, Weld, CSU, and DPS(1)) used nationally recognized protocols such as the Horizon Classroom Observation Protocol or Oregon Teacher Observation Protocol to assess teachers in the classroom. DPS(2) reported using a modified version of a nationally normed tool.

Table 12: MSP Teacher Assessment Information 2009-10 (Math)

MSP Name	Content Knowledge Assessment	Nationally Normed/ Standardized?	Classroom Observation	Nationally Normed/ Standardized?
Mesa State	DTAMS	Nationally normed and/or standardized tool	None described	N/A
Weld County	DTAMS	Nationally normed and/or standardized tool	Horizon Classroom Observation Protocol	Nationally normed and/or standardized tool
Fort Lewis	DTAMS	Nationally normed and/or standardized tool	Inside the Classroom Observation and Analytic Protocol	Locally developed look based upon California MSP "Getting Ready for Algebra" protocol
Jefferson County	Learning Mathematics for Teaching	Nationally normed and/or standardized tool	None described	N/A
Fort Morgan	Locally developed tool using ETS items	Locally developed test with evidence of validity and reliability	Horizon Classroom Observation Protocol	Nationally normed and/or standardized tool
Southern Colorado	NWEA Math Survey2/Goals 6+ CO V3	Nationally normed and/or standardized tool	Unspecified classroom observation used	Unknown
Eagle	Learning Mathematics for Teaching	Nationally normed and/or standardized tool	Unspecified classroom observation used	Unknown

Table 13: MSP Teacher Assessment Information 2009-10 (Science)

MSP Name	Content Knowledge Assessment	Nationally Normed/ Standardized?	Classroom Observation	Nationally Normed/ Standardized?
Mesa State	DTAMS	Nationally normed and/or standardized tool	None described	N/A
Weld County	DTAMS	Nationally normed and/or standardized tool	Horizon Classroom Observation Protocol	Nationally normed and/or standardized tool
Jefferson County	Instructor-Developed	Locally developed test, not tested for validity and reliability	None described	N/A
DPS (1)	Teacher Efficacy Belief Instrument	Nationally normed and/or standardized tool	Oregon Teacher Observation Protocol	Nationally normed and/or standardized tool
CSU	Select items from: SAT Biology; Graduate Record Exam; and Physical Science MOSART	Locally developed test with evidence of validity and reliability	Horizon Classroom Observation Protocol	Nationally normed and/or standardized tool
Colorado College	DTAMS; Proximal Measure of Earth Science	Nationally normed and/or standardized test; Locally developed test, not tested for validity and reliability	Locally Developed Classroom Observational Protocol	Locally developed tool
DPS(2)	Earth Sciences Teacher Concept Inventory; Life Sciences Teacher Concept Inventory; Physical Sciences Teacher Concept Inventory	Locally developed tools, not tested for validity and reliability	Revised version of the Reformed Teaching Observation Protocol	Modified version of nationally normed and/or standardized tool

Teacher Participant Content Knowledge Test Results

All MSPs assessed teacher content knowledge as a part of their individual MSP evaluation in 2009-10, and about two-thirds of the 2009-10 teacher participants had matching pretest and posttest scores. Further detail regarding teacher content knowledge test data available for each MSP is presented in Appendices A and C.

While information on the content knowledge tests used by each MSP was available in LERs and APRs, the Participant List, which was the data source for teacher content knowledge scores, included the test name for only one MSP (Eagle). As such, it was not possible to definitively identify the specific test associated with teacher-level test scores for most MSPs, and this was a particular issue for those MSPs using multiple content knowledge assessments. Although it is difficult to interpret the test scores without knowing what specific test is reflected by the data, the assumption was made that the same test was given at pretest and posttest within each MSP and year. This assumption allows a comparison between pretest and posttest scores by MSP. As such, descriptive statistics were calculated for all sets of matching pretests and posttests by MSP and subject area (math or science). A paired samples t-test was then conducted to compare pretest and posttest scores within each MSP that had at least 10 teachers with matching pre and posttest scores within a subject area.

Table 14 below presents teacher content knowledge test score descriptive statistics for pretest, posttest, and pre/post change, as well as p values for the pretest and posttest comparisons by MSP and topic area. Statistically significant increases ($p < .05$) in teacher knowledge test scores from pretest to posttest were found for nearly all of the MSPs examined. Specifically, only two MSPs (Weld (science) and CSU) had changes between pre- and posttest that were not statistically significant.

Table 14: 2009-10 Teacher Knowledge Test Score Descriptive Statistics and Statistical Significance of Change, by MSP

MSP Name	Subject Area	N	Pretest				Posttest				Change				Pretest/ Posttest Change t-test p
			Mean	Median	Min.	Max.	Mean	Median	Min.	Max.	Mean	Median	Min.	Max.	
Mesa State	Math	22	16.50	17.00	3.00	26.00	24.36	24.00	10.00	37.00	7.86	6.50	1.00	16.00	.000*
	Science	10	35.80	36.50	19.00	50.00	46.90	49.50	34.00	52.00	11.10	11.50	.00	23.00	.002*
Weld County	Math	23	23.57	24.00	8.00	35.00	26.74	30.00	8.00	38.00	3.17	4.00	-13.00	12.00	.014*
	Science	18	24.61	24.00	14.00	34.00	25.39	25.00	17.00	33.00	.78	1.50	-7.00	8.00	.465
Fort Lewis	Math	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Jefferson County	Math	91	23.52	26.00	5.00	47.00	26.75	31.00	5.00	56.00	3.23	2.00	-14.00	20.00	.000*
	Science	83	13.78	12.00	1.50	34.00	19.22	16.00	6.00	39.00	5.44	4.00	-2.00	20.00	.000*
DPS (1)	Science	7	9.36	8.00	6.00	19.00	21.36	22.00	13.50	28.00	12.00	13.00	5.00	16.50	.000*
Fort Morgan	Math	81	62.85	61.00	27.00	100.00	70.81	73.00	19.00	100.00	7.96	9.00	-21.00	39.00	.000*
CSU	Science	15	35.27	36.00	17.00	48.00	31.73	35.00	11.00	48.00	-3.53	-1.00	-21.00	4.00	.065
Colorado College	Science	20	50.00	50.00	25.00	75.00	70.00	80.00	24.00	100.00	20.00	22.50	-17.00	4.00	.004*
Southern Colorado	Math	28	271.57	274.00	237.00	300.00	275.32	279.50	235.00	314.00	3.75	4.00	-10.00	23.00	.007*
Eagle	Math	29	.41	.15	-.93	2.24	.85	.78	-.68	2.48	.44	.51	-1.39	2.42	.004*
DPS (2)	Science	42	6.94	7.50	1.00	12.50	9.92	10.00	4.50	15.50	2.98	3.00	-2.50	12.50	.000*

*$p<.05$

Three MSPs (Jefferson County, DPS(1), and Eagle) had multiple sets of matched pre/posttest data for some teachers in 2009-10. In fact, Jefferson County reported a third set of matched pre/posttest data for three 2009-10 teachers. Descriptive statistics and findings of statistically significant change between pre- and posttest for second and third tests are provided in Appendix C.

Teacher Participant Content Knowledge Change & Student Achievement

Additional analyses were conducted to explore the relationship between change in teacher content knowledge and student achievement at the MSP-level. Analyses reported in this section focus on the following measures of teacher content knowledge and student achievement:

- Change between pre- and posttest on teacher content knowledge assessments (for math and science separately);
- CSAP math median growth percentile; and/or
- Proportion of students proficient/advanced on science CSAP

A series of exploratory analyses were conducted to assess whether teachers that demonstrated clear gains in content knowledge had students with better achievement outcomes than teachers that demonstrated little to no gains in content knowledge. Four MSPs (Fort Morgan, Jefferson County, Eagle, and DPS(2))with sufficiently large sample sizes and relatively broad distribution of teacher content knowledge change scores were included in the analyses. Teachers from these four MSPs were divided into three groups:

a) Teachers demonstrating either negative or no change between pre- and posttest (little or no change);
b) Teachers demonstrating change greater than 0 but less than one standard deviation above the mean change score; and
c) Teachers demonstrating change of more than one standard deviation above the mean change score (high change).

Student performance on CSAP math or science (matched to the MSP subject area) was then compared between students taught by teachers in groups "a" ("little or no change") and those taught by teachers in group "c" ("high change"). The goal of this strategy was to ensure that we were comparing the students of teachers with clearly different outcomes with regard to teacher content knowledge change. Patterns of student achievement for MSP students, both by MSP and overall, are presented first, followed by results for only students taught by either little/no change and high change teachers (Tables 15-18).

Table 15: Median Growth Percentile Among Students Taught by 2009-10 MSP Teacher Participants

MSP Name	# of 09-10 Teacher Participants with Matched Students	# of Matched MSP Students	MSP Student Median Growth Percentile
Mesa	19	1255	50.0
Weld	28	3206	34.0
Fort Lewis	41	1978	55.5
Jefferson County	43	3023	48.0
Fort Morgan	52	1841	45.0
Southern Colorado	30	2086	38.0
Eagle	20	936	54.0
All MSPs	233	14325	44.0

Note: Teacher counts above reflect only those 2009-10 teachers that could be matched to students with valid median growth percentile data on the 2009-10 CSAP.

Table 16: 2009-10 CSAP Math Median Growth Percentile Among Students Taught by Little/No Change versus High Change MSP Teachers

MSP Name	# of 09-10 Teacher Participants with Pre/Post Scores	Mean Change (Standard Deviation)	Negative/No Change Teachers			High Change Teachers		
			# of Teachers	# of Matched Students	Median Growth Percentile	# of Teachers	# of Matched Students	Median Growth Percentile
Jefferson County	91	3.23 (5.338)	11	808	50.0	5	217	49.0
Eagle	29	.44 (.75)	6	280	43.0	2	86	49.5
Fort Morgan	81	7.96 (13.15)	25	445	44.0	12	169	35.0

Table 17: Proportion of MSP Students Proficient or Advanced on 2009-10

MSP Name	# of 09-10 Teacher Participants with Matched Students	# of Matched Students	% of MSP Students Proficient/ Advanced
Mesa	4	390	46.9%
Weld	7	875	22.9%
Jefferson County	27	1880	53.4%
DPS (1)	6	198	46.0%
CSU	13	621	53.8%
Colorado College	6	479	64.3%
DPS (2)	19	598	14.7%
All MSPs	82	5041	43.8%

Note: Teacher counts above reflect only those 2009-10 teachers that could be matched to students with valid science data on the 2009-10 CSAP.

Table 18: Proportion of Students Proficient or Advanced on 2009-10 Science CSAP Between Little/No Change and High Change MSP Teachers

MSP Name	# of 09-10 Teacher Participants with Pre/Post Scores	Mean Change (Standard Deviation)	Negative/No Change Teachers			High Change Teachers		
			# of Teachers	# of Matched Students	% Proficient/ Advanced	# of Teachers	# of Matched Students	% Proficient/ Advanced
Jefferson County	83	5.44 (4.09)	2	221	67.4%	9	273	74.7%
DPS(2)	42	2.98 (2.91)	5	66	18.2%	4	68	7.35%

As can be seen in Tables 16 and 18 above, for two MSPs (one in each subject area; Eagle and Jefferson County), the students taught by "high change" teachers performed better on CSAP than did those students taught by "little or no change" teachers. However, for two MSPs, students taught by "little or no change" teachers performed better than those taught by "high change" teachers. It is important to note that sample sizes for teachers in each analysis group were very small and, as such, results are difficult to interpret and should be considered preliminary.

Section 3: Years of Teacher MSP Participation & Student Achievement

Evaluation activities also explored the relationship between the number of years of MSP participation and student achievement. Specifically, analyses were conducted to assess whether achievement among students taught by teachers with only one year of MSP exposure differed from that of teachers with multiple years. Additional analyses were also conducted to examine any differences in student achievement among MSP teachers with different patterns of participation. Specifically, student achievement data were analyzed to identify differences among teachers in the following groups:

- Single Year vs. Multiple Years – Comparing teachers with one year of MSP exposure to those with either two or three years of exposure *(two groups)*;
- One vs. Two vs. Three Years – Comparing teachers with one year of MSP exposure to those with two years and those with three years *(three groups)*;
- Timing of Exposure:
    - One Year of Participation – Comparing only those teachers with one year of MSP exposure, but varying the timing of that year; *(three groups)*; and
    - Two Years of Participation – Comparing only those teachers with two years of MSP exposure, but varying the timing of those years (consecutive vs. divided) *(three groups)*.

Results in this section are presented first for MSPs providing math PD and then for those providing science PD. Throughout this section, statistical analyses are presented only when both of the following criteria were met:

- An MSP had teachers present in each of the sub-groups described; and
- Teachers in each sub-group could also be matched to at least 20 students with CSAP data in the relevant subject (either math or science).

It is important to note that, in the interest of maximizing the available data, analyses were conducted based on the sample size of students rather than teachers. Because MSP interventions occur at the teacher-level, limited teacher sample sizes in many instances made it difficult to draw meaningful conclusions from the data. This was particularly true for those analyses focused on specific patterns of multiple year participation.

Teacher Participation in Math MSP PD

A Mann Whitney U test was conducted to compare math growth percentiles among students taught by single-year MSP teachers to those taught by MSP teachers with multiple years of participation. Table 19 below presents the median growth percentile scores for students taught by single and multiple-year teachers by MSP. Five of the six MSPs with teachers in both groups demonstrated statistically significant differences. Specifically, student median growth percentile scores for four MSPs were higher for multiple-year vs. single-year teachers. However, in Mesa, students taught by single-year teacher participants scored higher than those students taught by multiple-year teachers.

Table 19: Single- and Multiple-Year Teachers' Student CSAP Math Median Growth Percentile in 2009-10, by MSP

MSP Name	Single-Year Teachers			Multiple-Year Teachers			Statistical Significance
	Number of Teachers	Median Growth Percentile (Number of Students)		Number of Teachers	Median Growth Percentile (Number of Students)		
Mesa	24	55.0	(1618)	7	48.0	(355)	.018*
Weld	13	32.0	(1349)	17	37.0	(2028)	.000*
Fort Lewis	12	49.0	(546)	34	57.0	(1668)	.008*
Jefferson County	9	40.0	(420)	38	49.0	(2603)	.000*
Fort Morgan	10	40.0	(509)	43	45.5	(1342)	.006*
Southern Colorado	15	39.0	(894)	15	37.0	(1192)	.660
Eagle	20	54.0	(936)	0	n/a	n/a	n/a

*$p<.05$

The multiple-year teacher group from above was further divided into those teachers with two years or three years of participation. A Kruskal-Wallis test was conducted to compare the distribution of student median growth percentile scores among students taught by single-year, two-year, or three-year teacher participants. Student achievement data were available for teachers in each of the three groups for only three MSPs (Weld, Fort Lewis, and Fort Morgan). All three MSPs demonstrated statistically significant differences among the three groups (Table 20 below).

To explore the source of these overall differences, a series of Mann-Whitney U tests were conducted comparing mean ranks of student growth percentiles between groups within each of the MSPs. The results of these significance tests are reported using the letters 'a', 'b', and 'c', with 'a' denoting higher mean rank than 'b,' and 'b' denoting a higher mean rank than 'c,' as shown in Table 18. The ranking of median growth percentiles with no annotation were not statistically different from any other group within the MSP; the ranking of median growth percentiles with the same annotation (e.g., both 'a') are not statistically different from each other. For example, in the case of Fort Morgan, students taught by three-year teachers had significantly higher growth percentile rankings than those students taught by either one-year or two-year teachers, and there was no significant difference in growth percentile rankings among students taught by one-year or two-year teacher participants.

Table 20: One-, Two-, and Three-Year MSP Teachers' Student CSAP Math Median Growth Percentile in 2009-10, by MSP

MSP Name	One-Year Teachers			Two-Year Teachers			Three-Year Teachers			Statistical Significance
	Number of Teachers	Median Growth Percentile (Number of Students)		Number of Teachers	Median Growth Percentile (Number of Students)		Number of Teachers	Median Growth Percentile (Number of Students)		
Mesa	24	55.0	(1618)	7	48.0	(355)	0	n/a	n/a	n/a
Weld	13	32.0c	(1349)	5	40.0a	(531)	12	35.0b	(1497)	.000*
Fort Lewis	12	49.0b	(546)	27	57.0a	(1340)	7	53.0	(328)	.016*
Jefferson County	9	40.0	(420)	38	49.0	(2603)	0	n/a	n/a	n/a
Fort Morgan	10	40.0b	(509)	11	43.0b	(333)	32	47.0a	(1009)	.003*
Southern Colorado	15	39.0	(894)	15	37.0	(1192)	0	n/a	n/a	n/a
Eagle	20	54.0	(936)	0	n/a	n/a	0	n/a	n/a	n/a

*$p<.05$

Next, teacher participants with only one year of MSP participation were divided into three groups based on the specific year in which they participated (i.e., 2007-08, 2008-09, or 2009-10). Only two MSPs had student achievement data available for teacher participants in each of the three groups. Of these two MSPs, only one (Mesa) showed a statistically significant difference in student median growth percentile among these groups (Table 21).

Table 21: One-Year Teachers' Student CSAP Math Median Growth Percentile in 2009-10, by MSP

MSP Name	2007-08 Only Teachers			2008-09 Only Teachers			2009-10 Only Teachers			Statistical Significance
	Number of Teachers	Median Growth Percentile (Number of Students)		Number of Teachers	Median Growth Percentile (Number of Students)		Number of Teachers	Median Growth Percentile (Number of Students)		
Mesa	5	59.0a	(345)	5	59.0a	(298)	14	52.0b	(975)	.001*
Weld	0	n/a	n/a	0	n/a	n/a	13	32.0	(1349)	n/a
Fort Lewis	2	46.0	(48)	1	40.0	(42)	9	51.0	(456)	.384
Jefferson County	0	n/a	n/a	0	n/a	n/a	9	40.0	(420)	n/a
Fort Morgan	0	n/a	n/a	0	n/a	n/a	10	40.0	(509)	n/a
Southern Colorado	0	n/a	n/a	0	n/a	n/a	15	39.0	(894)	n/a
Eagle	0	n/a	n/a	0	n/a	n/a	20	54.0	(936)	n/a

*$p<.05$

As described above, a series of Mann-Whitney U tests were conducted for this MSP to explore the source of these overall differences. In Mesa, the median growth percentile ranking among students taught by teachers

that participated either in only the 2007-08 year or only the 2008-09 year was higher than among students taught by teachers that participated in only the 2009-10 year (i.e., 2007-08>2009-10 and 2008-09>2009-10). Finally, teachers with two years of MSP participation were divided into three groups, according to the pattern of years (either consecutive or divided). Two MSPs had student achievement data available for students taught by teachers in all three groups. Of these, only one (Mesa) demonstrated statistically significant differences in student achievement overall (see Table 22).

Table 22: Two-Year Teachers' Student CSAP Math Median Growth Percentile in 2009-10, by MSP

MSP Name	2007-08 & 2008-09 Teachers			2007-08 & 2009-10 Teachers			2008-09 & 2009-10 Teachers			Statistical Significance
	Number of Teachers	Median Growth Percentile (Number of Students)		Number of Teachers	Median Growth Percentile (Number of Students)		Number of Teachers	Median Growth Percentile (Number of Students)		
Mesa	1	60.0a	(75)	1	62.0	(23)	5	43.0b	(257)	.003*
Weld	1	36.0	(171)	0	n/a	n/a	4	57.0	(360)	n/a
Fort Lewis	2	53.0	(146)	11	60.0	(474)	14	49.0	(720)	.138
Jefferson County	0	n/a	n/a	0	n/a	n/a	38	49.0	(2603)	n/a
Fort Morgan	1	--	--	2	55.5	(52)	8	41.0	(271)	--
Southern Colorado	0	n/a	n/a	0	n/a	n/a	15	37.0	(1192)	n/a

*$p<.05$

Again, a series of Mann-Whitney U tests were conducted for this MSP to assess the source of these overall differences. These analyses indicated that only one pair of teacher groups demonstrated statistically significant levels of student achievement. Specifically, the median growth percentile ranking among students taught by teachers with two consecutive years of participation in 2007-08 and 2008-09 was higher than among students taught by teachers with two consecutive years of participation in 2008-09 and 2009-10 (i.e., 2007-08 & 2008-09>2008-09 & 2009-10).

Teacher Participation in Science MSP PD

A Pearson's chi-square test was conducted to compare the proportion of students proficient or advanced on the science CSAP among students taught by single-year MSP teachers, to those taught by MSP teachers with multiple years of participation. Jefferson County was the only MSP demonstrating statistically significant differences between the groups, with 55% of students taught by multiple-year teachers testing proficient/advanced, as compared to 46% of students taught by one-year teachers. (Table 23)

Table 23: Proportions of Single- and Multiple-Year Teachers' Students Proficient or Advanced on Science CSAP in 2009-10, by MSP

MSP Name	Single-Year Teachers			Multiple-Year Teachers			Statistical Significance
	Number of Teachers	Proportion Proficient/ Advanced (Number of Students)		Number of Teachers	Proportion Proficient/ Advanced (Number of Students)		
Mesa	8	45%	(644)	1	48%	(119)	.585
Weld	2	24%	(219)	5	22%	(656)	.584
Jefferson County	7	46%	(276)	20	55%	(1604)	.011*
DPS(1)	12	36%	(643)	0	n/a	n/a	n/a
CSU	5	53%	(257)	10	56%	(556)	.514
Colorado College	3	63%	(167)	4	63%	(369)	.894
DPS(2)	19	15%	(598)	0	n/a	n/a	n/a

*$p<.05$

As with math, multiple-year teachers were divided between those with two years of participation and those with three. The results of these analyses are presented in Table 24 below. Only two MSPs (Weld and CSU) had teachers in each of the three groups that could be matched to students with science CSAP data. Neither of these MSPs demonstrated statistically significant differences among the three groups.

Table 24: Proportions of One-, Two-, and Three-Year MSP Teachers' Students Proficient or Advanced on Science CSAP in 2009-10, by MSP

MSP Name	One-Year Teachers			Two-Year Teachers			Three-Year Teachers			Statistical Significance
	Number of Teachers	Proportion Proficient/ Advanced (Number of Students)		Number of Teachers	Proportion Proficient/ Advanced (Number of Students)		Number of Teachers	Proportion Proficient/ Advanced (Number of Students)		
Mesa	8	45%	(644)	1	48%	(119)	0	n/a	n/a	n/a
Weld	2	24%	(219)	1	24%	(139)	4	22%	(517)	.698
Jefferson County	7	46%	(276)	20	55%	(1604)	0	n/a	n/a	n/a
DPS(1)	12	36%	(643)	0	n/a	n/a	0	n/a	n/a	n/a
CSU	5	53%	(257)	6	60%	(319)	4	50%	(237)	.062
Colorado College	3	63%	(167)	4	63%	(369)	0	n/a	n/a	n/a
DPS(2)	19	15%	(598)	0	n/a	n/a	0	n/a	n/a	n/a

Next, teachers with one year of MSP participation were grouped based on the specific year of participation (i.e., 2007-08, 2008-09, or 2009-10). Only one MSP (DPS(1)) had teachers in each group that could be matched to students with science CSAP data. DPS(1) demonstrated a statistically significant difference in the proportion of students proficient/advanced among the three groups, with students taught by 2009-10 teacher participants being more likely to be proficient/advanced than students in other groups.

Table 25: Proportions of One-Year Teachers' Students Proficient or Advanced on Science CSAP in 2009-10, by MSP

MSP Name	2007-08 Only Teachers			2008-09 Only Teachers			2009-10 Only Teachers			Statistical Significance
	Number of Teachers	Proportion Proficient/ Advanced (Number of Students)		Number of Teachers	Proportion Proficient/ Advanced (Number of Students)		Number of Teachers	Proportion Proficient/ Advanced (Number of Students)		
Mesa	0	n/a	n/a	4	43%	(254)	4	47%	(390)	n/a
Weld	0	n/a	n/a	0	n/a	n/a	2	24%	(219)	n/a
Jefferson County	0	n/a	n/a	0	n/a	n/a	7	46%	(276)	n/a
DPS(1)	3	35%	(333)	3	20%	(112)	6	46%	(198)	.000*
CSU	1	--	--	1	55%	(173)	2	37%	(65)	--
Colorado College	0	n/a	n/a	1	53%	(57)	2	15%	(110)	n/a
DPS(2)	0	n/a	n/a	0	n/a	n/a	19	15%	(598)	n/a

*$p<.05$

Finally, student achievement was examined among science students taught by MSP teachers with two years of participation (i.e., teachers that participated in 07-08 and 08-09; 07-08 and 09-10; or 08-09 and 09-10). None of the seven MSPs offering science professional development had teachers in each of the three groups. As a result, no statistical analyses were conducted.

Section 4: Teacher Effectiveness Over Time (Changes in Achievement of Cohorts of Students Taught by the Same Teacher)

A final set of analyses were conducted to examine achievement among cohorts of students taught by MSP teacher participants over time. Findings presented below explore the CSAP performance of students taught by MSP teacher participants from the 2007-08 and 2008-09 years. Throughout this discussion, it is critical to note that it is the *teacher* that remained constant across years, while the group of students taught by each teacher varied from one year to the next. That is, if a teacher participated in an MSP in the 2008-09 year, the student achievement results reflect the performance of one group of students that the teacher taught in 2008-09 and a second group of students that the teacher taught in 2009-10.

There were insufficient data available on the 2007-08 MSP teacher participants to support in depth analysis. Data on 2008-09 MSP teacher participants were significantly more complete. Tables 26 and 27 compare MSP-level data on student performance between students taught by 2008-09 teacher participants in two separate years. For math MSPs, a Mann-Whitney U test was conducted for each MSP to assess the statistical significance of differences in performance between years. As is shown in Table 26 below, three MSPs (Weld, Fort Lewis, and Fort Morgan) showed a statistically significant difference in median growth percentile rankings between students taught in 2008-09 and those taught in 2009-10. For two of these MSPs (Weld and Fort Morgan), 2009-10 students had a higher median growth percentile ranking than did students from the previous year.

Table 26: 2008-09 MSP Teacher Participants' Students' CSAP Math Median Growth Percentile, by MSP and Year

MSP Name	# of 08-09 Teacher Participants on 2009-10 PL	Student Median Growth Percentile (# of Students)		Statistical Significance
		08-09	***09-10***	
Mesa	20	49.0 (696)	53.0 (630)	0.051
Weld	22	30.0 (537)	37.0 (2028)	0.000*
Fort Lewis	94	60.0 (821)	55.0 (1236)	0.000*
Jefferson County	71	47.0 (2235)	49.0 (2603)	0.819
Fort Morgan	112	37.0 (212)	45.0 (1290)	0.002*
Southern Colorado	28	37.0 (665)	37.0 (1192)	0.763

**p<.05; Note: Cohorts of students differ across years.*

Table 27 presents the proportion and counts of students taught by teacher participants receiving MSP science PD in 2008-09 that were either proficient or advanced on the science CSAP in either 2008-09 or 2009-10. Proportions and counts are presented both for all students in the respective MSP and year, as well as by grade. For purposes of comparison, Table 27 also presents the proportion of students proficient/advanced on the science CSAP in each year, both overall and by grade. Pearson's chi-square tests were conducted to compare the proportion of all MSP students proficient or advanced on the science CSAP among students taught in 2008-09 versus those taught in 2009-10. As is shown, two MSPs (Weld and Colorado College) demonstrated statistically significant differences in the proportion of students proficient/advanced between the two years. For both MSPs, a larger proportion of 2009-10 students were proficient/advanced than were 2008-09 students.

Table 27: Proportion of 2008-09 MSP Teacher Participants' Students Proficient of Advanced on Science, by MSP and Year

MSP Name	# of 08-09 Teacher Participants on 2009-10 PL	Student Grades	% Students Proficient/Advanced (# of Students)		Statistical Significance (all grades)
			08-09	***09-10***	
Mesa	14	***All Students***	***45.8% (273)***	***44.2% (373)***	***0.695***
		5th Grade	None	55.0% (20)	
		8th Grade	49.6% (230)	44.0% (343)	
		10th Grade	25.6% (43)	30.0% (10)	
Weld	22	***All Students***	***15.2% (178)***	***22.4% (656)***	***0.035****
		5th Grade	None	None	
		8th Grade	15.2% (178)	22.4% (656)	
		10th Grade	None	None	
Jefferson County	66	***All Students***	***58.1% (1333)***	***54.6% (1604)***	***0.055***
		5th Grade	48.1% (108)	58.6% (174)	
		8th Grade	59.3% (886)	52.8% (1018)	
		10th Grade	58.4% (339)	57.3% (412)	
DPS (1)	6	***All Students***	***17.5% (126)***	***19.6% (112)***	***0.665***
		5th Grade	None	None	
		8th Grade	None	None	
		10th Grade	17.5% (126)	19.6% (112)	
CSU	22	***All Students***	***58.9% (504)***	***55.6% (729)***	***0.240***
		5th Grade	23.3% (86)	39.7% (121)	
		8th Grade	66.3% (418)	58.9% (604)	
		10th Grade	None	25% (4)	
Colorado College	15	***All Students***	***52.5% (316)***	***61.5%(426)***	***0.014****
		5th Grade	None	None	
		8th Grade	52.5% (316)	61.5% (426)	
		10th Grade	None	None	
Statewide		***All Students***	***47.8% (174,041)***	***47.3% (175,481)***	n/a
Statewide		5th Grade	44.8% (59,010)	46.7% (60,247)	
Statewide		8th Grade	48.9% (57,558)	48.5% (57,970)	
Statewide		10th Grade	49.8% (57,473)	46.9% (57,264)	

**p<.05; Note: Cohorts of students differ across years.*

Conclusions and Future Direction

The current data collected for the evaluation of the MSP program presents several challenges. The following key limitations should be considered when interpreting the findings of this exploratory evaluation. First, the "nested" structure of the MSPs was not reflected in the analyses conducted. This is significant because analyses of links between teacher characteristics and student achievement did not model variation at both the teacher and student level. Ignoring this variation often results in biased estimates. Second, the sample sizes across groups differed widely for many of the teacher participant and student achievement data analyses, which can impact the results. Moreover, in some instances the number of teachers reflected in the student level analyses was very small. Third, multiple statistical tests were conducted on the outcome variables, which can result in obtaining significant findings by chance. Fourth, confounding variables for the MSP teacher participants and their students, such as school district characteristics, teacher characteristics, and student characteristics (e.g., socio-economic status) were not considered in the analyses. Finally, missing data may also have influenced the findings.

Despite these evaluation challenges, several findings surfaced across the qualitative and quantitative analyses regarding the MSP impact on teachers, students and learning environments. This section summarizes these findings and suggests opportunities to enhance MSP evaluation efforts. The implications of identified limitations for each question are described along with the summary of findings, as appropriate.

MSP Descriptive Information

MSP Programs

Two MSPs offered a Summer Institute Only. Four partnerships offered Summer Institutes with additional or follow-up activities. The remaining five partnerships provided activities that did not fit into either of these two categories. Four MSPs focused only on math, four only on science, and three addressed both subjects.

MSP Program Successes and Challenges

MSPs described a range of successes and challenges experienced during the 2009-10 academic year. Successes described by MSPs fell into the following nine categories:

- Teachers incorporating/expanding use of key pedagogical techniques (9 MSPs);
- Increased teacher enthusiasm (4 MSPs);
- Increased teacher confidence (9 MSPs);
- Enhanced use/understanding of data (2 MSPs);
- Increased teacher content knowledge (11 MSPs);
- Increased collaboration/networking (11 MSPs);
- Increased teacher leadership (2 MSPs);
- Increased/strong teacher participation (5 MSPs); and
- Improved data collection/evaluation (5 MSPs).

Challenges generally fell into three broad categories:

1) Implementation challenges – those challenges associated with the design/implementation of PD activities:
   - Lack of time/scheduling conflicts (4 MSPs);
   - Rural geographic setting (2 MSPs);
   - Lack of teacher participation/engagement (3 MSPs);
   - Lack of LEA administrator support (1 MSP);
   - Limited engagement/cooperation among MSP partners (2 MSPs);
   - Concerns about MSP impact on teacher/student knowledge or practice (5 MSPs); and
   - Other implementation challenges (2 MSPs).

2) Evaluation challenges – those challenges associated with measurement, data collection, and/or evaluation design:
   - Measurement and data collection (10 MSPs); and
   - Evaluation design (3 MSPs).

3) Systemic challenges – those challenges that exist outside of the MSP but appear to have relatively direct bearing on MSP goals and activities:
   - Teacher turnover and low morale (3 MSPs);
   - Lack of alignment between teacher and administrator philosophies (1 MSP); and
   - Other systemic challenges (4 MSPs).

MSP Teacher Participants

Select demographic characteristics of 2009-10 MSP teacher participants were examined. Key findings include:

- There were 681 teacher participants during 2009-10. MSPs served anywhere from 9 to 172 teachers in a given year, and the Jefferson County MSP had the most teacher participants (n=172).
- The number of school districts participating in a single MSP program in 2009-10 varied from 1 to 9.
- About one-third of the 2009-10 teacher participants had degrees in math or science. Weld had the largest proportion (71%) of teacher participants with degrees in math or science.
- Among all 2009-10 MSP teacher participants, the median years of teaching experience was 8. Teachers from Fort Lewis had the greatest median experience, followed by Colorado College and CSU.

MSP Teacher Participants' Students

Overall, students taught by 2009-10 MSP teacher participants were about equally likely to be male as female; more likely to be White, followed by Hispanic; and most likely to be in 6th, 7th, or 8th grade. Additionally, half of the students taught were eligible for free or reduced lunch, and 13% had limited or no English proficiency.

Teacher Content Knowledge & Student Achievement

Teacher content knowledge tests used varied across MSPs. However, using paired t-tests comparing teacher pre- and posttest scores, nearly all MSPs demonstrated statistically significant increases ($p < .05$) in teacher knowledge test; only two MSPs (Weld (science) and CSU) had changes between pre- and posttest that were

not statistically significant. These findings indicate that most MSPs have had a positive impact on teachers' content knowledge.

A series of preliminary analyses were conducted with the four MSPs with sufficiently large sample sizes to begin to assess the relationship between the *amount* of change between pre- and posttest for teachers and the achievement of their students. No clear pattern emerged from these analyses.

Years of Teacher MSP Participation & Student Achievement

Analyses were conducted to assess differences in student achievement among students taught by teachers in four groupings, based on both the number and pattern of years of MSP participation. All analyses were conducted separately for teachers receiving math PD and those receiving science.

Key findings for math teachers include:

- Single Year vs. Multiple Years – Comparing teachers with one year of MSP exposure to those with either two or three years of exposure *(two groups)*;
- One vs. Two vs. Three Years – Comparing teachers with one year of MSP exposure to those with two years and those with three years *(three groups)*;
- Timing of Exposure:
    - One Year of Participation – Comparing only those teachers with one year of MSP exposure, but varying the timing of that year; *(three groups)*; and
    - Two Years of Participation – Comparing only those teachers with two years of MSP exposure, but varying the timing of those years (consecutive vs. divided) *(three groups)*.

Together, these findings indicate that there may be reason to believe that multiple years of math MSP participation may have a positive impact on student achievement. However, additional analysis is needed to better understand the specific dimensions of this relationship. For example, what are the factors that lead teachers to participate in multiple years of an MSP (e.g., were more experienced teachers more likely to participate in multiple years than less experienced teachers)? And, how might those same factors influence student achievement?

For science, few statistically significant differences among groups were observed. Lack of significant findings may simply be the result of smaller samples sizes, as the science CSAP, which was the measure of student achievement for science MSPs, is only administered to students in the 5th, 8th, and 10th grades.

Teacher Effectiveness Over Time (Changes in Achievement of Cohorts of Students Taught by the Same Teacher)

A final set of analyses were conducted examining whether teachers became more effective over time as evidenced by higher student achievement among cohorts of their students from one year to the next. These analyses explored the CSAP performance of students taught by MSP teacher participants from the 2007-08 and 2008-09 years. Sufficient data were available only for 2008-09 teacher participants. Key findings include:

- ***For math teachers*** – Three MSPs showed a statistically significant difference in median growth percentile rankings between students taught in 2008-09 and those taught in 2009-10. For two of these MSPs, 2009-10 students had a higher median growth percentile ranking than did students from the previous year.
- ***For science teachers –*** Two MSPs (Weld and Colorado College) demonstrated statistically

significant differences in the proportion of students proficient/advanced between the two years. For both MSPs, a larger proportion of 2009-10 students were proficient/advanced than were 2008-09 students.

The implications of these findings are unclear. While the data available do indicate that teacher participants from some MSPs may have had an increasingly positive impact on student achievement from one year to the next, it is unclear whether student achievement results from only two years are part of a larger, long-term trend, or simply reflect normal variation among years. Furthermore, the extent to which the characteristics of students taught by MSP participants vary from year to year is unknown. On this last point, further analysis is needed to explore whether student characteristics do vary significantly from one year to the next, and, if they do, whether these variations appear related to student achievement.

Evaluation Next Steps

Based on findings from this year, evaluation activities in the future could include the following:

- Analysis of changes in pedagogical practice and their relationship with student achievement, to the extent that MSPs collect and report quantitative teacher observation results;
- Continued tracking of student achievement among students taught by 2008-09 teacher participants to enable analysis of trends in student achievement over time ;
- Identification and study of a select number of MSPs that appear to have implemented promising, innovative, and/or unique approaches to examine the specific strategies and practices being used by these MSPs; and
- Consider the use of Hierarchical Linear Modeling in future years to address the nested structure of the MSP program.

Appendix A: Detailed Information on Data Sources and Cleaning

Quantitative Data Cleaning and Preparation

The following steps were taken to clean and prepare the 2009-10 data for analysis:

Step 1: Cleaning of Teacher Participant List

First, the Participant List of teachers who attended an MSP during the 2007-08, 2008-09, or 2009-10 years was cleaned and reformatted. Before cleaning there were 994 raw records in the Participant List. Of these, eight cases had missing Teacher Unique Identification Numbers (TUIDs) and were, therefore, removed from further analyses. The data file was then cleaned of duplicate entries, so that teachers were uniquely represented within the file. Once all duplicate cases had been resolved, the file contained 910 unique TUIDs. Teacher MSP participation was then determined based on the presence of subject area data for the respective year (i.e., only teachers with subject area data for 2009-10 were considered active teachers in that year). Any teacher with a row of data but missing subject area for a particular year was excluded from the count for that year (e.g., a teacher with subject area data for 2007-08 and 2008-09 but not for 2009-10 would be counted as a participant for the first two years, but not the third). Before excluding cases, a list of teachers included in the Participant List but lacking a subject area in any of the three years was submitted to CDE and additional subject area and year information was provided for some of these teachers as follows: six teachers in 2007-08; six in 2008-09 and two in 2009-10. Additionally, four MSPs (Weld, Jefferson County, DPS(1), and Fort Morgan) had no teachers identified as having been 2008-09 participants, and DPS(1) also had no teachers identified as participating in the 2007-08 year, though teachers were present on the previous year's Participant List for each of these MSPs. For all teachers from these MSPs that were present on both the Year 2 and Year 3 Participant Lists, subject area (math or science) information was integrated into the Year 3 dataset to ensure that they were included in the 2007-08 or 2008-09 cohorts, as appropriate. Ultimately, 39 teachers from the Participant List were excluded from further analysis due to having no subject area identified for any of the three years examined. Based on this process, a total of 871 unique teachers were identified for inclusion in further analysis. Of these 871 teachers, 268 participated in 2007-08, 480 participated in 2008-09, and 681 participated in 2009-10. Additionally, 305 teachers participated in multiple years (123 of whom participated in all three years). Table 2 provides the final count of teachers by year of participation.

Table A.1: Count of Teachers Participating in MSP from 2007-08 through 2009-10

	Cohort Presence - Overall			
	09-10	**08-09**	**07-08**	**N**
	✓			421
	✓	✓		106
	✓		✓	31
	✓	✓	✓	123
		✓		75
		✓	✓	45
			✓	69
N	**681**	**480**	**268**	**871**

Two new variables (one for math and one for science) were then created to designate the specific subject area of PD. All subject areas provided for a teacher were assigned to one of these two categories, and no teachers were removed due to non-math or -science subject area designations. Summaries were then run to compute

the number of teachers receiving either math or science PD, as well as the number of teachers that had both math and science PD, across all years of participation. Of note, 16 teachers were identified as having received both math and science PD at some point during the three years examined. Teacher presence by subject is summarized in Tables A.2 and A.3 below.

Table A.2 & Table A.3: **Count of Teachers Participating in MSP from 2007-08 through 2009-10, by Subject Area**

Cohort Presence - Science				
	09-10	08-09	07-08	N
	✓			128
	✓	✓		91
	✓		✓	1
	✓	✓	✓	28
		✓		23
		✓	✓	3
			✓	16
N	**248**	**145**	**48**	**290**

Cohort Presence - Math				
	09-10	08-09	07-08	N
	✓			167
	✓	✓		154
	✓		✓	30
	✓	✓	✓	97
		✓		53
		✓	✓	43
			✓	53
N	**448**	**347**	**223**	**597**

Note: Sixteen teachers were categorized as receiving PD in both math and science. As such, these teachers appear in both Table A.2 and A.3 above.

Next, teacher content knowledge scores were formatted and cleaned of any non-numeric data and then further exploration was conducted to assess the extent to which matching pretest and posttest data were available for 2009-10 teachers on the Participant List. Matching pre/post data refers to teachers that had valid (non-missing) data on both their pretest and posttest. Thirty-four teachers, from three MSPs (CSU, Southern Colorado, and Eagle) had either pre or posttest values of exactly zero. Each of the 34 TUIDs were provided to CDE for review. CDE provided missing test data for two of the teacher from Eagle; for the remaining 32 teachers, all zero values were identified as invalid and, therefore, labeled as missing data. Table A.4 below presents the total number of 2009-10 teachers, as well as the number and proportion for which matching pre/posttest data were available, by MSP. Of note, one of the larger MSPs (Fort Lewis) had no available matching pre/posttest data for any of its 2009-10 teachers. Overall, matching pre/posttest data were available for 461 (67.7%) of the 681 2009-10 teachers on the Participant List. With Fort Lewis excluded from this calculation, 81.7% of the participating 2009-10 teachers had matching pre/posttest data. Further details are provided in Table A.4 below.

Table A.4: 2009-10 Teacher Participants with One Set of Matching Pre/Post Content Knowledge Test Data

MSP Name	Total N	Matching Pre/Posttest Data	
		N	Percent
Mesa State	41	32	78.0%
Weld	48	40	83.3%
Fort Lewis	117	0	0.0%

MSP Name	Total N	Matching Pre/Posttest Data	
		N	Percent
Jefferson County	172	167	97.1%
DPS (1)	9	7	77.8%
Fort Morgan	107	81	75.7%
CSU	34	15	44.1%
Colorado College	30	20	66.7%
Southern Colorado	40	28	70.0%
Eagle	30	29	96.7%
DPS (2)	53	42	79.2%
Total	**681**	**461**	**67.7%**

Finally, teachers from three MSPs had multiple complete sets of pre/posttest data for 2009-10. Analysis of teacher content knowledge presented in Section Two used only the first set of pre/posttest data for these teachers. Second and third sets of pre/post test data were analyzed separately for only these MSPs. Tables A.5 and A.6 present the MSPs that reported 2009-10 teachers with either two or three sets of pre/posttest data in that year.

Table A.5: 2009-10 Teacher Participants with a Second Set of Matching Pre/Post Content Knowledge Test Data

MSP Name	Total N	Matching Pre/Posttest Data	
		N	Percent
DPS (1)	9	7	77.8%
Eagle	30	29	96.7%
Jefferson County	172	21	12.2%
Total	**211**	**57**	**27.0%**

Table A.6: 2009-10 Teacher Participants with a Third Set of Matching Pre/Post Content Knowledge Test Data

MSP Name	Total N	Matching Pre/Posttest Data	
		N	Percent
Jefferson County	172	3	1.7%
Total	**172**	**3**	**1.7%**

Step 2: Cleaning of HR/ADE Data

Second, HR/ADE teacher data, as well as data for students taught by these teachers over the same time period, were cleaned and reformatted. The initial HR/ADE file submitted by CDE contained 749 lines of teacher data. Teacher data were first examined to identify duplicate records (i.e., teachers with multiple lines

of data in the file). When duplicate cases were identified, information across duplicates was compared for consistency. No single teacher had two (or more) rows of identical information. However, 39 teachers had data on multiple rows that could be combined to create one complete row of data for each of the 39 teachers. After cleaning, 709 unique teachers across all three years were present in the HR/ADE dataset.

Next, the Student ADE data file was cleaned. There were initially 581 unique teachers present in the student ADE file. Fourteen students were identified as having missing student identification numbers (SUIDs) and were excluded from further analysis. No teachers were removed from the data file as a result.

Step 3: Merging of Teacher Participant List with HR/ADE Data

Third, the cleaned Participant List file was merged with the 2009-10 HR/ADE data, which was then cleaned and reformatted further. Immediately after this merge, 569 of the 2009-10 teacher participants were matched between the files. Teacher demographic analyses presented in Section 1 of this report include these 569 teachers. In an effort to maximize sample sizes available for later analyses, all teachers from the cleaned Participant List (n=871) remained in the data file, regardless of whether or not they had matched HR/ADE data.

Step 4: Merging of Teacher Data with Student ADE Data

Fourth, the merged HR/ADE and Participant List teacher data were matched with student ADE data. Student ADE data included records from only the 2009-10 academic year, regardless of the year in which that student's teacher participated in an MSP. The initial student HR/ADE data file contained 581 unique TUIDs. Students were matched with teachers based on teacher and student ID numbers, and duplicate teacher-student pairs were removed from the file.[2] A total of 525 (60.2%) teachers matched between the Participant List and the student file across all cohorts (480 in 2009-10, 303 in 2008-09, and 149 in 2007-08). The 525 teachers that matched to students were then examined to identify instances in which the teacher subject area differed from the student subject area[3]. There were 1,674 students, taught by 26 teachers, who did not have matching subject areas (1,052 math students with science teachers; 622 science students with math teachers). Cases in which the teacher and student subject areas *did not* match were removed from the dataset and not included in further analyses. Nearly all, 517 (98.5%), of the 525 participating teachers with students in the student ADE data file also had students with the same designated subject area in 2009-10. Table A.7 below presents the breakdown of teachers with student data, by cohort year.

[2] Because duplicates were identified at the level of the teacher-student pair, students matched to multiple teachers within an MSP were not treated as duplicate cases and, therefore, these students were represented in the file multiple times (one time for each teacher with whom they were matched).

[3] In conducting these cleaning steps, the teacher subject area was assigned based upon the subject area of professional development in *any* year of participation. That is, a teacher that participated in only math professional development was matched to only her/his math students, while a teacher that participated in math professional development in 07-08 and then science professional development in 08-09 was matched to her/his associated students in both math and science.

Table A.7: Teacher Participants on Participant List (PL) with Available Student Data

Cohort	Participating MSP Teachers on Participant List	PL Teachers in Student ADE File		PL Teachers in Student File with Matching Subject Area	
		N	(%)	N	(%)
07-08	268	149	56%	147	55%
08-09	480	303	63%	300	63%
09-10	681	480	71%	472	69%
Overall	871	525	60%	517	59%

Step 5: Merging of CSAP Student Data

Finally, student CSAP data were merged with the dataset created in the previous step by student ID[4]. Prior to the merge, minimal cleaning and reformatting was conducted to recode science and math performance variable for use in analyses. Overall, 33,366 (88.9%) of the 37,516 cases on the previously merged file could be matched with CSAP data. Specifically, 30,816 of the cases had valid math growth percentile data for 2009-10; 12,227 had valid science proficiency level data for 2009-10.

The final cleaned data file that included matched student CSAP data had 517 unique teachers across one or more years: 147 teachers from 2007-08, 300 teachers from 2008-09, and 472 from 2009-10. Of these, 295 participated in more than one year of an MSP (107 participated in all three years). Tables A.8 throughA.13 below present counts of teachers matched to students with CSAP data overall, as well as by subject and number of years of MSP participation.

Table A.8: Count of Teachers Participating in MSP from 2007-08 through 2009-10 and Matched to 2009-10 Students

Cohort Presence - Overall				
	09-10	08-09	07-08	N
	✓			183
	✓	✓		164
	✓		✓	18
	✓	✓	✓	107
		✓		23
		✓	✓	6
			✓	16
N	**472**	**300**	**147**	**517**

[4] Note that CSAP is administered only to students in grades 3-12, so student achievement data presented in this report does not include any students of MSP teacher participants in grades K-2.

Table A.9: Number of Years of Participation by Teacher Participants Matched to 2009-10 Students, Overall

Number of Years	N
1	222
2	188
3	107
Total	**517**

Table A.10 & Table A.11: **Count of Teachers Participating in MSP from 2007-08 through 2009-10 and Matched to 2009-10 Students, by Subject Area**

Cohort Presence - Math				
	09-10	08-09	07-08	N
	✓			104
	✓	✓		105
	✓		✓	17
	✓	✓	✓	83
		✓		8
		✓	✓	5
			✓	7
N	**309**	**201**	**112**	**329**

Cohort Presence - Science				
	09-10	08-09	07-08	N
	✓			81
	✓	✓		67
	✓		✓	1
	✓	✓	✓	26
		✓		15
		✓	✓	1
			✓	9
N	**175**	**109**	**37**	**200**

Note: Twelve teachers were categorized as receiving PD in both math and science. As such, these teachers appear in both Table A.10 and A.11 above.

Table A.12: Number of Years of Participation by Teacher Participants Matched to 2009-10 Students, Math

Number of Years	N
1	119
2	127
3	83
Total	**329**

Table A.13: Number of Years of Participation by Teacher Participants Matched to 2009-10 Students, Science

Number of Years	N
1	105
2	69
3	26
Total	**200**

Qualitative Data Sources

The following three data sources were used for qualitative analysis of MSP programs:

Annual Performance Report (APR)

The APR is collected through a secure online data collection system and includes the following data elements: description of MSP partners; PD models; program evaluation design; evaluation findings; and evidence of outcomes. Each MSP is required to submit this report to CDE, and CDE reviews each APR prior to sending it to the U.S. Department of Education during each 12-month period after the award of the MSP grant. CDE provided OMNI with a login and password to access the 2009-10 APRs for the 11 MSPs in cohorts 4, 5, and 6.

Local Evaluation Report (LER)

An LER was written by each MSP's external evaluator and supplements the APR submission. The LER provides an in-depth look at program and evaluation activities. MSPs submit their LERs as attachments to their APRs, and OMNI obtained copies from the same online system described above. LERs for 2009-10 were reviewed for all 11 MSPs in cohorts 4, 5, and 6.

MSP Application

Each MSP submitted an application to CDE to request funding. Applications provide information about program goals, objectives, and strategies. All 11 MSPs included in Year 3 analyses submitted an application prior to 2009-10. As such, all MSP application data presented in this report was gathered during Year 2.

Appendix B: MSP-level Student Demographics

The following student demographic variables were examined by MSP and year: gender, ethnicity, grade, free/reduced lunch eligibility and English proficiency. The gender and ethnicity variables were obtained from the HR student data, while grade, free/reduced lunch eligibility and English proficiency came from CSAP data. Tables presented in Appendix B contain the frequency and proportion of students in each demographic category by MSP and year.

Table B.1: 2009-10 Student Demographics – Mesa State

Demographic Characteristic	Number of Students (%)
Gender	
Female	1209 (47.0%)
Male	1365 (53.0%)
Total	**2574 (100.0%)**
Ethnicity	
American Indian or Alaska Native	25 (1.0%)
Asian or Pacific Islander	30 (1.2%)
Black (non-Hispanic)	31 (1.2%)
Hispanic	558 (21.7%)
White (non-Hispanic)	1930 (75.0%)
Total	**2574 (100.0%)**
Grade	
3rd	n/a
4th	n/a
5th	87 (3.4%)
6th	898 (35.4%)
7th	776 (30.6%)
8th	662 (26.1%)
9th	101 (4.0%)
10th	16 (0.6%)
11th	n/a
12th	n/a
Total	**2540 (100.0%)**
Free/Reduced Lunch Eligibility	
Unreported	n/a
Not Eligible	1443 (56.8%)
Reduced Lunch Eligible	213 (8.4%)
Free Lunch Eligible	884 (34.8%)
Total	**2540 (100.0%)**
English Proficiency	
N/A	2277 (89.6%)
Not English Proficient	25 (1.0%)
Limited English Proficient	111 (4.4%)
Fluent English Proficient	127 (5.0%)
Total	**2540 (100.0%)**

Note: There were 34 students with missing grade data, missing free/reduced lunch eligibility data, and missing English proficiency data.

Table B.2: 2009-10 Student Demographics – Weld

Demographic Characteristic	Number of Students (%)
Gender	
Female	3168 (49.1%)
Male	3289 (50.9%)
Total	**6457 (100.0%)**
Ethnicity	
American Indian or Alaska Native	136 (2.1%)
Asian or Pacific Islander	79 (1.2%)
Black (non-Hispanic)	128 (2.0%)
Hispanic	3850 (59.6%)
White (non-Hispanic)	2264 (35.1%)
Total	**6457 (100.0%)**
Grade	
3rd	n/a
4th	n/a
5th	n/a
6th	2326 (36.3%)
7th	2295 (35.9%)
8th	1779 (27.8%)
9th	n/a
10th	n/a
11th	n/a
12th	n/a
Total	**6400 (100.0%)**
Free/Reduced Lunch Eligibility	
Unreported	n/a
Not Eligible	1792 (28.0%)
Reduced Lunch Eligible	571 (8.9%)
Free Lunch Eligible	4037 (63.1%)
Total	**6400 (100.0%)**
English Proficiency	
N/A	3799 (59.4%)
Not English Proficient	233 (3.6%)
Limited English Proficient	1283 (20.0%)
Fluent English Proficient	1085 (17.0%)
Total	**6400 (100.0%)**

Note: There were 57students with missing grade data, missing free/reduced lunch eligibility data, and missing English proficiency data.

Table B.3: 2009-10 Student Demographics – Fort Lewis

Demographic Characteristic	Number of Students (%)
Gender	
Female	1248 (48.7%)
Male	1313 (51.3%)
Total	**2561 (100.0%)**
Ethnicity	
American Indian or Alaska Native	234 (9.1%)
Asian or Pacific Islander	24 (0.9%)
Black (non-Hispanic)	24 (0.9%)
Hispanic	434 (16.9%)
White (non-Hispanic)	1845 (72.0%)
Total	**2561 (100.0%)**
Grade	
3rd	49 (2.2%)
4th	264 (11.9%)
5th	217 (9.8%)
6th	387 (17.5%)
7th	338 (15.3%)
8th	381 (17.2%)
9th	334 (15.1%)
10th	242 (10.9%)
11th	n/a
12th	n/a
Total	**2212 (100.0%)**
Free/Reduced Lunch Eligibility	
Unreported	4 (0.2%)
Not Eligible	1211 (54.7%)
Reduced Lunch Eligible	257 (11.6%)
Free Lunch Eligible	740 (33.5%)
Total	**2212 (100.0%)**
English Proficiency	
N/A	2037 (92.1%)
Not English Proficient	10 (0.5%)
Limited English Proficient	69 (3.1%)
Fluent English Proficient	95 (4.3%)
Total	**2211 (100.0%)**

Note: There were 349 students with missing grade data, missing free/reduced lunch eligibility data, and 350 missing English proficiency data.

Table B.4: 2009-10 Student Demographics – Jefferson County

Demographic Characteristic	Number of Students (%)
Gender	
Female	4161 (48.4%)
Male	4428 (51.6%)
Total	**8589 (100.0%)**
Ethnicity	
American Indian or Alaska Native	125 (1.5%)
Asian or Pacific Islander	295 (3.4%)
Black (non-Hispanic)	167 (1.9%)
Hispanic	2618 (30.5%)
White (non-Hispanic)	5384 (62.7%)
Total	**8589 (100.0%)**
Grade	
3rd	22 (0.3%)
4th	52 (0.7%)
5th	413 (5.4%)
6th	1063 (13.9%)
7th	2590 (34.0%)
8th	2149 (28.2%)
9th	694 (9.1%)
10th	642 (8.4%)
11th	n/a
12th	n/a
Total	**7625 (100.0%)**
Free/Reduced Lunch Eligibility	
Unreported	n/a
Not Eligible	4815 (63.1%)
Reduced Lunch Eligible	614 (8.1%)
Free Lunch Eligible	2196 (28.8%)
Total	**7625 (100.0%)**
English Proficiency	
N/A	6436 (84.4%)
Not English Proficient	104 (1.4%)
Limited English Proficient	514 (6.7%)
Fluent English Proficient	571 (7.5%)
Total	**7625 (100.0%)**

Note: There were 964 students with missing grade data, missing free/reduced lunch eligibility data, and missing English proficiency data.

Table B.5: 2009-10 Student Demographics – DPS(1)

Demographic Characteristic	Number of Students (%)
Gender	
Female	318 (54.7%)
Male	263 (45.3%)
Total	**581 (100.0%)**
Ethnicity	
American Indian or Alaska Native	1 (0.2%)
Asian or Pacific Islander	26 (4.5%)
Black (non-Hispanic)	100 (17.2%)
Hispanic	115 (19.8%)
White (non-Hispanic)	339 (58.3%)
Total	**581 (100.0%)**
Grade	
3rd	8 (1.4%)
4th	45 (8.1%)
5th	120 (21.7%)
6th	142 (25.6%)
7th	n/a
8th	n/a
9th	161 (29.1%)
10th	78 (14.1%)
11th	n/a
12th	n/a
Total	**554 (100.0%)**
Free/Reduced Lunch Eligibility	
Unreported	n/a
Not Eligible	407 (73.5%)
Reduced Lunch Eligible	19 (3.4%)
Free Lunch Eligible	128 (23.1%)
Total	**554 (100.0%)**
English Proficiency	
N/A	489 (88.3%)
Not English Proficient	4 (0.7%)
Limited English Proficient	20 (3.6%)
Fluent English Proficient	41 (7.4%)
Total	**554 (100.0%)**

Note: There were 27 students with missing grade data, missing free/reduced lunch eligibility data, and missing English proficiency data.

Table B.6: 2009-10 Student Demographics – Fort Morgan

Demographic Characteristic	Number of Students (%)
Gender	
Female	1595 (48.0%)
Male	1728 (52.0%)
Total	**3323 (100.0%)**
Ethnicity	
American Indian or Alaska Native	14 (0.4%)
Asian or Pacific Islander	15 (0.5%)
Black (non-Hispanic)	85 (2.6%)
Hispanic	1665 (50.1%)
White (non-Hispanic)	1544 (46.5%)
Total	**3323 (100.0%)**
Grade	
3rd	272 (12.3%)
4th	232 (10.5%)
5th	325 (14.7%)
6th	299 (13.6%)
7th	264 (12.0%)
8th	241 (10.9%)
9th	283 (12.8%)
10th	289 (13.1%)
11th	n/a
12th	n/a
Total	**2205 (100.0%)**
Free/Reduced Lunch Eligibility	
Unreported	n/a
Not Eligible	771 (35.0%)
Reduced Lunch Eligible	229 (10.4%)
Free Lunch Eligible	1205 (54.6%)
Total	**2205 (100.0%)**
English Proficiency	
N/A	1383 (62.7%)
Not English Proficient	72 (3.3%)
Limited English Proficient	358 (16.2%)
Fluent English Proficient	392 (17.8%)
Total	**2205 (100.0%)**

Note: There were 1118 students with missing grade data, missing free/reduced lunch eligibility data, and missing English proficiency data.

Table B.7: 2009-10 Student Demographics – CSU

Demographic Characteristic	Number of Students (%)
Gender	
Female	1110 (46.8%)
Male	1261 (53.2%)
Total	**2371 (100.0%)**
Ethnicity	
American Indian or Alaska Native	44 (1.9%)
Asian or Pacific Islander	46 (1.9%)
Black (non-Hispanic)	46 (1.9%)
Hispanic	845 (35.6%)
White (non-Hispanic)	1390 (58.6%)
Total	**2371 (100.0%)**
Grade	
3rd	n/a
4th	n/a
5th	187 (8.0%)
6th	764 (32.7%)
7th	819 (35.1%)
8th	436 (18.7%)
9th	124 (5.3%)
10th	6 (0.3%)
11th	n/a
12th	n/a
Total	**2336 (100.0%)**
Free/Reduced Lunch Eligibility	
Unreported	n/a
Not Eligible	1236 (52.9%)
Reduced Lunch Eligible	180 (7.7%)
Free Lunch Eligible	920 (39.4%)
Total	**2336 (100.0%)**
English Proficiency	
N/A	1773 (75.9%)
Not English Proficient	46 (2.0%)
Limited English Proficient	291 (12.5%)
Fluent English Proficient	226 (9.7%)
Total	**2336 (100.0%)**

Note: There were 35 students with missing grade data, missing free/reduced lunch eligibility data, and missing English proficiency data.

Table B.8: 2009-10 Student Demographics – Colorado College

Demographic Characteristic	Number of Students (%)
Gender	
Female	759 (54.5%)
Male	634 (45.5%)
Total	**1393 (100.0%)**
Ethnicity	
American Indian or Alaska Native	15 (1.1%)
Asian or Pacific Islander	59 (4.2%)
Black (non-Hispanic)	116 (8.3%)
Hispanic	267 (19.2%)
White (non-Hispanic)	936 (67.2%)
Total	**1393 (100.0%)**
Grade	
3rd	n/a
4th	n/a
5th	n/a
6th	445 (33.8%)
7th	390 (29.6%)
8th	482 (36.6%)
9th	1 (0.1%)
10th	n/a
11th	n/a
12th	n/a
Total	**1318 (100.0%)**
Free/Reduced Lunch Eligibility	
Unreported	n/a
Not Eligible	899 (68.2%)
Reduced Lunch Eligible	98 (7.4%)
Free Lunch Eligible	321 (24.4%)
Total	**1318 (100.0%)**
English Proficiency	
N/A	1205 (91.4%)
Not English Proficient	17 (1.3%)
Limited English Proficient	53 (4.0%)
Fluent English Proficient	43 (3.3%)
Total	**1318 (100.0%)**

Note: There were 75 students with missing grade data, missing free/reduced lunch eligibility data, and missing English proficiency data.

Table B.9: 2009-10 Student Demographics – Southern Colorado

Demographic Characteristic	Number of Students (%)
Gender	
Female	1377 (50.2%)
Male	1364 (49.8%)
Total	**2741 (100.0%)**
Ethnicity	
American Indian or Alaska Native	25 (0.9%)
Asian or Pacific Islander	25 (0.9%)
Black (non-Hispanic)	56 (2.0%)
Hispanic	679 (24.8%)
White (non-Hispanic)	1956 (71.4%)
Total	**2741 (100.0%)**
Grade	
3rd	n/a
4th	n/a
5th	3 (0.1%)
6th	415 (18.8%)
7th	513 (23.2%)
8th	400 (18.1%)
9th	421 (19.0%)
10th	460 (20.8%)
11th	n/a
12th	n/a
Total	**2212 (100.0%)**
Free/Reduced Lunch Eligibility	
Unreported	n/a
Not Eligible	1438 (65.0%)
Reduced Lunch Eligible	247 (11.2%)
Free Lunch Eligible	527 (23.8%)
Total	**2212 (100.0%)**
English Proficiency	
N/A	2138 (96.7%)
Not English Proficient	2 (0.1%)
Limited English Proficient	37 (1.7%)
Fluent English Proficient	35 (1.6%)
Total	**2212 (100.0%)**

Note: There were 529 students with missing grade data, missing free/reduced lunch eligibility data, and missing English proficiency data.

Table B.10: 2009-10 Student Demographics – Eagle

Demographic Characteristic	Number of Students (%)
Gender	
Female	694 (49.7%)
Male	703 (50.3%)
Total	**1397 (100.0%)**
Ethnicity	
American Indian or Alaska Native	7 (0.5%)
Asian or Pacific Islander	15 (1.1%)
Black (non-Hispanic)	12 (0.9%)
Hispanic	560 (40.1%)
White (non-Hispanic)	803 (57.5%)
Total	**1397 (100.0%)**
Grade	
3rd	29 (2.8%)
4th	99 (9.7%)
5th	132 (12.9%)
6th	201 (19.7%)
7th	139 (13.6%)
8th	232 (22.7%)
9th	63 (6.2%)
10th	127 (12.4%)
11th	n/a
12th	n/a
Total	**1022 (100.0%)**
Free/Reduced Lunch Eligibility	
Unreported	n/a
Not Eligible	695 (68.0%)
Reduced Lunch Eligible	74 (7.2%)
Free Lunch Eligible	253 (24.8%)
Total	**1022 (100.0%)**
English Proficiency	
N/A	705 (69.0%)
Not English Proficient	39 (3.8%)
Limited English Proficient	152 (14.9%)
Fluent English Proficient	126 (12.3%)
Total	**1022 (100.0%)**

Note: There were 375 students with missing grade data, missing free/reduced lunch eligibility data, and missing English proficiency data.

Table B.11: 2009-10 Student Demographics – DPS(2)

Demographic Characteristic	Number of Students (%)
Gender	
Female	877 (51.1%)
Male	838 (48.9%)
Total	**1715 (100.0%)**
Ethnicity	
American Indian or Alaska Native	17 (1.0%)
Asian or Pacific Islander	37 (2.2%)
Black (non-Hispanic)	345 (20.1%)
Hispanic	1074 (62.6%)
White (non-Hispanic)	242 (14.1%)
Total	**1715 (100.0%)**
Grade	
3rd	140 (9.8%)
4th	407 (28.5%)
5th	571 (40.0%)
6th	249 (17.4%)
7th	28 (2.0%)
8th	34 (2.4%)
9th	n/a
10th	n/a
11th	n/a
12th	n/a
Total	**1429 (100.0%)**
Free/Reduced Lunch Eligibility	
Unreported	n/a
Not Eligible	321 (22.5%)
Reduced Lunch Eligible	145 (10.1%)
Free Lunch Eligible	963 (67.4%)
Total	**1429 (100.0%)**
English Proficiency	
N/A	737 (51.6%)
Not English Proficient	84 (5.9%)
Limited English Proficient	432 (30.2%)
Fluent English Proficient	176 (12.3%)
Total	**1429 (100.0%)**

Note: There were 286 students with missing grade data, missing free/reduced lunch eligibility data, and missing English proficiency data.

Appendix C: Teacher Content Knowledge Score Analysis for MSPs with 2009-10 Teachers with Multiple Sets of Test Scores

The results of statistical significance testing conducted on second and third sets of matched pre/post teacher content knowledge test scores appear in Tables C.1 and C.2. As is shown, math teachers from Jefferson County with second and third sets of test scores demonstrated a statistically significant change between pre- and posttest on both tests. Changes between pre- and posttest were not statistically significant for the second set of scores for teachers in DPS (1) or in Eagle. In DPS(1), this result may be the result of a particularly small sample size (n=7).

Table C.1: 2009-10 Teacher Knowledge Test Score Descriptive Statistics and Statistical Significance of Change (Second Test), by MSP

MSP Name	Subject Area	N	Pretest				Posttest				Pretest/ Posttest Change t-test p
			Mean	Median	Min.	Max.	Mean	Median	Min.	Max.	
Jefferson County	Math	13	31.27	33.00	11.00	45.00	37.62	35.00	25.00	51.00	.005*
	Science	8	12.75	12.00	9.00	17.00	16.00	13.50	11.00	29.00	.078
DPS (1)	Science	7	41.14	45.00	26.00	48.00	37.71	42.00	11.00	48.00	.179
Eagle	Math	29	.27	.06	-1.88	2.65	.39	.33	-1.52	2.08	.251

**p< .05*

Table C.2: 2009-10 Teacher Knowledge Test Score Descriptive Statistics and Statistical Significance of Change (Third Test), by MSP

MSP Name	Subject Area	N	Pretest				Posttest				Pretest/ Posttest Change t-test p
			Mean	Median	Min.	Max.	Mean	Median	Min.	Max.	
Jefferson County	Math	3	39.33	41.00	35.00	42.00	48.67	48.00	48.00	50.00	.044*

**p< .05*