

eMINTS Program Evaluation Report:

**An Investigation of Program Fidelity and Its Impact on Teacher
Mastery and Student Achievement**

Submitted by:

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Executive Summary

The eMINTS professional development programs are designed to help teachers learn how to integrate technology into their teaching, using instructional strategies that promote inquiry-based learning and encourage collaboration and community building among students and teachers. The eMINTS programs considered in this evaluation include: (1) eMINTS Comprehensive Professional Development (Comp PD), a two-year program consisting of approximately 250 hours of teacher professional development and support, for teachers in school-designated grades, including 10--12 Classroom Visits each year; (2) eMINTS4ALL, a two-year, 90-hour professional development program built for teachers in the grades above and below eMINTS Comp PD teachers, to support students for multiple years, including 8–9 Classroom Visits per year; and (3) Professional Development for Educational Technology Specialists (PD4ETS), a two-year program that prepares local district staff members to become eMINTS instructional specialists.

Since 1999 the eMINTS National Center has engaged external evaluators to examine the program to understand its impact on schools, teachers, and students. In the 2005–2006 school year, the eMINTS program added new professional development programs and expanded beyond the state of Missouri, where it began (as “enhancing Missouri’s Instructional Networked Teaching Strategies”). In order to help eMINTS ensure a high level of program quality as it scaled up, the Education Development Center, Inc.’s Center for Children and Technology (EDC/CCT) was brought in as the external evaluator in 2006 and charged with designing an evaluation that would create instruments and procedures to assess Program Fidelity and Teacher Mastery of eMINTS core concepts, and would examine the relationships among Program Fidelity, Teacher Mastery, and student achievement. Program Fidelity consists of two components:

1. PD Fidelity, or how well the professional development addressed the key conceptual constructs of eMINTS
2. Classroom Visits, or how much time instructional specialists spent on certain activities during their regular visits to participant classrooms.

EDC/CCT’s evaluation strategy was designed to answer the following questions about the eMINTS Comprehensive and eMINTS4ALL professional development programs:

Regarding *Program Fidelity*:

- Are the current eMINTS professional development sessions faithfully addressing the core program constructs (PD Fidelity)?

- Are there differences in the level of PD Fidelity between professional development sessions delivered by eMINTS staff and those delivered by participants or graduates of the PD4ETS program?
- What activities are specialists spending the most time on during their Classroom Visits?
- Are there differences in the amount of time eMINTS staff and participants or graduates of the PD4ETS program spend on different activities during Classroom Visits?

Regarding *Teacher Mastery*:

- What are the baseline levels of Teacher Mastery of eMINTS concepts?
- Are eMINTS participants mastering some concepts more successfully than others?

Regarding *Program Impact*:

- Does the level of eMINTS Program Fidelity have an impact on participating teachers' mastery of the concepts presented in the professional development sessions?
- Does the level of eMINTS Program Fidelity have an impact on the achievement of students in the classrooms of eMINTS teachers?
- Does teachers' level of mastery of the program concepts have an impact on the achievement of student in their classrooms?

EDC/CCT evaluators worked closely with eMINTS program staff to design Fidelity and Teacher Mastery instruments that were closely aligned with the core concepts about effective instruction and technology integration that serve as the foundation for all eMINTS programming. Data collected for the evaluation included:

- Observational data from eMINTS professional development sessions
- Records of Classroom Visits by eMINTS instructional specialists
- Teacher artifacts (Lesson Plans, WebQuests, and Classroom Websites) submitted as part of eMINTS teachers' portfolios
- Data from interviews conducted with 16 teachers one year after they completed the eMINTS program
- Student assessment data from the Missouri Assessment Program (MAP) tests in Mathematics (MA), Communication Arts (CA), Science (SC), and Social Studies (SS)

KEY FINDINGS FROM THIS EVALUATION OF EMINTS

Regarding *Program Fidelity*, the findings suggest that there was a high level of fidelity to the core eMINTS concepts:

- The majority of instructional specialists addressed many of the key concepts.

- The majority of instructional specialists used the recommended instructional practices.
- There were few differences in PD Fidelity between eMINTS staff and participants or graduates of the PD4ETS program.
- During Classroom Visits, instructional specialists spent the most time working with teachers on Lesson Planning and Modeling Instruction and the least amount of time providing Technology Assistance and Problem Solving.
- eMINTS staff spent more time than participants or graduates of the PD4ETS program on Lesson Planning during Classroom Visits.

Regarding *Teacher Mastery*, the findings indicate a wide range in the levels of mastery of the eMINTS concepts, with certain concepts more successfully mastered than others:

- Teachers displayed a high level of mastery of some core eMINTS concepts, such as integrating technology to support student learning and having students create authentic products to demonstrate their learning.
- Teachers displayed a lower level of mastery of other core eMINTS concepts, such as designing instruction to address diversity and having students generate their own questions to guide their inquiry.

Regarding *Program Impact*, our findings suggest that higher PD Fidelity is associated with greater Teacher Mastery of eMINTS concepts, and more time spent Lesson Planning in Classroom Visits is associated with greater Teacher Mastery as reflected in the Lesson Plans:

- There was a significant, positive correlation between PD Fidelity and Teacher Mastery scores on the Lesson Plans teachers submitted in their portfolios.
- There was a positive trend between PD Fidelity and Teacher Mastery on the WebQuests teachers submitted in their portfolios.
- There was a significant, positive correlation between the amount of time teachers spent on Lesson Planning during Classroom Visits and the scores on the Lesson Plans they submitted as part of their portfolios.

Also regarding *Program Impact*, our findings suggest that higher levels of Teacher Mastery of eMINTS concepts are associated with greater student achievement, higher levels of PD Fidelity are associated with greater student achievement, and more time spent on Lesson Planning during Classroom Visits is associated with greater student achievement:

- There were significant, positive correlations between student MAP scores and Teacher Mastery on the Lesson Plan (in grades 3, 4, and 7), on the WebQuest (in grades 3 and 7), and on the Classroom Website (in grades 4, 5, and 7).
- There were significant, positive correlations between PD Fidelity and student MAP scores in grades 3, 4, 5, and 8.

- There were significant, positive correlations between student MAP scores and Lesson Planning during Classroom Visits in grades 4, 5, and 8.

Overall, this evaluation provides evidence that the eMINTS program is being implemented with a high level of fidelity by both the eMINTS staff and participants and the graduates of the PD4ETS program; that teachers are mastering some, but not all, of the core eMINTS concepts; and that maintaining a high level of Program Fidelity is important for ensuring that teachers are mastering the core program concepts, which may then result in higher levels of student achievement.

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Section I: Introduction

eMINTS is a comprehensive program that offers a wide range of professional development options to teachers, administrators, technology specialists, and other educators. eMINTS professional development is designed to help teachers learn how to integrate technology into their teaching using instructional strategies that promote inquiry-based learning and encourage collaboration and community building among students and teachers. eMINTS began in 1999 as a professional development program for teachers in Missouri (it is an acronym for “enhancing Missouri’s Instructional Networked Teaching Strategies”), but it has since expanded to 11 more states and to Australia. The “flagship” professional development program is eMINTS Comprehensive PD (Comp PD), a two-year program consisting of approximately 250 hours of online and face-to-face teacher professional development and support, including 10–12 Classroom Visits each year by eMINTS instructional specialists. eMINTS4ALL was created as a professional development program for teachers in the grades above and below the grade taught by eMINTS Comp PD teachers, to help prepare students for and extend the kind of instruction they experience in eMINTS Comprehensive classrooms. eMINTS4ALL is also a two-year program, consisting of 90 hours of online and face-to-face instruction, with 8–9 Classroom Visits each year by eMINTS instructional specialists. The PD4ETS program is a two-year program that prepares local district staff members to become eMINTS instructional specialists. Other programs include professional development for administrators, technology coordinators, and special education teachers, and continuing education for veteran eMINTS teachers.

Evaluation has been an integral part of the eMINTS program since its inception. eMINTS program developers have commissioned external evaluators to take both formative and summative approaches to the evaluation of eMINTS. Data from these evaluations have been used to inform program improvement and to understand the impact of eMINTS on teacher participants and their students.

From 1999 to 2005, Missouri’s Office of Social and Economic Data Analysis (OSED) served as the external program evaluator for eMINTS. This group conducted a wide range of evaluation activities, including focus groups and interviews with teachers, administrators, and parents; observations of eMINTS classrooms; surveys of teachers and students; and analyses of student assessment data from the Missouri Assessment Program (MAP) tests that compared outcomes for the students of eMINTS participants and comparison groups of students whose teachers had not participated in eMINTS (see <http://www.emints.org/evaluation/index.shtml> for a complete list of evaluation publications). These evaluation reports present a rich picture of the eMINTS program and the schools in which it has been implemented. Along with qualitative findings about such things as effective instructional practices

of eMINTS teachers, leadership styles of principals in schools participating in eMINTS, and professional development methodologies of educators in the eMINTS PD4ETS program, the OSEDA summative evaluations of student outcomes consistently found that eMINTS had a significant, positive impact on student achievement, especially for low-income, Special Education, and Title I students, in each of the five years for which they conducted these analyses.

In 2006 the eMINTS program was scaling up dramatically, in both its programming (implementing more PD4ETS professional development sessions and adding the eMINTS4ALL program to its suite of professional development offerings) and its reach (expanding beyond Missouri to Utah, Maine, Nevada, Arkansas, Illinois, Oklahoma, Ohio, and Texas¹). To ensure that they could maintain a high level of program quality as they scaled up the program, the eMINTS program staff recognized the need to revise their evaluation strategy, to build a better understanding of Program Fidelity and its relationship to the program's impact on teachers and students. They selected the Education Development Center, Inc.'s Center for Children and Technology (EDC/CCT) to develop instruments and procedures for collecting data about Program Fidelity and Teacher Mastery and to conduct an evaluation that looked at the relationships among Program Fidelity, Teacher Mastery, and student achievement.² In this evaluation design, Program Fidelity consisted of two components:

1. PD Fidelity, or how well the professional development addressed the key conceptual constructs of eMINTS
2. Classroom Visits, or how much time instructional specialists spent on certain activities during their regular visits to participant classrooms.

Teacher Mastery of concepts was determined through an analysis of some of the key artifacts (a Lesson Plan, a WebQuest, and a Classroom Website) teacher participants submitted in their program portfolios at the end of their two-year professional development experience. Student achievement was determined through an analysis of student MAP data.

The new evaluation strategy was designed to answer the following questions about the eMINTS Comprehensive and eMINTS4ALL professional development programs:

¹ Since the 2005–2006 school year, eMINTS has further expanded to Alabama, Delaware, Minnesota, and New South Wales, Australia.

² Though EDC/CCT's main evaluation responsibilities consisted of conducting this new approach to eMINTS evaluation, EDC/CCT evaluators also conducted an analysis comparing achievement on the 2005 MAP of students in eMINTS and non-eMINTS classrooms, and, consistent with the OSEDA evaluations, found the program had a significant, positive impact on student achievement.

Regarding *Program Fidelity*:

- Are the current eMINTS professional development sessions faithfully addressing the core program constructs (PD Fidelity)?
- Are there differences in the level of PD Fidelity between professional development sessions delivered by eMINTS staff and those delivered by participants or graduates of the PD4ETS program?
- What activities are instructional specialists spending the most time on during their Classroom Visits?
- Are there differences in the amount of time eMINTS staff and participants or graduates of the PD4ETS program spend on different activities during Classroom Visits?

Regarding *Teacher Mastery*:

- What are the baseline levels of Teacher Mastery of eMINTS concepts?
- Are eMINTS participants mastering some concepts more successfully than others?

Regarding *Program Impact*:

- Does the level of eMINTS Program Fidelity have an impact on participating teachers' mastery of the concepts presented in the professional development sessions?
- Does the level of eMINTS Program Fidelity have an impact on the achievement of students in the classrooms of eMINTS teachers?
- Does Teacher Mastery of the program concepts have an impact on the achievement of student in their classrooms?

This evaluation looked primarily at teachers who took part in the eMINTS Comprehensive and eMINTS4ALL programs in Missouri between the fall of 2005 and the spring of 2007. Data from the 2006–2008 cohort were collected as well and were included in our examination of PD Fidelity and the Classroom Visit records, for the purpose of instrument validation and refinement, and to have a larger dataset for determining the Program Fidelity baselines. The districts that participated in eMINTS during this time period did so in many different ways. Some districts used their own funds to pay for eMINTS professional development and made their own unique choices about which grades and teachers would participate. Some schools eligible for Title IID federal funds applied to participate in eMINTS and were awarded competitive Title IID grants through the Missouri Department of Elementary and Secondary Education (DESE). DESE and the eMINTS National Center took a more systematic approach in 2005 than in previous years in awarding the grants to schools eligible for Title IID funds, encouraging whole grade levels and multiple grades in schools and districts to participate in the program. This approach

helped to establish larger and more robust support networks in schools and districts. However, it had implications for the kind of data analysis that could be conducted, which will be discussed below. Participants from the Title IID grant districts were required to submit teacher portfolios at the end of their eMINTS experience. Teachers from a few other districts also voluntarily submitted teacher portfolios and/or were included in the data collected from observations of eMINTS professional development sessions and classroom visit records. Because the Teacher Mastery data are derived from teacher portfolio artifacts, only data from teachers who submitted portfolios are included in the combined analyses that look at the relationships among Program Fidelity and Teacher Mastery, Program Fidelity and student achievement, and Teacher Mastery and student achievement.

Fifty-five Missouri districts and one Arkansas district (shown in Table 1) participated in the evaluation project. The evaluation activities in which they took part are noted.

Table 1: Participating Districts

District	Teachers and/or district eMINTS instructional specialist participated in observed session	Teachers and/or district eMINTS instructional specialist participated in classroom visits	Teachers submitted portfolios	Provided teacher rosters allowing student data to be analyzed
Avenue City R-IX	X	X		
Bayless	X	X		
Bolivar R-I	X	X		
Cameron R-I	X	X		
Carrollton R-VII	X		X	X
Carthage R-IX	X	X		
Central R-III	X	X		
Chillicothe R-II	X	X	X	X
Confluence Academy	X	X		
Corning School District (AR)		X		
Crawford Co R-II	X	X		
Dallas Co R-I		X		
DeSoto 73	X	X	X	
Fort Zumwalt R-II	X		X	
Francis Howell R-III	X	X	X	X
Gasconade Co R-I	X	X	X	X
Hartville R-II	X	X	X	X
Hazelwood	X	X	X	
Hillsboro R-III	X	X	X	
Humansville R-IV	X	X		
Hurley R-I	X	X		
Jefferson City	X	X	X	X
Joplin R-VIII	X	X		
Junction Hill C-12	X	X		

Kingston K-12	X	X	X	
Maplewood Richmond Heights	X	X		
Marion C. Early R-V	X	X	X	
Monett R-I	X	X	X	
Moniteau Co R-V	X	X		
New Franklin R-I	X	X		
Nixa R-II	X	X	X	
North Kansas City 74	X	X	X	X
North Harrison R-III		X		
Norwood R-I		X		
Oregon-Howell R-III	X	X		
Perry County 32	X	X	X	X
Poplar Bluff R-I	X		X	
Potosi R-III	X	X		
Republic R-III	X	X	X	
Savannah R-III	X	X		
Sedalia 200	X	X		
Seymour R-II	X	X	X	
Smithville R-II	X	X	X	X
Sparta R-III	X	X	X	X
Special School District	X	X	X	
St. Charles R-VI	X		X	
St. James R-I	X	X	X	
Tri-County R-VII	X	X		
Union R-XI	X	X	X	
Valley Park	X	X	X	
Warrensburg R-VI	X		X	
Webster Groves	X	X	X	X
Wellston	X	X	X	
West Plains R-VII	X	X	X	
Wheatland R-II		X	X	
Willow Springs R-IV		X		

In Section II of this report, we describe the methods used to collect the evaluation data. In Section III, we describe the analyses that were conducted on the data and the creation of the comprehensive database. In Section IV, we present the findings from our analyses, and in Section V, we discuss the implications of this study.

Section II: Methods

EDC/CCT evaluators used a variety of methods to obtain data to examine the implementation and impact of the eMINTS program on teacher participants and their students. The evaluators collected data about eMINTS professional development sessions, visits to participants' classrooms, participants' mastery of the eMINTS concepts, and student achievement of participants' students.

PD FIDELITY

INSTRUMENT DEVELOPMENT

Observational data from eMINTS professional development sessions were collected to determine the level of PD Fidelity experienced by eMINTS participants. Designing instruments to gather information about PD Fidelity required a close collaboration with the program developers, since they are the experts on what faithful program implementation entails. Our fidelity instrumentation development process comprised six steps: existing document review; initial core concept and individual item development; item review and validation; creation of instruments; training on instruments and assessment of inter-rater reliability; and data collection.

EXISTING DOCUMENT REVIEW

The first stage of development involved the collection and review of all existing eMINTS program documentation and identification of those elements that were deemed essential to the program. These materials included (but were not limited to) the program's lists of key competencies for eMINTS teachers, hallmarks of an effective eMINTS classroom, and the entire curricula for the PD program.

INITIAL CORE CONCEPT AND INDIVIDUAL ITEM DEVELOPMENT

Using the collected information described in the first step, the evaluation team identified and operationalized five core concepts of the eMINTS program:

- Modeling Instruction
- Community Building
- Technology Utilization
- Connection to Practice
- Inquiry-Based Learning

Each core concept was then further developed to include five to eight individual items. Specific criteria for the development of individual items were as follows:

1. Items had to represent an observable or verifiable behavior, activity, or procedure.

2. Items had to be logically discrete from other items.
3. Items had to be specific to the eMINTS program models.

Together, they comprised our initial conceptual framework.

ITEM REVIEW AND VALIDATION

An adequately valid instrument will have: (1) a high level of face validity, meaning that it will be easily recognized and accepted by program developers as fitting with their understanding of the core features of the eMINTS program, and (2) a high level of content validity, meaning that experts with deep knowledge of the eMINTS curriculum and implementation model will accept the instrument's characterizations of the curriculum and its key procedural and conceptual features. Thus, the third step in the development process involved the establishment of face and content validity. This was accomplished by engaging in a review process with the eMINTS leadership team, which served as our expert panel, whereby items were eliminated, modified, or added. Items were eliminated if they were not identified by the experts as essential to the eMINTS experience (across both the eMINTS Comprehensive and eMINTS4ALL implementation models), or they were modified to more accurately reflect the identified core elements of the program. New items that emerged during the review process that were deemed valuable and significant to the PD program by the experts were added to the framework at that point as well.

CREATION OF INSTRUMENTS

In the fourth step, the evaluation team created two instruments for gathering fidelity data from observations of eMINTS professional development sessions: a checklist to be completed at the end of the professional development session and another protocol that enables the observer to capture "snapshot" information about the professional development session at regular intervals (15 minutes) throughout the session. The utilization of this dual methodology provided information on fidelity of both structural elements of the eMINTS PD program (by reporting on the overall program delivery) and its dynamic processes (by reporting on the ways in which a program is being delivered). Specifically, the Checklist instrument items focused more on the key conceptual and pedagogical elements of the program, whereas the Snapshot instrument focused primarily on the professional development process and facilitation strategies of the instructional specialist.

After these two instruments were created, evaluation team members attended three professional development sessions (one they observed together, and two they observed independently). The evaluators practiced using the instruments during these sessions, examined the data collected, and discussed how accurately the data reflected what they observed. These observations and post-observation analyses informed further refinement of the instruments and the data collection process. At

the conclusion of this process, the evaluators finalized the two instruments to reflect six core program elements, each including from 4 to 15 individual items (across both instruments):

- Program Logistics and Planning
- Modeling Instruction
- Community Building
- Technology Utilization
- Connection to Practice
- Inquiry-Based Learning

As both instruments were derived from the same conceptual framework developed in earlier stages, they share the same core concepts and scoring mechanism (Yes/No). The two instruments also share their organizational format, as they are both divided into items that are evidenced by the facilitator, the participants, or the interaction of facilitator with participants. Individual items are not grouped by core element, to avoid response bias.

TRAINING ON INSTRUMENTS AND ASSESSMENT OF INTER-RATER RELIABILITY

Our next step involved the training of observers and assessment of inter-rater reliability on both protocols. The purpose of establishing inter-rater reliability was to assure the usability and consistency of the instruments' scoring system. During a day-long training session with a team of seven observers, scheduled a few weeks prior to the beginning of the fidelity observations, the evaluators reviewed the process of instrument development, introduced and carefully reviewed items on each of the instruments, and provided examples and clarifications for each item. This review process was accompanied by the viewing of 12 carefully selected video segments recorded during two separate eMINTS professional development sessions. Questions, clarifications, and opportunities for the observers to actually score segments were integral parts of this day-long training session. At the end of the training session, observers were shown two 30-minute video segments and were asked to score both of the instruments as they would do in a true observation. Inter-rater agreement calculated as the average percent agreement among all trained observers yielded an 83% and 88% agreement on the Checklist and Snapshot protocols, respectively.

DATA COLLECTION

Six eMINTS staff members conducted a total of 50 observations of 28 different instructional specialists facilitating four-hour eMINTS professional development sessions. Observers observed both eMINTS and eMINTS4ALL sessions for both Year

1 and Year 2 participants (see Table 2). Observers sat in on a range of modules (content) during the winter and spring of 2007. Some instructional specialists were observed more than once. Observation data were entered into a standard Excel form and submitted to the eMINTS Moodle (data sharing) site. These files were then downloaded by EDC/CCT evaluators and entered into a PD Fidelity database.

Table 2: Number of professional development sessions observed, by program and teacher’s year in that program

	eMINTS	eMINTS4ALL
Year 1	11	1
Year 2	28	10

CLASSROOM VISIT RECORD

INSTRUMENT DEVELOPMENT

An important element of the eMINTS program is the regular Classroom Visits that the eMINTS instructional specialists provide to the teachers during both years of the program. The eMINTS staff and evaluators wanted to understand what kind of classroom support eMINTS participants were requesting from their instructional specialists, and how often and for what length of time instructional specialists visited the teachers. For this reason, EDC/CCT evaluators developed a short Excel worksheet in which instructional specialists could record what they did during each Classroom Visit they made. The form asks for teacher demographic information (grade, school, district, subject taught, when applicable) and for instructional specialists to fill out the date of the visit; the amount of time they spent on specific activities (Modeling Instruction, Lesson Planning, Technology Assistance, Reflective Practice, Problem Solving, or other); and the total amount of time spent on the visit. eMINTS instructional specialists reviewed the worksheet and reformatted it to make it easier to complete.

DATA COLLECTION

Twenty-six eMINTS instructional specialists recorded what they did during 2,367 Classroom Visits to 355 teachers. They entered the information into the Classroom Visit Excel worksheets and uploaded these to the eMINTS Moodle. EDC/CCT evaluators downloaded these over the fall, winter, and spring of 2006–2007. After the final Classroom Visits had been made, EDC/CCT evaluators downloaded the final set of Classroom Visit records and entered the data into a Classroom Visit database.

TEACHER TECHNOLOGY LITERACY SURVEY

INSTRUMENT DEVELOPMENT

EDC/CCT evaluators collaborated with eMINTS staff on the Teacher Technology Literacy Survey, which was administered online by the eMINTS National Center to all program participants. eMINTS staff developed the first eight questions, which asked for demographic information and for teachers to rate their level of understanding on a range of technology skills. They had used these questions in surveys they had conducted in previous years. EDC/CCT evaluators developed the next five questions, which asked about teachers' technology access, their level of classroom use of a range of technological devices and applications, and their perceptions of challenges they might have experienced using technology in their teaching. Some of these questions were based on the eMINTS requirements for teacher technology access stipulated on the eMINTS program website. Other questions were derived from surveys of other technology professional development programs evaluated by EDC/CCT, such as the Intel® Teach Essential program and New Mexico's Regional Educational Technology Assistance program, and from surveys conducted for the Use, Support, and Effect of Instructional Technology (USEIT) Study conducted by the Technology and Assessment Study Collaborative (<http://www.bc.edu/research/intasc/>).

DATA COLLECTION

All eMINTS participants were asked to complete the Teacher Technology Literacy Survey online in the spring of 2007. All 464 participants in Year 1 and Year 2 of eMINTS were asked to complete the survey. Two hundred and thirty-one participants responded to the survey, for a response rate of 49.8%.

TEACHER MASTERY RUBRICS

INSTRUMENT DEVELOPMENT

To assess whether eMINTS participants understood the key concepts of the eMINTS program, EDC/CCT evaluators reviewed teacher portfolios. Participants who came from districts that funded their eMINTS participation through Title IID funds were required to submit teacher portfolios to receive eMINTS certification. In addition, teachers from some other districts also voluntarily submitted portfolios. eMINTS Comprehensive teachers had to submit a Lesson Plan, a WebQuest, and a Classroom Website as part of their portfolios, and the eMINTS4ALL participants had to submit a Lesson Plan as part of theirs. EDC/CCT evaluators created rubrics for evaluating all three of these artifacts. Because the portfolio artifacts are designed by teacher participants to guide their instruction or their interactions with students, the artifacts can serve as proxies, if not for teacher practice, then for teacher understanding of how to structure their instructional practice and use of technology to support students.

The process of creating the Teacher Mastery rubrics was similar to the process used to create the fidelity instruments and consisted of the following steps: existing documentation review; initial rubric development; item review and validation; rubric training and assessment of inter-rater reliability; and final revision for use by program staff.

EXISTING DOCUMENTATION REVIEW

To create the Teacher Mastery rubrics, EDC/CCT evaluators first reviewed a number of existing documents to inform the design, in particular, the existing rubric for evaluating WebQuests; the constructivist Lesson Plan form; examples of Classroom Websites, WebQuests, and constructivist Lesson Plans; the hallmarks of an effective eMINTS classroom, and the eMINTS modules that focus on creating Classroom Websites, WebQuests, and Lesson Plans. These documents informed both the design of the rubrics and their content.

INITIAL RUBRIC DEVELOPMENT

Using the information derived from our review of existing documentation, we created three different rubrics: a Lesson Plan rubric, a Classroom Website rubric, and a WebQuest rubric. Evaluators aligned the Lesson Plan rubric format with the constructivist Lesson Plan form that eMINTS participants use. The WebQuest rubric was a revised version of the existing one, and the Classroom Website rubric was designed to address key content areas covered in the Classroom Website module.

ITEM REVIEW AND VALIDATION

As with the PD Fidelity instruments, we engaged in a process of gathering input from the eMINTS leadership team members to ensure the face and content validity

of the Teacher Mastery rubrics. Once the initial draft rubrics were created, evaluators shared them with eMINTS staff and held a series of meetings to go over the rubrics item by item to get their feedback on (a) whether the different items were appropriate, (b) whether all necessary content was covered, and (c) whether the staff agreed with the descriptions of what constituted high, medium, and low levels of mastery for each item.

Expert feedback from the leadership team was used to revise the Teacher Mastery rubrics. These revised rubrics were then sent to eMINTS staff for a second round of review. Staff sent additional feedback, which was used to further revise the rubrics.

RUBRIC TRAINING AND ASSESSMENT OF INTER-RATER RELIABILITY

Three EDC/CCT evaluators were involved in scoring teacher portfolio artifacts. The evaluators were trained for a full day on the use of the rubrics. For each of the rubrics, evaluators were presented with a sample artifact. Evaluators went through each rubric, item by item, as they reviewed the teacher artifact and discussed how they would score it. Slight revisions to the rubrics were made during the trainings, particularly when language needed to be more precise. After training, the evaluators independently scored a common Lesson Plan, WebQuest, and Classroom Website.

Three independent raters were required due to the volume of Lesson Plans, WebQuests, and Classroom Websites. Inter-rater reliabilities were taken throughout the scoring period to ensure that raters maintained high levels of agreement. The scores of the three raters were analyzed for inter-rater reliability using Cohen's Kappa³. The goal was to achieve an average Kappa value that is considered substantial, 0.60 to 0.79, or outstanding, 0.80 and above, with the minimum acceptable Kappa being 0.50. Inter-rater reliability was performed on six Lesson Plans, four WebQuests, and four Classroom Websites. The average Kappa value for Lesson Plans ranged from 0.51 to 0.79. The average Kappa value for WebQuests ranged from 0.72 to 0.82, and the average Kappa value for Classroom Websites ranged from 0.64 to 0.84. These Kappa values were all significant at $p < .01$, showing sufficient inter-rater reliability.

Three independent composite scores were then made by totaling each rubric item for Lesson Plans, WebQuests, and Classroom Websites. These composite scores constitute Teacher Mastery in each area.

DATA COLLECTION

The eMINTS instructional specialists collected portfolios from those teachers whose districts paid for their eMINTS professional development with Title IID funds, and from a few other districts that also had teachers volunteer to submit portfolios.

³ Cohen's Kappa coefficient is a statistical measure of inter-rater agreement that takes into account the likelihood of chance agreements and thus is a more valid measure than percent agreement calculations.

Along with the artifacts, these portfolios contained some demographic information about the teacher, such as the teacher’s school, district, and grade taught. In addition, the teachers needed to prove that they had actually used the Lesson Plan (all participants), WebQuest, and Classroom Website (eMINTS Comprehensive participants). Therefore, the portfolios needed to contain student work associated with these artifacts.

The instructional specialists submitted the portfolios to the eMINTS National Center, after which they were sent to EDC/CCT. The portfolios were distributed to three EDC/CCT evaluators. Using the Teacher Mastery rubrics, these evaluators scored the teacher artifacts. One of the evaluators then recorded all of the scores in a Teacher Mastery database. Overall, EDC/CCT evaluators reviewed 180 Lesson Plans (99 from eMINTS Comprehensive and 81 from eMINTS4ALL), 95 WebQuests, and 103 Classroom Websites. The numbers for each artifact are slightly different due to some incomplete and corrupt files and sites upon data collection.

RUBRIC REFINEMENT

Once the scoring and the analysis of the Teacher Mastery scores were complete, EDC/CCT evaluators revisited the Teacher Mastery rubrics. Using frequency data from the analysis of Teacher Mastery scores—which showed the items that had little variation—and raters’ own experience scoring dozens of artifacts, EDC/CCT evaluators edited the rubrics a final time, adding and subtracting items in some cases, but primarily revising the wording to make it even more precise and concrete. This was done to make the rubrics even more effective for future evaluations and research. These revised rubrics were then submitted to the eMINTS program staff for use in their own internal evaluation of the program, both in Missouri and in other states as the program is scaled up.

STUDENT-LEVEL DEMOGRAPHIC AND MISSOURI ASSESSMENT PROGRAM (MAP) DATA

DATA COLLECTION

In order to measure the impact of the eMINTS program on students, EDC/CCT evaluators had to gain access to district and state student-level data. First, evaluators had to obtain information from the participating districts about the students and teachers in the schools that participated in the eMINTS program. We asked districts to complete rosters for these schools that provided student names and state ID numbers and the eMINTS status of their teachers (eMINTS veteran; eMINTS or eMINTS4ALL, Years 1 or 2; or non-eMINTS). These rosters gave us information on how many teachers were involved in each phase and program of eMINTS from each district.

The rosters then enabled us to collect student assessment data from students in each phase and program of eMINTS. This gave a student sample that would allow us to examine the relationships among student performance, Program Fidelity, and Teacher Mastery. To accomplish this, we obtained the standardized test (the Missouri Assessment Program or MAP) data for students in the schools that received their eMINTS funding from Title IID funds and from one other district that had teachers submit portfolios. EDC/CCT evaluators submitted a request for all Communication Arts (CA), Mathematics (MA), Science (SC), and Social Studies (SS) data from the specific schools to the Missouri Department of Elementary and Secondary Education, and they made these data available to EDC/CCT. In all, the MAP database contains data from 11,254 students in 40 schools from teachers that submitted portfolios (see Table 3). MAP data from students could not be used if it could not be matched to a roster from a participating, consent-giving teacher.

Table 3: Number of students with at least one MAP test, by program type, with number of schools that those students attended

Program Type	Number of Students	Number of Schools
eMINTS Comprehensive	2,119	26
eMINTS4ALL	2,074	22
eMINTS Veterans	152	5
non-eMINTS	6,066	21
Program data unavailable	155	3

TEACHER FOLLOW-UP INTERVIEWS

EDC/CCT evaluators conducted interviews with 16 randomly selected teachers in the spring after they completed the eMINTS program. The interviews were designed to focus the discussion around a specific artifact, the Lesson Plan that teachers submitted as part of their eMINTS portfolios. The teachers were asked about some of the core eMINTS instructional strategies, what they learned from eMINTS about these strategies, and whether the specific Lesson Plan under discussion made use of these strategies. The interview data were analyzed using Atlas TI qualitative analysis software.

Section III: Analyses and database creation

FREQUENCIES

For each complete set of data we had, we tabulated basic frequencies, first to identify any problems with the data, so that the data could be cleaned, and then to see what the results were for each form of data collection. Preliminary and descriptive analyses were also run to ensure the data from all sources were compiled and cleaned accurately. Preliminary analyses also provided rich information about each variable from the instructional specialists, teachers, and students; they created a context in which to understand the subsequent, more advanced analyses. The findings from the frequency analyses of the PD Fidelity data, the Classroom Visit data, the Teacher Technology Literacy Survey, and the Teacher Mastery data are presented in Section IV.

RELIABILITY AND FACTOR ANALYSES AND CREATION OF VARIABLES FOR ANALYSIS

Each set of data had to be analyzed in a unique way, not only to make findings from that specific dataset meaningful, but also to prepare that dataset for integration into a comprehensive database that would allow for more complex analyses. In most cases, this meant that numerous data points had to be consolidated into a more comprehensive variable that could then be integrated into a larger database for complex analyses. For example, scores for the many different items on the Lesson Plan rubric had to be consolidated into a single cumulative Lesson Plan Mastery score. This section describes processes and analyses used for each dataset.

PD FIDELITY

In the process of creating the PD Fidelity instruments, EDC/CCT evaluators and eMINTS staff worked to identify key constructs that eMINTS program developers believed characterize a faithful, high-quality eMINTS professional development experience, based on program theory of eMINTS. The constructs identified were:

- Program Logistics and Planning
- Modeling Instruction
- Community Building
- Technology Utilization
- Connection to Practice
- Inquiry-Based Learning

When we created the Checklist and Snapshot instruments, we made sure to include multiple items that represented different aspects of each of these constructs.

After the professional development observation data were collected, EDC/CCT evaluators conducted a reliability analysis (shown in Table 4), using Cronbach's alpha⁴, on the items in each category of the Snapshot and Checklist instruments. This would demonstrate whether the items that we determined to be related fell reliably into one group or type of item. Before doing this analysis, we reviewed the frequencies for the Checklist items and removed any items that had very little variation (less than 20% or more than 80% of responses as 'yes') from the reliability analysis. Eleven of 37 items were removed. The reliability analysis indicated the following reliability for the items that comprised the different constructs, with .6 and higher being the standard cutoff for reliability:

Table 4: Reliability of Checklist constructs

Construct	Reliability
Program Logistics and Planning	.384
Modeling Instruction	not enough items after reduction
Community Building	.517
Technology Utilization	.608
Connection to Practice	.478
Inquiry-Based Learning	.709

It is important to remember that, because the Checklist was filled out only once per professional development session, the entire database includes only 50 data points per item. With few data points and only a single measure, with only 'yes' or 'no' answers, there is low variability, and finding high reliability across only 4 to 7 items is unlikely, even with related items. Technology Utilization and Inquiry-Based Learning were the only two constructs that could be considered highly reliable for the Checklist. We did not use the Checklist data in any subsequent analyses. Despite the lack of reliability for some of the constructs, however, the item-by-items frequencies still provide useful information about the specific instructional techniques that instructional specialists are using in the workshops and the kind of instruction teacher participants are experiencing.

We then engaged in the same process with the Snapshot data. Because the Snapshot instrument had observers record what was happening every 15 minutes, it included 16 data points for every item, which created a larger dataset to work with than the Checklist. The Snapshot items were summed and averaged across the number of

⁴ Cronbach's alpha is a measure of reliability that varies between 0 and 1 and increases as the correlations between the items increase.

Snapshots taken. For example, if item 1 was marked ‘yes’ on 8 out of 10 Snapshots taken by an observer, that instructional specialist received 0.8 for that item. This allowed for much more variability than the 0’s and 1’s utilized by the one-time Checklist.

We first removed the items with low variability (since there was more variability, only items with less than 15% or more than 85% of responses as ‘yes’). Thirteen of 44 items were removed. We then ran a reliability analysis on the remaining items in each category, (shown in Table 5), with .6 again indicating a reliable construct.

Table 5: Reliability of Snapshot theory-based constructs

Construct	Reliability
Program Logistics and Planning	not enough items after reduction
Modeling Instruction	.405
Community Building	.707
Technology Utilization	.600
Connection to Practice	.689
Inquiry-Based Learning	.784

The Snapshot reliability analysis determined that four of the six theory-based constructs created by eMINTS program staff and EDC/CCT evaluators were statistically reliable. These four factors could then reliably represent the constructs they were intended to represent in further analyses that look at the relationship between PD Fidelity and Teacher Mastery and student outcomes. Although Modeling Instruction did not have high internal reliability as a construct, this is probably because, once items with low variation were removed, the construct comprised only four items. It does not mean that the construct is not meaningful. Therefore, we still included the factor in later analyses because the items that comprise Modeling Instruction are important aspects of the professional development and have face validity. An overall fidelity measure, Program Construct Fidelity, was computed by averaging all of the composite scores for all of the original theory-based snapshot constructs.

The following boxes list theory-based constructs and the individual Snapshot items comprising them. Item numbers indicate placement on the original instrument.

Modeling Instruction
1. Facilitator is presenting session content
2. Facilitator is introducing, giving directions for, or summing up an activity
3. Facilitator is working with groups of participants/individual participants on tasks and activities
5. Facilitator is asking open-ended questions

Community Building
17. Facilitator is encouraging participants to answer each other's questions
36. Participants are asking questions of peers/facilitator
37. Participants are answering each other's questions
38. Participants are working independently
39. Participants are sharing ideas, resources
40. Participants are working in cooperative groups
41. Participants are engaging in community building

Technology Utilization
24. Facilitator is modeling ways to communicate information with technology
25. Facilitator is modeling use of eMINTS resources as instructional tools
27. Facilitator is using technology (e.g., SMART Board™) to facilitate discussions or present session materials
42. Participants are using technology for activities or research
43. Participants are using technology for presentations or to create materials

Connection to Practice
8. Facilitator is encouraging reflection on teaching practices and experiences
9. Facilitator is connecting session topic to practice
11. Facilitator is using examples from his/her observations of participants' classroom teaching
12. Facilitator is providing examples of assessment tools, Lesson Plans, activities, or resources for classroom use
29. Participants are connecting session topic to their practice
30. Participants are engaged in an activity or working on a lesson related to content of session
31. Participants are reflecting on what they are learning in the session

Inquiry-Based Learning
13. Facilitator is engaging participants in activities that enable them to formulate questions to drive lesson/activity
14. Facilitator is engaging participants in activities that enable them to investigate their questions

15. Facilitator is presenting resources and strategies for effective exploration and research
16. Facilitator is engaging participants in activities that enable them to analyze or synthesize what they have found through their research
32. Participants are developing their own questions to investigate
33. Participants are gathering information from a variety of resources
34. Participants are analyzing or synthesizing information that they have gathered
35. Participants are presenting information

We then ran an exploratory factor analysis on the Snapshot items to identify whether another set of factors representing PD Fidelity could be found in the data. Again, we removed 13 out of 44 items because of low variability. Principal axis factoring⁵ was performed using oblimin rotation⁶ on all items. The factor analysis produced five groupings of related items. EDC/CCT evaluators reviewed each group of items. Table 6 presents the five factor names given to the item sets, followed by their reliability levels.

Table 6: Reliability for Snapshot Factor Analysis-Based Constructs

Factors	Reliability
Structured Activities	.530
Participant-Led Discussion	.715
Scaffolding Instruction	.828
Facilitating Discussion	.823
Active Work/Learning	.795

The following boxes list theory-based constructs and the individual Snapshot items comprising them. Item numbers indicate placement on the original instrument.

Structured Activities
11. Facilitator is using examples from his/her observations of participants' classroom teaching
31. Participants are reflecting on what they are learning in the session
35. Participants are presenting information
40. Participants are working in cooperative groups

⁵ Principal axis factoring is a type of principal components analysis that looks for a combination of items that explains the maximum proportion of the variance of those items. This leads to factors that have the strongest reliability.

⁶ Oblimin rotation is the standard method of factoring when one wishes to find a solution that allows the factors to be correlated (a non-orthogonal solution). This allows the analysis to consider all possible combinations of items in determining factors.

Participant-Led Discussion
36. Participants are asking questions of peers/facilitator
39. Participants are sharing ideas, resources
41. Participants are engaging in community building
37. Participants are answering each other's questions
38. Participants are working independently

Scaffolding Instruction
15. Facilitator is presenting resources and strategies for effective exploration and research
27. Facilitator is using technology (e.g., SMART Board™) to facilitate discussions or present session materials
1. Facilitator is presenting session content
9. Facilitator is connecting session topic to practice
24. Facilitator is modeling ways to communicate information with technology
2. Facilitator is introducing, giving directions for, or summing up an activity
12. Facilitator is providing examples of assessment tools, Lesson Plans, activities, or resources for classroom use

Facilitating Discussion
5. Facilitator is asking open-ended questions
8. Facilitator is encouraging reflection on teaching practices and experiences
17. Facilitator is encouraging participants to answer each other's questions
29. Participants are connecting session topic to their practice

Active Work/Learning
3. Facilitator is working with groups of participants/individual participants on tasks and activities
13. Facilitator is engaging participants in activities that enable them to formulate questions to drive lesson/activity
16. Facilitator is engaging participants in activities that enable them to analyze or synthesize what they have found through their research
30. Participants are engaged in an activity or working on a lesson related to content of session
32. Participants are developing their own questions to investigate
33. Participants are gathering information from a variety of resources
34. Participants are analyzing or synthesizing information that they have gathered
42. Participants are using technology for activities or research
43. Participants are using technology for presentations or to create materials

An overall fidelity measure, called Factor Analysis-Based Fidelity (FA-Based Fidelity), was computed by averaging all of the composite scores for these factors. This overall fidelity measure and the individual factors are used in further analyses of Teacher Mastery, Classroom Visits, and student impact.

CLASSROOM VISITS

Instructional specialists visited their teacher participants up to 10 times over the school year and recorded in a spreadsheet the amount of time (minutes) they spent assisting teachers in each of the following areas: Modeling Instruction, Lesson Planning, Technology Assistance, Reflective Practice, Problem Solving, and other.

In order to compare across all cases the kind of support received by teachers from their instructional specialists, EDC/CCT evaluators summed for each teacher the number of minutes spent in each area across visits and then divided by the total number of minutes spent in visitation, to obtain the percentage of time the instructional specialist spent assisting the teacher in a particular area.⁷ The number of visits made to each teacher by the instructional specialist provided another variable for analysis.

TEACHER TECHNOLOGY LITERACY SURVEY

To prepare the Teacher Technology Literacy Survey data to be included in the combined analyses of all the datasets, EDC/CCT evaluators made composite variables out of sets of items. For example one question presented respondents with statements about challenges they may have encountered in using technology in their teaching and asked them to rate their level of agreement. Certain questions were reverse-coded because the statements were positively and negatively phrased. Factor analysis⁸ was performed on all of the items in that question, to determine if certain challenges were related to each other. The analysis indicated that two sets of items grouped together. One set included items associated with technology access, such as, 'An adequate number of computers were available,' and another set were associated with support issues, such as, 'I have had adequate technical support.' Thus scores were obtained for **computer challenge issues** and **support challenge issues** by taking the average of the responses for each, respectively.

The two variables created from the Teacher Technology Literacy Survey, here on referred to as Computer Issues and Support Issues, were used in further analyses discussed below.

⁷ For example, if 415 minutes across the visits were spent in helping the teacher model instruction and the total number of minutes in visitation was 2502, then the percentage of time spent in that area was 16.6%.

⁸ Specifically, principal axis factoring with oblimin rotation^{5,6}.

TEACHER MASTERY

EDC evaluators computed Teacher Mastery scores for each artifact (Lesson Plan, WebQuest, Classroom Website) by totaling the scores from each rubric for every teacher. The Lesson Plan rubric had a total of 21 items, each with a low score of 1, a medium score of 2, and a high score of 3, for a range of 21–63 points. Both the WebQuest and Classroom Website rubrics had a total of 17 items each with the same 1–3 scoring system, for a range of 17–51 for each of these artifacts. The overall Teacher Mastery scores were then used in further analyses described below.

CREATION OF THE COMPREHENSIVE eMINTS DATABASE

BUILDING THE FULL TEACHER DATABASE

The full teacher database was built by merging data from four databases. The Classroom Visit (CV) database was chosen as the starting database into which the other three sets—Teacher Mastery (TM), Teacher Survey (TS), and PD Fidelity Snapshot (SS)—would be merged, as it contained the most teacher-level data.

To begin, we decided to merge the TS data into the CV database. Within the survey database, one dummy-coded variable stood for both years (1, 2) and both eMINTS programs (4ALL, Comp PD). That variable was parsed out into two separate year and program variables using syntax. The TS data were then merged into the CV database using menu commands and matching by teacher code. Teacher names, districts, year, and program were double-checked to ensure the merge was successful. This merged database will now be referred to as the full database.

The TM database did not yet include teacher codes, so we merged the teacher code variable from the full database by matching last and first names of teachers. As a number of teachers had TM data but no CV or TS data, some teacher names were left over with no codes attached. The missing codes were filled in by matching teachers and codes from a prior database. Since the program variable in the TM database was dummy-coded, this coding was transformed to “4ALL” or “Comp PD.” The TM database was then merged into the full database by matching teacher code. The names of instructional specialists, teachers, and districts were double-checked to make sure the merge was successful.

The SS database was the last to be merged. Year and program variables were rewritten to the standardized form included in the other databases (“4ALL” and “Comp PD”). Instructional specialist names were also not standardized, so that variable was rewritten to match the instructional specialist name form in the other databases as well. Upon doing this, we found that there were some teachers in the full database that did not have an instructional specialist name attached—these were teachers who had TS data and not CV data. To rectify the missing instructional specialist names, we consulted the spreadsheet that listed the teacher assignment to each instructional specialist. We double-checked teacher assignment to instructional specialist for each teacher listed in the database.

In the SS database, some instructional specialists had multiple observations. These scores were simply averaged together so each instructional specialist or pair of instructional specialists had one overall fidelity score. If an instructional specialist had multiple scores, but they were for different types of program (e.g., one observation for eMINTS Comp PD and one for eMINTS4ALL; or one for Year 1 teachers and one for Year 2 teachers), then those were left separate. Teachers in the

instructional specialist's complete scores would be matched with the fidelity observation(s) from that instructional specialist's complete observation, and vice versa. The SS database was then imported, matching by instructional specialist, year, and type of eMINTS program, so that each teacher was paired with the appropriate fidelity scores from his or her instructional specialist.

The overall database was then checked to ensure that all importing was successful and all teacher and instructional specialist data corresponded appropriately. All variables were standardized (e.g., ensuring school names were spelled the same each time) so that statistics could be cleanly run. Once the database was complete, all teacher and instructional specialist names were removed and replaced with codes, preserving confidentiality.

BUILDING THE FULL STUDENT DATABASE

The full student database was built by merging teacher and instructional specialist information into a database with all student MAP scores. Students with at least one MAP score (out of Communication Arts, Mathematics, Science, and Social Studies) from grades 3 through 8 were included in the database. Only students on the rosters we received from the participating districts were included.

In the student database, students were matched with their teacher's code and the teacher's instructional specialist's code. All teacher and instructional specialist information was imported (via matching the teacher and instructional specialist codes) to align with each student, so that statistics could be run to determine any relationship between teacher and instructional specialist variables and MAP scores. Once the database was assembled, it was cleaned and checked for importing accuracy. Student names were removed and replaced with codes to preserve confidentiality.

ANALYSIS OF THE FULL TEACHER DATABASE AND FULL STUDENT DATABASE

Descriptive and preliminary analyses were run first to determine the variability and basic statistics of each measure and to lay a contextual foundation for more-advanced analyses. Descriptive statistics were utilized for the following:

- Analyzing the Checklist items
- Analyzing the Snapshot items
- Analyzing what teachers and instructional specialists are spending their time on during the Classroom Visits, as well as how many visits are taking place, and whether any of this varies by year, program, or eMINTS staff vs. PD4ETS
- Analyzing Teacher Mastery artifacts and individual items on each rubric

- Looking at program participation across districts

Correlations were run among teacher variables to determine relationships within the teacher level. They were also run to determine relationships across teacher, instructional specialist, and student variables. Specifically, correlations were run to analyze relationships between:

- PD Fidelity and Teacher Mastery
- PD Fidelity and the Teacher Technology Literacy Survey
- Teacher Mastery and Classroom Visits
- Classroom Visits and PD Fidelity
- Program and teacher findings and student MAP scores

Analysis-of-variance tests were also run to analyze differences between eMINTS staff and external instructional specialists and to look at differences in outcome measures across program year and type. These tests were run for:

- Comparing the Checklist items for eMINTS staff vs. PD4ETS
- Comparing the Snapshot items for eMINTS staff vs. PD4ETS
- Comparing the Classroom Visits across program, year, and eMINTS staff vs. PD4ETS
- Examining covariates of student MAP scores
- Analyzing the relationship between Teacher Mastery and student MAP scores
- Analyzing the relationship between PD Fidelity and student MAP scores
- Analyzing the relationship between Classroom Visits and student MAP scores

Lastly, where appropriate, regression analyses were run to predict student outcomes while controlling for appropriate student covariates. Analysis was run to:

- Analyze the relationship between PD Fidelity and Teacher Mastery
- Analyze the relationship between program and teacher findings and student MAP scores

Section IV: Findings

PD FIDELITY

The first step in the process of this multi-layered exploration of the eMINTS program was to understand whether the program is being implemented with fidelity. The two observation instruments were designed to capture different kinds of information about PD Fidelity. The Checklist, which is completed only once during a professional development session, contains items that program designers would expect to see at least once during a faithful, high-quality eMINTS professional development session.

Table 7 shows the percentage of times across all professional development sessions that each item occurred. For example, the second item down, “Consistently engaged all participants,” occurred in 92.0% of all sessions observed. The information in the table is organized by construct, with each item listed that loads onto that construct.

Table 7: Percentage of professional development sessions in which key activities from the Checklist occurred

Construct	Item	Percent (%)
Modeling Instruction	3. Presented the sessions' essential question/goals at the beginning of the session	84.0
	5. Consistently engaged all participants	92.0
	10. Reviewed session goals and/or essential question and tied it to the session's content	60.0
Technology Utilization	4. Focused primarily on technology and not on its integration into teaching	6.0
	7. Used own technology-integrated lessons/artifacts	48.0
	16. Used technology to engage in lessons/activities/presentations	88.0
	23. Discussed online tools and resources that support instructional practice	66.0
	24. Discussed challenges of integrating technology into classroom practice	58.0
	26. Discussed how technology can be used to support community building	12.0
	30. Discussed how technology can be used to support inquiry-based learning	52.0

Community Building	8. Was respectful toward participants	100.0
	9. Used deliberate strategies to group participants	46.0
	17. Engaged in collaborative group work	86.0
	18. Engaged in whole-group discussion	92.0
	25. Discussed techniques for community building	18.0
	26. Discussed how technology can be used to support community building	12.0
	27. Discussed techniques for collaborative learning	22.0
	28. Discussed the challenges of classroom use of collaborative learning techniques	16.0
	29. Discussed meeting the needs of diverse learners	40.0
Connection to Practice	6. Allowed time for participants to discuss, reflect, and share	98.0
	11. Debriefed participants on the session's activities and their implementation in the classroom	66.0
	15. Engaged in or created a lesson/activity that could be used with students	86.0
	22. Reflected on what they learned in the session	80.0
	34. Discussed the integration of higher-order thinking skills in lesson and activity planning	46.0
	35. Discussed alternative assessment strategies (rubrics, portfolios, performances-based assessment)	26.0
	36. Discussed the role of assessment in shaping instruction	24.0
	37. Discussed how to apply what they learned in the session to their own practice	90.0
Inquiry-Based Learning	19. Developed questions to drive exploration/research	52.0
	20. Engaged in exploration/research	68.0
	21. Analyzed and synthesized what they learned	80.0
	30. Discussed how technology can be used to support	52.0
	31. Discussed techniques for IBL inquiry-based learning	32.0
	32. Discussed the challenges of integrating inquiry-based learning into classroom practice	32.0
	33. Discussed how session topic can support inquiry-based learning	44.0

Program Logistics and Planning	1. Provided a session agenda (online or paper)	92.0
	2. Verifying that equipment is fully functioning	88.0
	12. Arranged for meals/food	86.0
	13. Ended the session on time	86.0
	14. Returned facility to its original state	86.0

These findings for the Checklist data indicate that, for many of the key eMINTS instructional strategies—such as engaging “in collaborative group work,” having “time for participants to reflect, discuss, and share,” engaging in or creating “a lesson/activity that can be used with students,” and connecting “the session topic to participants’ practice”—there is a high level of fidelity across the professional development sessions. However, some instructional approaches, particularly the explicit discussions around Community Building and Inquiry-Based Learning, are not occurring in the majority of sessions. The Checklist frequencies suggest that eMINTS instructional specialists are, overall, well-prepared to model the kind of instruction eMINTS advocates, but may need extra support and professional development in engaging participants in explicit discussions about some of the instructional strategies and techniques that are integral to the eMINTS approach to teaching and learning.

We also examined the Checklist data by whether the instructional specialist was an eMINTS staff member or was a participant or graduate of the PD4ETS program (see Table 8). We found that there were no significant differences between the PD4ETS participants and graduates and the eMINTS staff on any of the Checklist items except one, “used deliberate strategies to group participant.” eMINTS staff engaged in this practice significantly more than their PD4ETS counterparts.

Table 8: Proportion of professional development sessions in which key activities from the Checklist occurred, by staff and PD4ETS

Item	Staff	PD4EST
	Mean (SD)	Mean (SD)
1. Provided a session agenda (online or paper)	.86 (.35)	.96 (.19)
2. Verified that equipment is fully functioning	.91 (.29)	.86 (.36)
3. Presented the sessions' essential question/goals at the beginning of the session	.86 (.35)	.82 (.39)
4. Focused primarily on technology and not on its integration into teaching	.09 (.29)	.04 (.19)
5. Consistently engaged all participants	.91 (.29)	.93 (.26)

6. Allowed time for participants to discuss, reflect, and share	1.00 (.00)	.96 (.19)
7. Used own technology-integrated lessons/artifacts	.55 (.51)	.43 (.50)
8. Was respectful toward participants	1.00 (.00)	1.00 (.00)
9. Used deliberate strategies to group participants	.68 (.48)	.29 (.46)
10. Reviewed session goals and/or essential question and tied it to the session's content	.68 (.48)	.54 (.51)
11. Debriefed participants on the session's activities and their implementation in the classroom	.64 (.49)	.68 (.48)
12. Arranged for meals/food	.86 (.35)	.86 (.36)
13. Ended the session on time	.86 (.35)	.86 (.36)
14. Returned facility to its original state	.86 (.35)	.86 (.36)
15. Engaged in or created a lesson/activity that could be used with students	.91 (.29)	.82 (.39)
16. Used technology to engage in lessons/activities/presentations	.91 (.29)	.86 (.36)
17. Engaged in collaborative group work	.96 (.21)	.79 (.42)
18. Engaged in whole-group discussion	.91 (.29)	.93 (.26)
19. Developed questions to drive exploration/research	.55 (.51)	.50 (.51)
20. Engaged in exploration/research	.72 (.46)	.64 (.49)
21. Analyzed and synthesized what they learned	.86 (.35)	.75 (.44)
22. Reflected on what they learned in the session	.77 (.43)	.82 (.39)
23. Discussed online tools and resources that support instructional practice	.59 (.50)	.71 (.46)
24. Discussed challenges of integrating technology into classroom practice	.55 (.51)	.61 (.50)
25. Discussed techniques for community building	.27 (.46)	.11 (.32)
26. Discussed how technology can be used to support community building	.14 (.35)	.11 (.32)
27. Discussed techniques for collaborative learning	.23 (.43)	.21 (.42)
28. Discussed the challenges of classroom use of collaborative learning techniques	.23 (.43)	.11 (.32)
29. Discussed meeting the needs of diverse learners	.36 (.49)	.43 (.51)
30. Discussed how technology can be used to support inquiry-based learning	.46 (.51)	.57 (.51)
31. Discussed techniques for inquiry-based learning	.32 (.48)	.32 (.48)
32. Discussed the challenges of integrating inquiry-based learning into classroom practice	.32 (.48)	.32 (.48)
33. Discussed how session topic can support inquiry-based learning	.50 (.51)	.40 (.50)
34. Discussed the integration of higher-order thinking skills in lesson and activity planning	.41 (.50)	.50 (.51)
35. Discussed alternative assessment strategies (rubrics, portfolios, performances-based assessment)	.23 (.43)	.29 (.46)

36. Discussed the role of assessment in shaping instruction	.27 (.46)	.21 (.42)
37. Discussed how to apply what they learned in the session to their own practice	.82 (.40)	.96 (.19)

The Snapshot instrument was designed to capture information not only about what happened during a professional development session, but also about how often certain things happened. The Snapshot instrument, completed up to 16 times in a four-hour session, contains items that program designers would expect to see frequently during a faithful, high-quality eMINTS professional development session.

Table 9 presents data showing the frequency with which the activities described in the Snapshot occurred during professional development sessions. For each instructional specialist, the number of times each Snapshot item was checked off (observed in a session) was divided by the total number of Snapshots taken during a session, resulting in the proportion of time the item was present across Snapshots. The minimum proportion of time is listed, along with the maximum proportion of time. The proportions for each instructional specialist were also averaged, shown in the “Mean” column with the standard deviation in parenthesis.

For example, the eighth item down, “Encouraging reflection on teaching practices and experiences”, occurred in a professional development session at a minimum 0% of the time and at a maximum 45% of the time. The average proportion of time the item occurred across Snapshots was 17%, with a standard deviation of 15%.

Table 9: Proportion of Snapshots that recorded various activities as occurring

Item	Min	Max	Mean (SD)
1. Presenting session content	.00	.50	.20 (.13)
2. Introducing, giving directions for, or summing up an activity	.07	.55	.30 (.14)
3. Working with groups of participants/individual participants on tasks and activities	.08	.70	.41 (.18)
4. Connecting session topic to other eMINTS training sessions	.00	.08	.02 (.03)
5. Asking open-ended questions	.00	.46	.23 (.15)
6. Asking questions to which he/she knows the answer	.00	.17	.02 (.05)
7. Providing a “brain break” for participants	.00	.23	.03 (.06)
8. Encouraging reflection on teaching practices and experiences	.00	.45	.17 (.15)
9. Connecting session topic to practice	.00	.82	.22 (.19)
10. Connecting session topic and educational standards	.00	.08	.005 (.02)
11. Using examples from observations of participants’ classroom teaching	.00	.09	.02 (.04)

12. Providing examples of assessment tools, Lesson Plans, activities, or resources for classroom use	.00	.36	.12 (.12)
13. Engaging participants in activities that enable them to formulate questions to drive lesson/activity	.00	.27	.09 (.10)
14. Engaging participants in activities that enable them to investigate their questions	.00	.45	.07 (.13)
15. Presenting resources and strategies for effective exploration and research	.00	.27	.04 (.08)
16. Engaging participants in activities that enable them to analyze or synthesize what they have found through their research	.00	.45	.08 (.13)
17. Encouraging participants to answer each other's questions	.00	.45	.13 (.14)
18. Limiting participant discussion or input	.00	.07	.005 (.02)
19. Facilitating the sharing of ideas and experiences	.00	.55	.25 (.14)
20. Discussing effective techniques of classroom community building	.00	.09	.006 (.02)
21. Ignoring conflicts among group members	.00	.00	.00 (.00)
22. Allowing an individual(s) to dominate conversation or intimidate others	.00	.36	.02 (.09)
23. Showing frustration with technology	.00	.00	.00 (.00)
24. Modeling ways to communicate information with technology	.00	.21	.08 (.07)
25. Modeling use of eMINTS resources as instructional tools	.00	.29	.06 (.09)
26. Presenting technology irrelevant to session's content and/or to classroom utilization (other than a "brain break")	.00	.07	.005 (.02)
27. Using technology (e.g., SMART Board™) to facilitate discussions or present session materials	.00	.82	.29 (.22)
28. Participants are expressing their confusion about a task/activity they are asked to do.	.00	.14	.03 (.05)
29. Participants are connecting session topic to their practice.	.00	.73	.27 (.19)
30. Participants are engaged in an activity or working on a lesson related to content of session.	.00	1.0	.50 (.28)
31. Participants are reflecting on what they are learning in the session.	.00	.46	.14 (.11)
32. Participants are developing their own questions to investigate.	.00	.15	.02 (.05)
33. Participants are gathering information from a variety of resources.	.00	.40	.09 (.11)
34. Participants are analyzing or synthesizing information they have gathered.	.00	.55	.14 (.15)
35. Participants are presenting information.	.00	.27	.09 (.08)
36. Participants are asking questions of peers/facilitator.	.07	.64	.40 (.17)
37. Participants are working independently.	.00	.75	.32 (.21)
38. Participants are answering each other's questions.	.00	.58	.32 (.18)
39. Participants are sharing ideas, resources.	.00	.67	.31 (.20)
40. Participants are working in cooperative groups.	.00	.42	.20 (.15)

41. Participants are engaging in community building.	.00	.14	.05 (.06)
42. Participants are using technology for activities or research.	.00	.85	.31 (.25)
43. Participants are using technology for presentations or to create materials.	.00	.38	.13 (.14)
44. Participants are sharing non-educational technological resources or tools.	.00	.07	.005 (.02)

Because the Snapshot instruments record what happens throughout the entire professional development session, and because the eMINTS professional development sessions have many different kinds of activities happening over the four hours, no single activity is likely to occur a majority of the time. In the frequencies for the Checklist, percentages in the 80's and 90's indicate a high level of fidelity across observations because the Checklist presents binary findings—the activity either happened or did not. The Snapshot frequencies show not only whether something happened but how often. Each item is more meaningful when looked at in relation to the other items. For example, the fact that the instructional specialists spent 20% of the time presenting session content is more meaningful when contrasted with the finding that instructional specialists were working with groups of participants on activities 41% of the time, that participants were working on an activity or lesson 50% of the time, and that participants were presenting information 27% of the time. These four statistics viewed together present an interesting picture of eMINTS professional development sessions. One-fifth of the time, on average, instructional specialists provided content information to participants, and they spent twice as much time working with participants in small groups. Participants spent half of their time in the sessions engaged in a lesson or activity; during most of that time the instructional specialists were working with them, and a quarter of the time they were presenting information themselves. This balance between instructional specialist and participant presentations and engagement by participants in facilitated activities, is consistent with the eMINTS approach to professional development and instruction.

These frequencies show that many other of the core components of the eMINTS model were being implemented regularly. Forty percent of the time participants were asking questions of their peers or the facilitator, and 32% of the time they were answering each other's questions, which suggests that a lot of back and forth discussion was taking place, rather than lecturing. In addition, frequencies were very low on the negative items, such as "limiting participants' discussion or input" or "showing frustration with technology." However, the Snapshot frequency data suggest that instructional specialists were spending less time on some key instructional practices, such as Community Building and using the techniques of Inquiry-Based Learning, like having participants develop their own questions, gather information, and analyze and synthesize that information.

We also compared the level of fidelity, as determined by the Snapshot data, for eMINTS staff and for participants and graduates of the PD4ETS program, using a multivariate analysis of variance⁹. Table 10 presents the item-by-item Snapshot means and standard deviations for staff and for PD4ETS participants and graduates. The F statistic shows whether there was a significant difference between the two groups on how often that particular item was present. These findings show that, on most Snapshot items, there were no significant differences between staff and PD4ETS participants and graduates. Where they do differ, PD4ETS participants and graduates often engaged in those practices associated with the eMINTS model with greater frequency than staff, indicating that the PD4ETS program is preparing them to deliver the eMINTS professional development with a high level of fidelity.

Table 10: Proportion of Snapshots that recorded various activities as occurring, by staff and PD4ETS

Item	Staff	PD4ETS	F
	Mean (SD)	Mean (SD)	
1. Presenting session content	.14 (.12)	.22 (.15)	4.07**
2. Introducing, giving directions for, or summing up an activity	.25 (.16)	.29 (.12)	ns
3. Working with groups of participants/individual participants on tasks and activities	.32 (.21)	.43 (.22)	3.38*
4. Connecting session topic to other eMINTS training sessions	.02 (.03)	.04 (.06)	ns
5. Asking open-ended questions	.21 (.15)	.22 (.13)	ns
6. Asking questions to which he/she knows the answer	.03 (.05)	.01 (.04)	2.98*
7. Providing a “brain break” for participants	.02 (.04)	.02 (.06)	ns
8. Encouraging reflection on teaching practices and experiences	.13 (.14)	.14 (.12)	ns
9. Connecting session topic to practice	.18 (.18)	.24 (.16)	ns
10. Connecting session topic and educational standards	.02 (.05)	.01 (.02)	ns
11. Using examples from his/her observations of participants’ classroom teaching	.05 (.07)	.02 (.06)	ns
12. Providing examples of assessment tools, Lesson Plans, activities, or resources for classroom use	.08 (.10)	.10 (.10)	ns
13. Engaging participants in activities that enable them to formulate questions to drive lesson/activity	.04 (.07)	.11 (.11)	6.33**
14. Engaging participants in activities that enable them to investigate their questions	.05 (.11)	.07 (.11)	ns
15. Presenting resources and strategies for effective exploration and research	.02 (.06)	.04 (.09)	ns

⁹ Multivariate analysis of variance is a statistical test that allows for comparisons between one or more groups across several different measures.

16. Engaging participants in activities that enable them to analyze or synthesize what they have found through their research	.06 (.11)	.07 (.10)	ns
17. Encouraging participants to answer each other's questions	.09 (.12)	.11 (.11)	ns
18. Limiting participant discussion or input	.00 (.02)	.00 (.01)	ns
19. Facilitating the sharing of ideas and experiences	.23 (.14)	.25 (.11)	ns
20. Discussing effective techniques of classroom community building	.02 (.04)	.01 (.02)	ns
21. Ignoring conflicts among group members	.00 (.00)	.00 (.00)	ns
22. Allowing an individual(s) to dominate conversation or intimidate others	.00 (.00)	.01 (.07)	ns
23. Showing frustration with technology	.01 (.02)	.01 (.06)	ns
24. Modeling ways to communicate information with technology	.05 (.06)	.08 (.09)	ns
25. Modeling use of eMINTS resources as instructional tools	.04 (.06)	.04 (.06)	ns
26. Presenting technology irrelevant to session's content and/or to classroom utilization (other than a "brain break")	.01 (.03)	.00 (.02)	ns
27. Using technology (e.g., SMART Board™) to facilitate discussions or present session materials	.17 (.20)	.26 (.22)	ns
28. Participants are expressing their confusion about a task/activity they are asked to do.	.02 (.04)	.02 (.05)	ns
29. Participants are connecting session topic to their practice.	.23 (.17)	.30 (.16)	ns
30. Participants are engaged in an activity or working on a lesson related to content of session.	.33 (.26)	.51 (.29)	4.91**
31. Participants are reflecting on what they are learning in the session.	.14 (.16)	.12 (.10)	ns
32. Participants are developing their own questions to investigate.	.04 (.08)	.04 (.08)	ns
33. Participants are gathering information from a variety of resources.	.10 (.11)	.10 (.12)	ns
34. Participants are analyzing or synthesizing information they have gathered.	.08 (.13)	.12 (.11)	ns
35. Participants are presenting information.	.10 (.11)	.08 (.09)	ns
36. Participants are asking questions of peers/facilitator.	.35 (.21)	.43 (.15)	2.81*
37. Participants are working independently.	.32 (.23)	.37 (.21)	ns
38. Participants are answering each other's questions.	.29 (.22)	.37 (.19)	ns
39. Participants are sharing ideas, resources.	.34 (.22)	.40 (.20)	ns
40. Participants are working in cooperative groups.	.24 (.16)	.22 (.20)	ns
41. Participants are engaging in community building.	.06 (.07)	.06 (.09)	ns

42. Participants are using technology for activities or research.	.19 (.18)	.32 (.22)	5.20**
43. Participants are using technology for presentations or to create materials.	.18 (.15)	.14 (.17)	ns
44. Participants are sharing non-educational technological resources or tools.	.02 (.03)	.00 (.00)	10.76**

*p < .05 **p < .01 ns = not significant

CLASSROOM VISITS

Analysis of the Classroom Visit data indicates that eMINTS instructional specialists spent the largest amount of their Classroom Visit time supporting teachers in Lesson Planning and Modeling Instructional strategies. This held true for both years of the professional development and both the eMINTS Comp PD and eMINTS4ALL programs. Year 1 eMINTS4ALL instructional specialists also spent a large amount of time on reflection. Table 11 presents the average percentage of time spent in each area by instructional specialists during Classroom Visits, broken down by year and program. The first column gives the mean percent time spent in each area, along with the standard deviation (SD) in parentheses, in the eMINTS4ALL program in Year 1. The second column presents those data for teachers in the eMINTS Comp PD program in Year 1, and next two columns represent those programs in Year 2.

Table 11: Percentage of time spent on different activities during Classroom Visits, by program and year

	Year 1 - 4All	Year 1 - Comp	Year 2 – 4All	Year 2 – Comp
Topic Area	Mean % (SD)	Mean % (SD)	Mean % (SD)	Mean % (SD)
Modeling Instruction	21 (19)	17 (12)	35 (21)	23 (20)
Lesson Planning	30 (22)	39 (19)	27 (17)	32 (23)
Technology Assistance	10 (13)	13 (11)	16 (14)	15 (13)
Reflective Practice	26 (31)	15 (13)	12 (10)	13 (10)
Problem Solving	13 (10)	13 (13)	6 (9)	10 (11)
Other	1 (4)	4 (9)	5 (10)	8 (10)

The eMINTS Comp PD program requires more Classroom Visits than the eMINTS4ALL program, as evidenced in Table 12. The data indicate eMINTS Comp PD Year 1 teachers received an average of two more visits per year than eMINTS Comp PD Year 2 participants.

Table 12: Average number of Classroom Visits, by program and year

Group	Mean Number of Visits to Teachers (SD)
Year 1 – 4All	3.87 (1.9)
Year 1 – Comp	9.81 (2.7)
Year 2 – 4All	4.08 (1.1)
Year 2 – Comp	7.79 (2.8)

We also looked to see if the PD4ETS participants and graduates and eMINTS staff were doing similar things during their Classroom Visits, and if they made a comparable number of visits over the year. We found that the eMINTS staff were doing more Lesson Planning than their PD4ETS counterparts, in both eMINTS Comp PD and eMINTS4ALL (see Table 13). Meanwhile, PD4ETS participants and graduates doing eMINTS4ALL were engaging their teachers in more Reflective Activities than staff doing eMINTS4ALL; and PD4ETS participants and graduates doing eMINTS Comp PD were Modeling Instruction more than eMINTS staff. In both programs, the eMINTS staff conducted more visits to their teachers than PD4ETS participants and graduates.

Table 13: Percentage of time spent on different activities, and number of Classroom Visits by program and staff/PD4ETS

	eMINTS4ALL		eMINTS Comp	
	Staff	PD4ETS	Staff	PD4ETS
Modeling Instruction	25.6%	28.1%	16.3%	25.8%
Lesson Planning	38.0%	22.0%	39.9%	26.6%
Technology Assistance	12.1%	13.1%	13.4%	15.4%
Reflective Practice	11.3%	23.9%	13.1%	14.6%
Problem Solving	10.3%	9.2%	13.4%	8.1%
Number of Visits	5.30	3.12	10.10	6.40

TEACHER MASTERY

We also analyzed the Teacher Mastery data generated from our review of the artifacts in teacher portfolios, using rubrics for each artifact. The rubrics evaluated the teacher work products (Lesson Plans, WebQuests, and Classroom Websites) on a 1–3 scale, with 1 reflecting low-quality work and 3 high-quality work. Our analysis of the Teacher Mastery data indicated that, overall, teachers scored highest on the

WebQuest artifact (see Table 14). Their average total scores on this artifact were 40.74, based on 17 items; this means that teachers scored an average of 2.39 per item on their WebQuests, well above the medium quality score of 2. On the Lesson Plans, teachers overall scored just about at the medium level. The average total score on the Lesson Plans was 41.45, based on 21 items; this means average of 1.97 per item. Teachers scored lowest on Classroom Websites. The average total score on the Classroom Website artifacts was 31.5, based on 17 items; this means an average of 1.85 per item.

Table 14: Average total and per-item scores on teacher portfolio artifacts

Artifact	# of items in rubric	Average total score	Average per-item score
Lesson Plan	21	41.45	1.97
WebQuest	17	40.74	2.39
Classroom Website	17	31.5	1.85

One possible reason for the differences in artifact quality is that WebQuests provide teachers with a pre-determined structure for planning an online investigation. A WebQuest has a distinct format that prescribes what should be included and how the lesson should be designed. In addition, there are many online examples of high-quality WebQuests that teachers can review. This level of structure may enable more teachers to meet the requirements for quality work stipulated in the rubric. The eMINTS program has a constructivist Lesson Plan template that also provides teachers with a structure for designing quality lessons, but it is less prescriptive than the WebQuest format and therefore results in more variation in quality across teachers. Although eMINTS participants take part in eMINTS PD sessions on how to create high-quality Classroom Websites that includes information about what kind of content and design elements are important, teachers have a great deal of flexibility in the websites they design, so there is a great deal of variation in their quality.

More interesting, perhaps, is an examination of the item-by-item frequencies for the three artifacts, which provide a greater level of detail about what concepts teachers have mastered and which they have not at the end of their eMINTS experience. The Lesson Plan scores suggest that teachers were skillful in articulating what students need to do to demonstrate their learning, connecting their lesson to the standards, requiring students to create an authentic end product, identifying learning goals, and using technology effectively. Where they struggled the most was again in designing the lesson to accommodate student diversity (in background, language, ability and learning style), articulating how students will share resources, having students generate questions to guide their learning, helping them plan their explorations, and helping them reflect on their learning.

The WebQuest scores show that teachers were most successful at sharing their assessment resources with the students and having clear assessment criteria that were connected to the lesson, providing a clear and coherent task and process for completing the task, and requiring students to be creative in the way they communicated their answer to the WebQuest lesson. The only items on which teachers performed poorly related to the use of deliberate grouping strategies (assigning students different roles in group projects), designing lessons to accommodate student diversity (providing students with options for different resources, processes, and end products), and concluding the lesson in a way that connects what they have learned to other lessons.

The Classroom Website scores indicate that teachers' websites were generally well designed and easy to navigate, and provided links to many high-quality resources. However, they often did not contain student work, information about or examples of assessments used in their teaching, or information about classroom policies.

RELATIONSHIP BETWEEN TEACHER MASTERY SCORES AND TEACHER FOLLOW-UP INTERVIEWS

As noted above in the Methods section, EDC evaluators conducted interviews with sixteen randomly selected participants in the spring after they completed their eMINTS professional development programs. Ten of the interviewees had completed the eMINTS Comprehensive professional development, and six had completed the eMINTS4ALL professional development. To focus our discussions with teachers on concrete ideas and instructional practices, we based our interviews on artifacts. The artifacts we chose as the anchor for our interviews were the Lesson Plans teachers submitted as part of their eMINTS portfolios. Though teachers were welcome to refer to other lessons or general practices in the interviews, the portfolio Lesson Plans gave us a common object around which to ground our discussion. Here we discuss the relationships between the findings from the Teacher Mastery analysis of the Lesson Plans and our analysis of the interview data regarding some of the key topics addressed in the eMINTS program. In many cases the interview data corroborate the Teacher Mastery findings, but in other cases interview data suggest that the larger picture of what teachers take away from eMINTS is more complex than the one presented by Teacher Mastery scores alone.

TECHNOLOGY USE

Helping participants understand how to incorporate technology into instruction to support student learning is one of the cornerstones of eMINTS. The Teacher Mastery scores teachers received on the Technology Use item of the Lesson Plan rubric demonstrate that a majority of teachers (64.1%) designed Lesson Plans that integrated technology to support students' learning activities, rather than just to

increase productivity or to give students an opportunity to practice technology skills.

The follow-up interviews provide additional evidence that teachers gained from the professional development an understanding that technology should serve as a support for learning and its use should not be an end in itself. “I learned it’s not teaching for the technology, but with the technology,” said one teacher. “I used to teach for it, but eMINTS helped me just integrate it. eMINTS was very hands-on and allowed us to make things we could use with children.” Another teacher added, “The great part about eMINTS is that it’s not just technology, it’s a framework for teaching.”

Fourteen of the sixteen teachers interviewed gave specific examples of how they were using technology to help students engage with content in new ways. The following is an example of how one teacher integrated technology into a math lesson to help students understand a complex concept.

The kids last year struggled a lot in general, so to have something where they used the Internet, that motivated them. This was a lesson out of their textbook, which I tweaked. They could play around with the equations and lines much quicker [using the software], and see what happens when they changed things. With my honors group, they tried to figure out how to make an undefined line. They were creating their own shapes.

Interestingly, eMINTS4ALL participants were just as likely as eMINTS Comprehensive participants to talk about how the professional development not only helped them think about using technology in their teaching, but also allowed them to engage in different instructional practices. One eMINTS4ALL teacher observed:

I realized how powerful having an interactive SMART Board™ in the class was. It’s easy to work and use . . . I’ve really found the technology to be helpful in my classroom. Before eMINTS I didn’t use as many virtual manipulatives on websites. We just didn’t do that stuff because we didn’t have good computer access in labs. Now my students are making PowerPoints on ecology, and they are doing Internet research while working in the library. They can then be very self-guided. They couldn’t really do this before without the technology.

As enthusiastic as the participants were about the technology they received through the program and learned how to use, none of the teachers interviewed spoke about technology as the answer to all of their instructional needs. Instead, participants came away from the program with positive but realistic expectations of what technology could contribute to learning. As one teacher said:

I learned a lot about technology . . . You'll never replace a good book . . . or pencil and paper math, the old fashioned techniques, but the eMINTS program gives us opportunities to explore things in more than one way—and that's what education is all about.

COLLABORATIVE GROUPING

The eMINTS program addresses collaborative learning not only by covering it in the professional development session content but also by having instructional specialists model the use of this technique in their own instruction. The Teacher Mastery scores from the Lesson Plan rubric indicate that, while most teachers (81.3%) had students work in groups on their lessons, only 11.5% of teachers had students assume different but interdependent responsibilities in their group work.

The majority of interviewees reported being experienced with group work. Eleven out of the sixteen interviewees said that they used group work often in their instruction even before eMINTS, but nine of the sixteen noted that eMINTS had introduced new techniques for grouping that they then applied in their teaching. Some teachers reported having students work in small groups more often since the professional development. One teacher stated:

I do a lot more collaborative work and divide them up differently than before [eMINTS]. For example, I now have students read pieces of a newspaper, then get back together to discuss it. They would each present an article. I hadn't done this type of thing before. The kids are more interested listening to each other, and benefit from putting things in their own words.

Other teachers mentioned that eMINTS gave them more ideas about how to formulate groups. One teacher said, "Actually this year I bought [a commercial product for team work], and it creates groups for you based on ability, or random, or other criteria. That was something I saw at an eMINTS conference. Before I grouped completely randomly; now I'm more picky."

Another teacher described how eMINTS helped her improve her grouping techniques.

So, the training helped me with some strategies to make sure the groups were actually functioning. Like making sure that each person was being responsible—I had created some ways of making sure that they did that but eMINTS did give me a few more ideas on that.

One teacher observed that some of the grouping strategies suggested by eMINTS helped her support different kinds of learners.

From eMINTS I learned to allow more time for discussion. Some thinkers are great at talking about their ideas but not [at] writing it down. There is writing in

math, and they need to sit and chat with each other; that “think, pair, share” strategy is really important. They need to think through what they are doing and talk about it . . . That is a strategy I learned from eMINTS that I do all the time. They love to talk things out first, and then they can get it on paper. If you look at the lesson, there is a lot for them to look at, and they could feel overwhelmed, but by giving them discussion time, it’s not so overwhelming.

Still another teacher reported that eMINTS changed the way she thought about resolving conflicts that arise in group work.

Something I learned from eMINTS, there are always kids who don’t work well with others. Before I would always blame the student. eMINTS taught me, you need to say to the group, what are you doing to make that student feel part of the group? That really helped a lot. I focus on the group and not the child that’s causing problems.

While most teachers were familiar with grouping students, only three of the sixteen teachers interviewed mentioned having the students assume roles in their group work. One teacher stated:

I learned about having the students take different roles in group work from the eMINTS instructional specialist, during a module where we looked at different WebQuests. It made a big difference for them to have a specific job. It seems more realistic. I didn’t do that before.

Another teacher who already knew the importance of roles believed that eMINTS reinforced her understanding.

I was basically very much trained in constructivism, so a lot of the lessons to me were refreshers. It reaffirmed the idea that they had to have specific roles and choosing group sizes that are meaningful to whatever project you’re doing. You want everybody to have a meaningful role, not just busy work. The eMINTS program does a real good job teaching people how to do that and how to manage groups and use strategies that work.

Even among those who spoke about students having different roles, only one teacher mentioned the need to create interdependence among students working in groups.

There are a lot of strategies for making group work happen. From the beginning [of eMINTS] we talk about behavior within a cooperative group, whether it is a partner or a group of four people. We talk about roles and how they can change daily, how to share use of the computer in an equitable way, how to solve disagreements when they arise. We use an “ask three then me” strategy for making sure students become interdependent on one another rather than just relying on me for answers. We try to make the roles very definitive—who is

responsible for what piece of the puzzle. And the key for me is that in some assignments the grade is given as a cooperative grade, but in others it is an individual grade. I don't want to rely too heavily on the group process if I'm going to grade a project.

The interview analysis suggests that even those teachers who are comfortable and familiar with grouping students took away new ideas about grouping strategies from eMINTS. However, the Teacher Mastery data, coupled with the interview data, also suggest that teachers are not necessarily coming away from the professional development with a clear understanding of the importance of creating interdependence among group members by assigning different, meaningful roles and responsibilities to students.

ACCOMMODATING STUDENT DIVERSITY

The eMINTS program goals include not only helping participants to address student diversity in their instruction but also helping them to understand that students can be diverse in many ways, such as their learning styles, their abilities, their languages, and their races, ethnicities, and backgrounds. The Teacher Mastery scores on the Lesson Plan rubrics indicate that the majority of participants (63%) addressed diversity at least in a limited way (receiving a score of 2) in their Lesson Plans, but it is notable that very few (4.2%) took into account multiple forms of diversity, such as learning styles, ability, and multicultural diversity. Furthermore, very few (1%) accommodated diverse learners in their Lesson Plans by offering different activities or different products through which students could demonstrate their learning.

In the follow-up interviews, we asked teachers what they had learned from eMINTS about addressing diversity. Six of the teachers mentioned that eMINTS had helped to expand their conception of diversity and given them strategies for addressing diversity in their classrooms. "A big part of eMINTS for me was widening the definition of diversity," one participant stated. Another teacher noted, "I had thought about diversity in limited ways, but eMINTS made me think about it and apply it in new ways."

One notable pattern in the data was that, in talking about how they addressed diversity, ten out of the sixteen teachers interviewed spoke about how they grouped students of different abilities or learning styles. This was the most commonly cited strategy for addressing diversity among the interviewees. Teachers were able to point to specific lessons they learned. One teacher gave an example of a technique she learned from eMINTS about grouping by ability level.

I . . . learned from eMINTS that when you group a high student with a low student they can get very impatient. Now I try to pair an average student with a low student. They are more patient. You have to have different abilities in a

group, but it's often better to have your high paired with an average student, and low with an average child.

Half of those interviewed discussed how technology could help accommodate diverse abilities and needs. One teacher stated:

[I learned] just to be aware that when you choose technology [you need] to take learner diversity into account. When you pick a website, it needs to be a reading level that all students are comfortable with. My ESL student could do the [software I chose for the lesson] because it was visual. eMINTS just reminds you to make it equitable.

Another teacher described how technology can help support students with different strengths and weaknesses.

I think [technology] builds confidence for lower-education kids. I thought technology would make it more difficult for them, but that was an “ah ha” moment. It's given them a great deal of confidence. It's amazing how students who are struggling in school can figure out a computer game. That's where the technology comes in. A lot of what special education kids struggle with is organization, and the technology helps with organization.

Only one of the interviewees said that she addressed diversity by offering different activities for different students to engage in or providing students with options for creating different work products to demonstrate their learning. Three teachers said that diversity was not an issue for them because their schools lacked ethnic diversity. “I remember [the eMINTS instructional specialists] talking about [diversity],” said one of these teachers, “but I work in a county that's all white, with no diversity. There is no practical application in my classroom.” Comments such as this suggest that a few teachers still held a limited view of what is meant by diversity.

INQUIRY-BASED LEARNING

Inquiry-based learning is strongly emphasized in the eMINTS program; a number of its professional development sessions are designed to help teachers learn how to teach using an inquiry-based approach. There are many instructional components to inquiry-based learning, including having students develop their own questions and engage in independent research, and asking students to analyze and synthesize the data they collect and reflect on their learning. Using the inquiry-based instructional approach effectively requires teachers to master a range of skills and techniques, a task that can prove challenging for many teachers.

The Lesson Plan rubric has six items that address aspects of inquiry-based learning. Teacher Mastery scores reflect a high level of integration of some of these concepts into teachers' Lesson Plans, but a low level of integration of other concepts. For

example, slightly more than half (51%) of the teachers who submitted Lesson Plans came up with high-quality essential questions that spur inquiry, require students to gather and analyze data and involve an authentic problem. More than a third (39.1%) described specific techniques students could use to organize the information they gathered and less than a third (31.3%) described the techniques students could use to analyze the information they collected. However, a large majority (74%) did not require students to generate their own questions and 68.2% had no activities in the lesson that involved student reflection.

The interview data show that, while many teachers recognized the benefits of the inquiry-based learning approach, they also saw the challenges of it, and some struggled to implement it. Six of the teachers interviewed had not used inquiry-based learning methods before in their teaching, and seven of the sixteen spoke of the difficulties of implementing these methods. However, most saw the value of this method, because eleven of the sixteen teachers interviewed reported using inquiry-based teaching methods more often in their teaching since eMINTS. “I do inquiry-based learning informally all the time,” said one teacher. “That came from the eMINTS training. I am very animated when I teach. I come up with stories. I did that in student teaching, but it was me force-feeding and kids push back. They don’t push back as much when you let them think first.”

Another teacher described how eMINTS expanded on the ideas about inquiry-based learning she encountered in her pre-service teacher education.

Even with kindergarten, this kind of teaching [inquiry-based learning] provides ownership of work by [giving students] some control about what they are learning, and the students are more likely to want to be a part of it. I learned some about this in college but eMINTS emphasized this; and it gave me a finer look at things. College was much more macro and wide. eMINTS focused it in to my classroom and learners and refined my ideas.

A third teacher mentioned how eMINTS extended what she was she was already doing in her teaching by emphasizing reflection and questioning.

That reflection on their own work is pretty key. They need to go back and reflect and see what they did right and what they did wrong, and how to improve it. They won’t grow if they don’t do that. I didn’t do enough of that before I started eMINTS. I did a lot of discovery-based learning, which is similar to eMINTS inquiry-based learning, but not exactly the same thing. So, where they were having to discover their learning and discover the answers—they didn’t necessarily have to make up their own questions. And in 6th grade they’re getting really the first taste of doing research. We give them a really big project and I give them a plan. And they come up with an additional question to add to the questions I’ve already asked. It’s kind of a start for them into the research

project and the research process. And I think I would like to have them start coming up with more of their own questions but I'm still going to give them the guide that I give them as well. Because they won't answer the questions that I'm looking for on their own. They need a little scaffolding on that part.

As noted earlier, Teacher Mastery scores for designing lessons that involved student-generated questions were generally low. One of the main obstacles to the use of inquiry-based methods that teachers cited was the difficulty of getting their students to ask good questions. While the teacher above described how she's just starting to introduce student-generated questions into her teaching, other teachers admitted that they struggled with this. One teacher stated:

Well, eMINTS was my first introduction to inquiry-based learning. I have not mastered the skill of it. I have not been able to get those deeper questions from my students. The self-generated questions that my kids generate are just kind of knowledge- and content-based. They're not higher-level thinking questions. I feel that it's one of the weakest links in myself that I don't have the skill to bring it out in them.

Another teacher felt that it was especially difficult to elicit questions from lower-achieving students.

Inquiry-based learning, that's something I struggle with—especially with larger, more diverse classes. Lower students have a hard time forming their own questions. I know I need to work on how to help these students do these things. But eMINTS helped give me some ideas. For example, we are doing a PowerPoint project on ecology. I gave them some basic ideas, but they needed to come up with the content and points to discuss on the PowerPoint through research. The high-level ones do well; the rest struggle from lack of practice. They struggle with forming questions.

However, even teachers who noted that some students have difficulty generating questions still believed the process was valuable.

The students generated their own ideas for inquiry and researched and gathered data. Some responded better than others though. Some are lazier and not motivated by it and moan and groan and just ask for problems to do instead. This takes a lot more work and motivation, but down the line most saw the benefit of it by understanding the material better and seeing a reason for learning it. In math, sometimes they don't see the application of, for example, quadratic equations, but this helps. Plus this makes it more than just out of a textbook, which they like. They get to explore and learn.

We found it particularly interesting that participants seemed to closely associate eMINTS with inquiry-based learning. Whenever they talked about the eMINTS philosophy, or used "eMINTS" as an adjective describing a way of teaching, the

meaning was usually synonymous with inquiry-based learning or some aspect of it. For example, one teacher stated, “Mostly my content lessons are taught in the eMINTS fashion, with inquiry-based methods.” Another teacher said, “Since eMINTS I’ve added [inquiry-based learning] a lot more. Even before I got my computers after eMINTS, I was preparing my Lesson Plans to match eMINTS, so once they arrived, I changed everything to match the eMINTS style.”

In responding to a question about whether she would revise a lesson she had used with her students, another teacher used the term “eMINTS” to mean an inquiry-based approach to teaching.

I think on the whole it’s a good lesson for accomplishing what I want them to accomplish. I would probably give students more opportunity to participate. Maybe I would let students be the camera people. I also probably spent a lot of time downloading the pictures to the computer. I could give that task over to the students. I would give students more opportunity to do things for themselves. In 5th grade, I’m probably the first teacher to let them do that. That would be one of the “eMINTS” things I would do.

The interview data indicated that teachers identified eMINTS with inquiry-based instruction. While many expressed enthusiasm for this approach to teaching, there was also an acknowledgment that this approach could be challenging, and some teachers questioned whether young students or low-achieving students were capable of handling the responsibility of having control over their own learning. However, teachers who had integrated these strategies saw the positive impact of this approach, and appreciated eMINTS for providing them with practical strategies for implementing this kind of teaching in their classroom.

ASSESSMENT

The eMINTS program encourages participants to think about assessment, not only as a final test or culminating product at the end of a lesson, but also as a variety of activities that can occur throughout a lesson to help both the teacher and the students understand what students are learning. The professional development sessions also emphasize the need for teachers to ask their students to analyze and synthesize the information they gather through inquiry and to present it in authentic and creative ways. The Teacher Mastery scores on the Lesson Plan rubric indicated that teachers were able to integrate some of these ideas into their lessons, but struggled with others. Over half (58.3%) of teachers had Lesson Plans that required students to create “an authentic end product” that could communicate to “multiple audiences.” A third (32.8%) of the participants had final assessments or end products that required students to engage in analysis and synthesis. However, less than a quarter (22.9%) shared or co-created their assessment criteria with

students, and almost half (49%) identified only one or no final assessments / products in their Lesson Plans.

Though Teacher Mastery of the eMINTS approach to assessment is mixed on the Lesson Plan rubric, the interview data paint a somewhat different picture. The majority of interviewees reported using multiple assessments. Fourteen of the sixteen teachers interviewed described using a wide a variety of assessments with their students for lessons. One teacher listed all the kinds of assessment she included in her lesson, “I had a scoring rubric. Students composed similes, drew pictures, did self-evaluation, and held consistent writing conferences with me.” Nine of the sixteen specifically noted that eMINTS changed their thinking about assessment. An elementary teacher described how eMINTS influenced her approach to assessment.

The students had a performance task, in the experiment, and they had worksheets and “think and write” questions and when they [used the software in the lesson], they had to justify orally why they picked the characteristics. We also had a debriefing time at the end and they journaled. They made a postcard out of the animals and put it on our blog, so parents could see. Before eMINTS I did paper-and-pencil multiple-choice tests. With eMINTS, I use performance tasks and use a rubric. A performance task is a much better way to assess students.

A math teacher also spoke about how eMINTS changed her approach to assessment.

I’ve tried to incorporate multiple assessments. I used these in all my Lesson Plans once I got into the eMINTS swing, to not just have a test at the end, but this is very different from what most math classes are like. I use rubrics that show students all the points they can get from the ongoing activities that make up one lesson or unit. This is really something new I learned in eMINTS—multiple assessments. Most math is just a quiz in the middle and test at the end. My kids were used to that and this was very different for them.

Another teacher detailed how the different kinds of assessments she used served different purposes, and how her students responded to this approach to assessment.

I gave the students a scoring guide up front. There was a written exam, but we did ongoing assessments on the SMART Board™ after each session. That is different [since eMINTS]. For example, after the food pyramid lesson, we’d do 10 questions multiple choice; students would work as a group and discuss them. We also did individual assessments to check their progress on understanding. The ongoing assessments were new, mostly we had done product assessment, but being able to do ongoing check-ins was great. My students enjoyed using the SMART Board™ and talking over their answers. They also liked having more than one grade, not just an end assessment.

Other teachers echoed this teacher’s description of the positive reaction students had to multiple assessments. Here is one example.

I used assessments throughout this project. I had them present their problem, getting things done on time. They had a rubric with lots of items they could get points for, an oral presentation. A lot of my students liked doing the projects because they could do better grade-wise because there were more opportunities to score points, rather than one test. They were rewarded for effort. They responded well to that.

Another teacher believed the multiple forms of assessment enabled a wider range of students to feel successful.

I started to pick up a lot of the formative and informal assessments. What I like about it is that your hard-working students can be rewarded with informal assessments, as opposed to just smart students. I didn’t really consider this before eMINTS.

Teachers also talked about using simple assessments flexibly to monitor student understanding on a regular basis. “We do shorter, common assessments just to see if students are getting it before moving on,” said one teacher. “They have some practice online tests that are like games.” Another teacher noted, “Sometimes I just give them a checklist for working and staying on task. I give them guides ahead of time to show them what we are looking for, having it ongoing—‘how did you work each day?’—then evaluate how to improve.”

Some teachers noted that eMINTS helped them understand how to create and use rubrics as part of their assessment strategy. One participant described collaborating on rubric design with her students.

I learned about creating a rubric with students from eMINTS. They said to have the students help you create the lesson, so I did the same with the rubric. I used to create my own rubrics, but not with the students. My lessons and rubrics used to be about me, because I created them, but now they are created with the students. They tend to follow the rubric because they created it. They would talk to each other about the rubric as they worked on their projects, making sure they covered everything.

Another teacher mentioned that eMINTS gave her an idea of how to use a rubric to integrate peer assessment of group process into her overall assessment strategy.

One of the things I learned from eMINTS was to give them a rubric for discussion of group work, which I never thought of before eMINTS. Did my partner listen to me? There are all those factors, that list of things that make for good group work, and they assess each other on that. If they are doing group

work and know they are getting a grade, they are annoyed if others aren't working. So I have them assess each other on their group work.

It is unclear why teachers were so articulate and descriptive about their use of a wide range of assessments in interviews, but did not score high on the assessment items of the Lesson Plan rubric. Perhaps they simply did not include all of the assessments they used in their teaching in their written plans. It is noteworthy that, of all the different topics covered in the professional development sessions, interviewees reported that eMINTS had the greatest impact on their Use of Technology and their approach to Assessment. Perhaps because strategies such as ongoing assessment were new to teachers, they were not accustomed to including them in formal Lesson Plans, even if they did use them in their teaching. The fact that interviewees were so detailed in their descriptions of the assessments they used in their practice suggests that teachers may have mastered this concept more than their Teacher Mastery scores reflect.

RELATIONSHIP BETWEEN PD FIDELITY AND TEACHER MASTERY

To understand whether there was a relationship between the fidelity of the professional development experienced by teachers and the level of mastery they displayed in their portfolio artifacts, we ran correlations examining this relationship. We found significant correlations between both composite fidelity scores and the quality of the Lesson Plan artifacts. The correlation between the WebQuest and the Program Construct Fidelity composite was marginally significant and the relationship with the Factor Analysis-Based Fidelity (FA-Based Fidelity) also approached significance (see Table 15). Both types of fidelity have a significant correlation with the Lesson Plan scores, which is important since this is the artifact that is probably most representative of teachers' instructional practice. These results provide evidence that the quality of the professional development does have an impact on the kind of work that teachers produce.

Table 15: Correlations between Teacher Mastery and PD Fidelity Composites

	Lesson Plan	WebQuest
Factor Analysis-Based Fidelity	.256**	.196 ^t
Program Construct Fidelity	.284**	.190 ^{tt}

**p < .01; ^tp = .05; ^{tt}p < .06

We then ran correlations between Teacher Mastery and the different factors that comprise the two Fidelity composites (see Table 16). This analysis indicated that the professional development factors most strongly associated with Teacher Mastery include, among the factor analysis-based factors: Scaffolding Instruction, Facilitating

Discussion and Active Work/Learning; and among the Program Construct Factors: Modeling Instruction, Technology Utilization, Connection to Practice, and Inquiry-based Learning. This analysis also shows that one factor per composite was also significantly correlated to Teacher Mastery on the WebQuest—Facilitating Discussion in the FA-Based Composite and Modeling Instruction on the Program Construct Composite.

Table 16: Correlations between Teacher Mastery and PD Fidelity Factors

Composite	Factor	Lesson Plan	WebQuest
FA-Based Fidelity	Scaffolding Instruction	.263**	ns
	Facilitating Discussion	.174*	.238*
	Active Work/Learning	.296**	ns
Program Construct Fidelity	Modeling Instruction	.388**	.282**
	Technology Utilization	.268**	ns
	Connection to Practice	.217**	ns
	Inquiry-Based Learning	.205**	ns

*p < .05 **p < .01 ns – not significant

We then ran statistical regressions on these same factors, as a more rigorous test of which factors are predictive of Teacher Mastery on the different artifacts. We found that some of the factors above were no longer significant. However, the regression demonstrated that, among the Factor Analysis-Based Fidelity components, Active Work/Learning continued to be a significant predictor of Teacher Mastery on the Lesson Plans (Beta¹⁰ = 0.26, t = 2.5, p < .02). This finding indicates that one of the key components of the eMINTS model—having teachers work together to take an active, hands-on approach to what they are learning—is one of the most important factors in shaping program impact on teachers. Another regression run with the Program Construct Fidelity factors demonstrated that Modeling Instruction was a significant predictor of Teacher Mastery on the Lesson Plan and the WebQuest (Beta = 0.43, t = 3.3, p < .001, and Beta = 0.57, t = 3.2, p < .01, respectively).

RELATIONSHIP BETWEEN PD FIDELITY AND THE TEACHER TECHNOLOGY LITERACY SURVEY

We treated the technology survey responses as dependent variables that could be affected by the quality of the eMINTS professional development. When we ran correlations between the two datasets, we found that there were significant

¹⁰ Beta is a measure of how strongly one variable predicts another in a linear regression, derived from the slope of the relationship.

negative correlations between both fidelity composites and survey respondents' identification of having computer issues and support issues (see Table 17). This means that teachers who experience high-fidelity professional development report experiencing fewer computer and support issues.

Table 17: Correlations between PD Fidelity and Teacher Survey

	FA-Based Fidelity	Program Construct Fidelity
Computer Issues	-.335**	-.344**
Support Issues	-.200*	-.210**

*p < .05 **p < .01

RELATIONSHIP BETWEEN TEACHER MASTERY AND CLASSROOM VISITS

We then looked at the relationship between Teacher Mastery of eMINTS concepts and Classroom Visits—what activities took place during the visits and how often those visits occurred. We examined the data for each program (eMINTS Comprehensive and 4ALL) separately because the expectations for the number of visits are different for the two. We found (see Table 18) that the eMINTS4ALL participants showed a significant positive correlation between the time spent on Lesson Planning and teachers' scores on their Lesson Plans, and a significant negative correlation between the amount of time spent on Technology Assistance and the quality of teachers' Lesson Plans. This means that teachers who spent more time with their instructional specialists working on Lesson Planning ended their professional development with higher-quality Lesson Plans, while those who used their Classroom Visit time to have instructional specialists provide Technology Assistance produced lower-quality Lesson Plans. We found no significant correlations between Classroom Visits and Teacher Mastery for the eMINTS Comprehensive participants.

Table 18: Correlations between Classroom Visits and Teacher Mastery for eMINTS4ALL participants

	Lesson Plan
Lesson Planning	.364**
Technology Assistance	-.326**

**p < .01

RELATIONSHIP BETWEEN CLASSROOM VISITS AND FIDELITY

We next examined the relationship between the Classroom Visit activities for each program (eMINTS Comprehensive and 4ALL) and the components of Program Construct Fidelity and Factor Analysis-Based Fidelity. The analysis identified a number of significant relationships (see Tables 19-22). Generally, these tables show negative correlations between Modeling Instruction and overall fidelity across both programs. This indicates that the stronger the fidelity of the professional development, the less time instructional specialists need to spend on Modeling Instruction during their Classroom Visits. For the eMINTS4ALL participants, there were strong positive correlations between Lesson Planning and fidelity, indicating that teachers who experienced higher fidelity PD could focus on improving their Lesson Plans during Classroom Visits. The eMINTS4ALL participants also had strong negative correlations between Technology Assistance and fidelity, indicating that teachers who experienced better fidelity could spend less time dealing with technical issues. The eMINTS4ALL participants also had strong positive correlations between Reflective Practice and fidelity, indicating that teachers who experienced better fidelity could reflect more on what was happening in the classroom. This pattern also held for Problem Solving. For all groups, the correlations between fidelity constructs and number of visits were strongly negative. It is unclear why this is the case. It is not likely that there is a causal connection between the two. This may be a finding in need of further investigation.

Table 19: Correlations between Classroom Visits and Program Construct Fidelity for eMINTS4ALL participants

Classroom Visit Activities	Overall Fidelity	Program Construct Fidelity				
		Modeling Instruction	Community Building	Technology Utilization	Connection to Practice	Inquiry-Based Learning
Modeling Instruction	-.55***	-.60***	-.25*	-.36**	-.59***	-.59***
Lesson Planning	.35**	-.31**	ns	ns	.35**	.55***
Technology Assistance	-.34**	ns	-.27*	-.33**	-.31**	-.31**
Reflective Practice	.66***	.45***	.50***	.53***	.67***	.59***
Problem Solving	.45***	ns	.26*	.59***	.41***	.31**
Number of Visits	-.51***	-.25*	-.55***	-.54***	-.52***	-.32**

*p < .05 **p < .01 ***p < .001 ns = not significant

Table 20: Correlations between Classroom Visits and Program Construct Fidelity for eMINTS Comprehensive participants

	Overall Fidelity	Program Construct Fidelity				
Classroom Visit Activities		Modeling Instruction	Community Building	Technology Utilization	Connection to Practice	Inquiry-Based Learning
Modeling Instruction	-.17*	ns	-.20**	ns	-.43***	-.38***
Lesson Planning	ns	-.21**	ns	.21**	-.15*	ns
Technology Assistance	ns	.28***	ns	ns	ns	ns
Reflective Practice	ns	ns	ns	ns	ns	ns
Problem Solving	ns	ns	.17*	-.32***	ns	ns
Number of Visits	-.42***	-.19**	-.28***	-.30***	ns	ns

*p < .05 **p < .01 ***p < .001 ns – not significant

Table 21: Correlations between Classroom Visits and the Factor Analysis-Based Fidelity for eMINTS4ALL participants

	Overall Fidelity	Factor Analysis-Based Fidelity				
Classroom Visit Activities		Structured Activities	Participant-Led Discussion	Scaffolding Instruction	Facilitating Discussion	Active Work/Learning
Modeling Instruction	-.55***	-.63***	ns	-.59***	-.27*	-.42***
Lesson Planning	.34**	.37***	ns	.25*	ns	.41***
Technology Assistance	-.33**	ns	-.36**	-.23*	ns	-.33***
Reflective Practice	.65***	.58***	.40***	.66***	.40**	.47***
Problem Solving	.46***	ns	.40***	.31**	ns	.48***
Number of Visits	-.52***	-.37***	-.42***	-.54**	-.47***	-.30**

*p < .05 **p < .01 ***p < .001 ns – not significant

Table 22: Correlations between Classroom Visits and the Factor Analysis-Based Fidelity for eMINTS Comprehensive participants

	Overall Fidelity	Factor Analysis-Based Fidelity				
Classroom Visit Activities		Structured Activities	Participant-Led Discussion	Scaffolding Instruction	Facilitating Discussion	Active Work/Learning
Modeling Instruction	-.16*	-.24***	-.17*	-.20**	-.19**	ns
Lesson Planning	ns	ns	ns	ns	ns	-.20**
Technology Assistance	ns	ns	ns	ns	ns	.15*
Reflective Practice	ns	.33***	ns	ns	ns	-.16*
Problem Solving	ns	ns	.21**	ns	-.16*	ns
Number of Visits	-.41***	ns	-.32***	-.29***	-.34***	-.26***

*p < .05 **p < .01 ***p < .001 ns – not significant

RELATIONSHIP BETWEEN PROGRAM AND TEACHER FINDINGS AND STUDENT MAP SCORES

The next step in the analysis was to examine the relationship between these same variables and student outcomes on the Missouri Assessment Program (MAP) test. Overall analyses were run to determine any relationships between program factors and students' MAP scores in Communication Arts (CA), Mathematics (MA), Science (SC), and Social Studies (SS) across grades 3 through 8, where students had MAP data and comparisons were appropriate. Analyses were run overall and controlling for the relevant covariates were appropriate (see next subheading). Where sample size would allow, analyses were also run independently within districts.

OVERVIEW OF COVARIATES

Students' academic scores are often related to demographic variables such as free and reduced lunch status. If such variables affect student scores, they may need to be statistically controlled when performing analysis on student-based data. Thus our first analysis aimed to discover any such covariates—variables that show differences in student scores across groups. Student variables that were analyzed to check for differences in MAP scores included IEP/LEP status free and reduced lunch status (FRL), grade, gender, race, and students' 2006 MAP scores.

IEP / LEP

IEP (individualized learning program) or LEP (limited English proficiency) status may have an impact on the overall mean of MAP scores if students with these designations score significantly lower than other students. For this reason, we ran t-tests to compare IEP and LEP students to the general population to see if this demographic would need to be added as a control variable. As seen in Table 23 and Table 24, IEP and LEP students scored significantly lower on every MAP test compared to students in the general education program, with t-tests ranging from 5.5 (df = 3,812) to 42.8 (df = 12,892), with every t-test being significant at $p < .001$. To ensure that this effect was not contingent upon grade level, the same analysis was run on each grade individually. IEP students and LEP students scored significantly lower on every MAP test in every grade for which there were sufficient data to run an analysis. Thus the effect was universal and did not vary across grade.

Table 23: Comparison of MAP scores for IEP students and students in the general education program

<i>Test</i>	<i>IEP</i>	<i>N</i>	<i>Mean</i>	<i>SD</i>	<i>t-value</i>	<i>p</i>
Communication Arts (CA)	Yes	11255	675.5	35.1	42.8	<.001
	No	1639	634.7	42.4		
Mathematics (MA)	Yes	11313	674.8	44.7	34.5	<.001
	No	1656	634.2	45.2		
Science (SC)	Yes	3307	684.7	45.5	15.0	<.001
	No	507	652.1	45.2		
Social Studies (SS)	Yes	3446	690.1	32.8	16.6	<.001
	No	461	662.8	35.5		

Table 24: Comparison of MAP scores for LEP students and students in the general education program

<i>Test</i>	<i>LEP</i>	<i>N</i>	<i>Mean</i>	<i>SD</i>	<i>t-value</i>	<i>p</i>
Communication Arts (CA)	Yes	12616	671.1	38.2	16.2	<.001
	No	278	633.5	37.4		
Mathematics MA)	Yes	12677	670.5	46.5	14.3	<.001
	No	292	631.3	43.1		
Science (SC)	Yes	3782	680.7	46.6	5.5	<.001
	No	32	635.4	45.8		
Social Studies (SS)	Yes	3869	687.2	34.1	6.8	<.001
	No	38	649.3	36.0		

One flaw in the statistical analysis above is that the number of LEP and IEP students is much lower than that of the general population, slightly reducing the validity of the tests; however, the differences in mean were dramatic enough to conclude that these students should not be considered in the general analysis. If the amount of LEP or IEP students were lopsided in any group, the analysis would be compromised, thus IEP and LEP students are excluded from all following analyses.

Grade Level

Students may perform differently on the MAP tests depending upon which grade level they are. The MAP tests are not universally normed. Thus analyses of variance were run to see if this demographic would need to be added as a controlled variable. When all grades for which MAP data were available (grades 3 through 12) were considered, significant differences were found for every MAP test at $p < .001$, with F-values ranging from 311.6 ($df = 6, 3401$) to 1246.8 ($df = 6, 11036$). When grades 3 through 8 were isolated for analysis, there was still a significant difference across grades for every test, with F-values ranging from 482.0 ($df = 2, 2969$) and 1168.1 ($df = 5, 10571$). All trends indicated that higher grades were receiving higher MAP scores. Thus grade levels were separated, with all subsequent analyses being run independently on each.

Gender

The effect of gender was analyzed by looking for differences in MAP performance between males and females. Focusing on grade 3 through 8, a significant difference was found on Communication Arts for every grade at $p < .001$, with females scoring higher each time. A significant difference was also found in Mathematics in grade 5, with males scoring significantly higher, $t(1894) = 3.0, p < .01$. Males also scored higher in Social Studies in grades 4 and 8, $t(1393) = 2.3, p < .05$, and $t(1574) = 3.1, p < .01$, respectively, and Science in grade 7, $t(1531) = 3.1, p < .01$. These results

indicate enough gender differences to include it as a control variable in more-complex analyses.

Race

The effect of race was analyzed by looking for differences in MAP performance across students who are African American, Asian American, Caucasian, Hispanic, and Native American/Alaska Native. Focusing on grades 3 through 8, every MAP test in every grade showed significant differences across race at $p < .01$, except Science in grade 8, due to lack of diversity; however, the validity is lowered due to the varied numbers of students in each race, with Caucasian, then African American, having significantly more students. This analysis still shows that the effect of each race should be independently controlled for in subsequent and more advanced analyses. Exact effects are not reported here since each race will be considered independently for future analyses.

FRL

The effect of free and reduced lunch status (FRL) was analyzed by looking for differences in MAP performance between FRL and non-FRL students. Focusing on grades 3 through 8, every MAP test in every grade showed significant differences across FRL at $p < .001$, except grade 8 Science, which was significant at $p < .01$. These results indicate clearly that FRL should be used as a control variable in more complex analyses.

2006 MAP scores

Often the best predictor of a student's score on an academic test is his or her previous score. Thus the relationship between students' 2006 MAP scores and 2007 MAP scores was analyzed. There were only enough matched students across the two years to look at Communication Arts (CA) and Mathematics (MA), but both showed significant correlations between the 2006 and 2007 scores, $r(5029) = .733$, $p < .001$ and $r(5032) = .793$, $p < .001$, respectively. These results indicate that students' 2006 scores should be used as a control variable in more complex analyses.

RELATIONSHIP BETWEEN STUDENT SCORES AND TEACHER MASTERY

The first analysis looked at the relationship between student MAP scores and Teacher Mastery data. Since teachers have immediate contact with students, it is possible that the strongest effects on MAP scores will be seen in what teachers learn, which is in part measured by Teacher Mastery scores. Fidelity was shown to link to Teacher Mastery; perhaps stronger Teacher Mastery will then lead to teaching practices that result in better student MAP scores.

Correlation analysis was the first step in analyzing this relationship. Correlations were run for each grade looking at the relationship of each student MAP test to each Teacher Mastery artifact (see Table 25). Results indicated that students' MAP performance was positively correlated to better Teacher Mastery scores. Not every item was correlated, but every significant relationship found was in the positive direction. Positive correlations were found in grades 3, 4, and 7 for student MAP scores and their teachers' Lesson Plan. Positive relationships were also found in grades 3 and 7 for WebQuests and in grades 4, 5, and 7 for Classroom Websites.

Table 25: Correlations between student MAP tests and Teacher Mastery artifacts

		Teacher Mastery Item		
Grade	MAP test	<i>Lesson Plan</i>	<i>WebQuest</i>	<i>Classroom Website</i>
3	CA	.14***	ns	ns
3	MA	.15***	.14**	ns
3	SC	ns	ns	ns
4	CA	ns	ns	.10, p=.06
4	MA	ns	ns	.10, p=.06
4	SS	.20**	ns	.25**
5	CA	ns	ns	.40***
5	MA	ns	ns	.32***
6	CA	ns	ns	ns
6	MA	ns	ns	ns
7	CA	.27***	.14*	.33***
7	MA	.18*	.16*	.25***
7	SC	ns	ns	ns
8	CA	ns	ns	ns
8	MA	ns	ns	ns
8	SC	ns	ns	ns
8	SS	ns	ns	ns

*p < .05, **p < .01 ***p < .001 ns – not significant

Overall, these correlations show a strong positive relationship between the artifacts teachers are making during eMINTS and how their students are performing on the MAP test. Higher teacher Lesson Plan ratings were consistently related to higher student MAP scores, in Communication Arts, Mathematics, and Social Studies. To further explore this relationship, regression analyses were performed, controlling for covariates, to analyze the impact of Teacher Mastery on MAP scores. The first

step of the regression controlled for the largest covariate, students' 2006 MAP scores. Step 2 added the other covariates to the regression (race, gender, FRL) and step 3 added each Teacher Mastery score independently to see if they explained a significant amount of variance to the regression after controlling for each covariate.

Teachers' Lesson Plan ratings repeatedly explained variance in students' MAP scores on both Communication Arts (CA) and Mathematics (MA) (see Table 26). Except for grade 6 CA, increased scores on Lesson Plans predicted increased MAP scores for every significant finding. The anomaly of grade 6 CA can mostly be attributed to an unreliable analysis, due to the disproportionately small number of grade 6 students taking this assessment. These results, taken with the correlations above, indicate that students whose teachers can create a good Lesson Plan [that incorporates the eMINTS concepts] perform better on MAP assessments.

Table 26: Amount of variance in students' MAP data explained by teachers' Lesson Plans, after controlling for all covariates.

Grade	MAP test	Variance explained by Lesson Plan	Beta	t	p
3	CA	2.0%*	.14	3.46	p < .001
3	MA	2.2%*	.15	3.71	p < .001
4	CA	ns			
4	MA	ns			
5	CA	0.5%	.07	2.10	p < .05
5	MA	ns			
6	CA	3.5%**	-.19	-3.15	p < .01
6	MA	ns			
7	CA	2.4%	.16	3.48	p < .001
7	MA	ns			
8	CA	1.6%	.13	2.37	p < .05
8	MA	0.8%	.09	1.86	p=.065

*Analyses were run without the 2006 MAP scores in the model because there were no scores for grade 2.

**This may be attributed to unreliable analysis due to the disproportionately small n for grade 6.

Teachers' WebQuest ratings were a less reliable predictor of student MAP scores, but positive trends can still be seen. Table 25 above shows three positive correlations for WebQuests, indicating that students whose teachers can create better WebQuests perform better on MAP assessments in CA and MA. The regression analyses provided more mixed results (see Table 27). The grade 6 CA assessment was again a negative anomaly, and the other negative result, grade 4

MA, explained less than 1% of the variance. The grade 5 MA is a reliable indicator, and it points to a positive relationship between better WebQuest creation and higher MAP performance.

Table 27: Amount of variance in students' MAP data explained by teachers' WebQuests, after controlling for all covariates.

Grade	MAP test	Variance explained by WebQuest	Beta	t	p
3	CA	ns*			
3	MA	ns*			
4	CA	ns			
4	MA	0.9%	-.10	-3.03	p < .01
5	CA	ns			
5	MA	3.3%	.19	3.68	p < .001
6	CA	1.9%**	-.14	-2.29	p < .05
6	MA	ns			
7	CA	ns			
7	MA	ns			
8	CA	ns			
8	MA	ns			

*Analyses were run without the 2006 MAP scores in the model because there were no scores for grade 2.

**This may be attributed to unreliable analysis due to the disproportionately small n for grade 6.

Teachers' Classroom Websites are another strong, positive predictor of how students would perform on their MAP assessments. Preliminary analysis showed seven positive correlations for Classroom Websites (see Table 25 above), indicating that students with teachers who are able to create a better Classroom Website perform better on MAP assessments in CA, MA, and SS. The regression analysis (see Table 28) also showed positive results. In grades 5 and 7, higher Classroom Website scores predicted higher student MAP scores.

Table 28: Amount of variance in students' MAP data explained by teachers' Classroom Websites, after controlling for all covariates

Grade	MAP test	Variance explained by Classroom Website	Beta	t	p
3	CA	ns*			
3	MA	ns*			
4	CA	ns			
4	MA	ns			
5	CA	4.0%	.22	3.68	p < .001
5	MA	1.7%	.14	2.57	p < .02
6	CA	ns			
6	MA	ns			
7	CA	1.8%	.14	2.99	p < .01
7	MA	ns			
8	CA	ns			
8	MA	ns			

*Analyses were run without the 2006 MAP scores in the model because there were no scores for grade 2.

Analyses were also run within districts with a large enough number of students to look for positive district-by-district trends of Teacher Mastery and students' MAP scores. Several positive relationships were found. In one district, grade 3 CA and MA were positively correlated with Lesson Plan, $r(132) = .21, p < .02$ and $r(132) = .19, p < .05$, respectively. In another, grade 3 CA was marginally correlated (because of the low n) with Lesson Plan, $r(42) = .27, p = .08$. In a third district, grade 4 SS was positively correlated with Lesson Plan, $r(112) = .21, p < .05$; and grade 4 CA was marginally correlated to WebQuest, $r(94) = .19, p = .07$. In a fourth district, grade 5 MA was positively correlated with WebQuest, $r(52) = .39, p < .01$. In a fifth district, grade 7 CA and MA scores were positively correlated with Lesson Plan, WebQuest, and Classroom Website at $p < .05$. Grade 8 CA and MA were also positively correlated to Lesson Plan and Classroom Website. A few negative relationships were found, which were far outweighed by the positive findings; however, this did indicate that there were some district-by-district variations in relationships among student achievement and Teacher Mastery that cannot be fully accounted for by these analyses.

RELATIONSHIP BETWEEN STUDENT SCORES AND PD FIDELITY

PD Fidelity was positively related to Teacher Mastery scores; thus it was possible that PD Fidelity had a small, but significant, impact on student achievement. Even if not reflected in Teacher Mastery scores, teachers may have learned certain core concepts from sessions with strong fidelity that would lead to improved pedagogical practices and thus to improved student scores. Correlations were run to detect any relationships between MAP performance and PD Fidelity scores from eMINTS PD sessions. Correlations were run with the overall PD Fidelity measure created from the Program Construct factors and checked with the overall PD Fidelity measure created from the Factor Analysis-Based factors.

Positive relationships were found (see Table 29). Results indicate that as overall Fidelity increased, student scores were higher. No negative correlations were found.

Table 29: Correlations between student MAP scores and PD Fidelity of eMINTS professional development

Grade	MAP test	Overall Fidelity
3	CA	ns
3	MA	.10*
3	SC	ns
4	CA	.17***
4	MA	.20***
4	SS	.21**
5	CA	.26***
5	MA	.30***
6	CA	ns
6	MA	ns
7	CA	ns
7	MA	ns
7	SC	ns
8	CA	.19* [†]
8	MA	.15 [†] (p=.08)
8	SC	ns
8	SS	ns

*p < .05 **p < .01 ***p < .001

[†]Only significant with fidelity score created from the Factor Analysis-Based factors.

To further explore this relationship, regression analyses were performed that controlled for all covariates (see Table 30). The results confirmed the positive association between MAP scores and overall PD Fidelity, especially with teachers of grades 5 and 8. The other results are mixed and may mean the covariates are so strong that the analysis is not showing the relationship.

Table 30: Amount of variance in students' MAP data explained by PD Fidelity, after controlling for all covariates

Grade	MAP test	Variance explained by PD Fidelity	Beta	t	p
3	CA	ns*			
3	MA	ns*			
4	CA	ns			
4	MA	ns			
5	CA	1.3%	.13	3.7	p < .001
5	MA	0.9%	.10	3.1	p < .01
6	CA	2.7%	-.17	-2.7	p < .01
6	MA	ns			
7	CA	ns			
7	MA	ns			
8	CA	2.2%	.15	2.7	p < .01
8	MA	2.9%	.18	3.4	p < .001

*Analyses were run without the 2006 MAP scores in the model because there were no scores for grade 2.

The positive results above prompted further analyses that looked at the specific aspects of PD Fidelity and which were correlating to improved student outcomes (see Table 31). A few negative correlations were found, but these were generally mixed with multiple positive correlations for the same student MAP test. This may indicate that the instructional specialists whose teachers had students with better MAP scores were simply focusing on certain elements of PD Fidelity more often (those with the positive correlations). Generally, the results were positive. Significant positive relationships were found on CA, MA, and SS across every grade except 6th (probably due to the lower n). Every factor of fidelity also had at least one positive relationship to student MAP scores. Only doing Structured Activities had more negative correlations than positive. The other activities may be more beneficial to helping teachers in the classroom, especially in grades 3 to 5.

Table 31: Correlations between student MAP scores and eMINTS PD Fidelity factors.

Dark gray areas indicate positive correlations and light gray indicate negative correlations.

(*Legend:* SA=Structured Activities, PD=Participant-Led Discussion, SI=Scaffolding Instruction, FD=Facilitating Discussion, AW=Active Work/Learning, MI=Modeling Instruction, CB=Community Building, TU=Technology Utilization, CP=Connection to Practice, IBL=Inquiry Based Learning.)

Grade	MAP	Factor Analysis-Based Factors					Program Construct Factors				
		SA	PD	SI	FD	AW	MI	CB	TU	CP	IBL
3	CA	ns	ns	.12**	ns	ns	ns	ns	.08 [†]	ns	ns
3	MA	-.09*	.09*	.19***	ns	ns	.09*	ns	.16***	ns	ns
3	SC	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
4	CA	-.13**	.12*	.25***	.09 [†]	ns	.16***	ns	.21***	.11*	.11*
4	MA	-.10*	.14**	.27***	.12*	ns	.20***	.10*	.21***	.14**	.11*
4	SS	ns	.30***	.19**	.13 [†]	.21**	.24***	.25***	.16*	.17*	.18*
5	CA	ns	.11*	.32***	.16***	ns	.17***	.10*	.31***	.20***	.28***
5	MA	ns	.17***	.36***	.21***	ns	.17***	.17***	.35***	.22***	.31***
6	CA	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
6	MA	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
7	CA	ns	.15*	-.41***	ns	ns	-.28***	ns	.25***	-.18*	ns
7	MA	ns	.23***	-.35***	ns	ns	-.27***	.22**	.27***	-.15*	.13 [†]
7	SC	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
8	CA	.25**	ns	-.16*	.19*	ns	ns	.20*	ns	ns	.29***
8	MA	.22**	ns	ns	.15 [†]	ns	ns	.18*	ns	ns	.25**
8	SC	-.28**	ns	ns	ns	ns	ns	-.28**	ns	-.28**	ns
8	SS	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns

*p < .05 **p < .01 ***p < .001,

[†]p < .08

Table 31 shows that when there is a significant positive relationship of one factor to any given MAP scores, there is usually a positive relationship with at least one other factor of PD Fidelity to the same MAP assessment. This is especially true when looking at grades 4 and 5, but grades 3, 7 and 8 also show this pattern. This may indicate that instructional specialists who are doing one aspect of the professional development well are also doing other aspects well, and these are the instructional specialists whose teachers have students with higher MAP scores. Thus it may not be one individual component of PD Fidelity that helps teachers boost students' MAP scores, but is more likely a combination of many factors.

Individual regressions were not run on individual aspects of PD Fidelity, for this reason and because of concern with alpha inflation and the mixed pattern of results from the overall regression. District-by-district analyses were also foregone, due to the lack of variability of PD Fidelity data within districts, since each district has only one or a few instructional specialists.

RELATIONSHIP BETWEEN STUDENT SCORES AND CLASSROOM VISITS

Aspects of Classroom Visits were positively related to PD Fidelity scores and to Teacher Mastery scores. Thus it was possible that Classroom Visits would show small but significant relationships to student achievement. Teachers who ask their instructional specialists for specific kinds of support during Classroom Visits may be building certain skills and knowledge that would lead to improved pedagogical practices and, as a result, higher student scores. An analysis was run to detect any relationships between MAP performance and Classroom Visits (see Table 32).

Table 32: Correlations between student MAP scores and Classroom Visits

Included variables are the total number of visits, and percent time doing each activity. Light gray boxes indicate a negative correlation and dark gray boxes indicate a positive correlation.

Grade	MAP	Number of visits	Modeling Instructions	Lesson Planning	Technology Assistance	Reflective Practice	Problem Solving	Other
3	CA	ns	ns	ns	ns	ns	ns	ns
3	MA	-.08*	-.09*	ns	ns	ns	ns	ns
3	SC	ns	ns	ns	-.12*	ns	ns	ns
4	CA	-.18*	ns	.11*	ns	ns	ns	ns
4	MA	-.18*	-.09*	.11*	ns	ns	ns	ns
4	SS	ns	-.12 [†]	ns	-.12 [†]	.25***	ns	ns
5	CA	ns	-.22***	.18***	ns	ns	ns	.10*
5	MA	ns	-.20***	.19***	ns	ns	-.09*	.10*
6	CA	ns	ns	ns	ns	ns	ns	ns
6	MA	ns	ns	ns	ns	ns	ns	ns
7	CA	.19**	ns	ns	-.22***	-.20**	-.24***	.41***
7	MA	ns	ns	ns	-.20**	-.18*	-.15*	.37***
7	SC	ns	ns	-.49*	ns	ns	-.52**	ns
8	CA	ns	ns	.31***	-.22**	ns	-.30***	ns
8	MA	ns	ns	.32***	-.24**	ns	-.29***	ns
8	SC	ns	ns	ns	ns	ns	ns	ns
8	SS	ns	ns	ns	ns	ns	ns	ns

*p < .05 **p < .01 ***p < .001,

[†]p < .06

The correlation analysis showed mixed findings. Generally, higher student MAP scores were associated with more time on Lesson Planning and less time on Modeling Instruction, Technology Assistance, and Problem Solving. This may indicate that teachers who spend time creating and refining their lessons with their instructional specialists provide better instruction for their students, which may then boost student scores. Conversely, teachers who request that their instructional specialists model instruction, provide technology assistance, and solve problems may be struggling more with the eMINTS practices or with integrating technology in general, and therefore may not be having as strong an impact on their students' MAP scores. Results for number of visits and reflection were mixed and inconclusive. Further exploratory research would be needed to understand these effects. The positive relationships found with 'other activities' indicate a need for more research about what instructional specialists are doing during their Classroom Visits that is not captured on the Classroom Visit Record instrument that may have positive effects on teacher practices and student test scores.

Individual regressions were not run on individual aspects of Classroom Visits because of the mixed results, covariance, and concern with alpha inflation. District-by-district analyses were performed. The alpha inflation is a limitation to this analysis; however, the district analyses corroborated some of the overall findings, but also uncovered a few unique relationships that emphasize the need for further exploration of district practices. Table 33 shows correlations for districts whose results corresponded to the overall findings, and Table 34 shows correlations whose results did not correspond.

Table 33: Correlations between student MAP scores and Classroom Visits

Broken up by districts that correspond to the overall findings. Included variables are the total number of visits and percent time doing each activity. Light gray boxes indicate a negative correlation and dark gray boxes indicate a positive correlation.

Grade	MAP	Number of visits	Modeling Instructions	Lesson Planning	Technology Assistance	Reflective Practice	Problem Solving	Other
3	CA	ns	ns	ns	ns	ns	ns	ns
3	MA	-.20*	ns	ns	ns	ns	ns	ns
3	SC	ns	ns	ns	-.16 [†]	ns	ns	ns
4	CA	ns	ns	ns	ns	ns	ns	ns
4	MA	ns	-.39** -.30*)	ns	ns	ns	ns	ns
4	SS	ns	-.29*	ns	ns	.31** .26 [†]	ns	ns
5	CA	ns	-.19*	.37***	ns	ns	ns	ns
5	MA	ns	-.19*	.21* .60***	ns	ns	-.22** -.30*	ns
6	CA	ns	ns	ns	ns	ns	ns	ns
6	MA	ns	ns	ns	ns	ns	ns	ns
7	CA	.50***	ns	ns	-.23*	-.23*	-.23* -.52***	.70***
7	MA	ns	ns	ns	-.19*	-.19*	-.19* -.44***	.68***
7	SC	ns	ns	ns	ns	ns	ns	ns
8	CA	ns	ns	.23*	ns	ns	-.23	ns
8	MA	ns	ns	.22*	ns	ns	-.21 -.30*	ns
8	SC	ns	ns	ns	ns	ns	ns	ns
8	SS	ns	ns	ns	ns	ns	ns	ns

*p < .05 **p < .01 ***p < .001 ns – not significant

[†]p < .07

These results show that many correlations that were found overall were also found within districts. This again shows the positive effect of working on Lesson Plans and the negative effect of having to spend extra time on modeling instruction and problem solving. The effect of having more visits is again mixed. Correlations that do not overlap with the overall findings provided some mixed results Table 34 shows spending time on Lesson Planning is related to higher student scores, although

results are slightly mixed. Table 34 also shows that other activities can be related to lower student scores in some districts, emphasizing the need for further research about what is happening. Results for Technology Assistance are again strongly negative. Modeling Instruction shows mixed results.

Table 34: Correlations between student MAP scores and Classroom Visits

Broken up by districts that do not correspond to the overall findings. Included variables are the total number of visits, and percent time doing each activity. Light gray boxes indicate a negative correlation and dark gray boxes indicate a positive correlation.

Grade	MAP	Number of visits	Modeling Instructions	Lesson Planning	Technology Assistance	Reflective Practice	Problem Solving	Other
3	CA	-.18*	.20*	-.19* .18*	-.29 [†]	ns	ns	- .19*
3	MA	ns	.36*	.26**	-.28 [†]	.18* -.28***	-.35*	ns
3	SC	.30*	-.26*	.29*	ns	ns	ns	ns
4	CA	ns	-.29* -.32*	ns	-.26 [†] (H)	.30*	ns	- .28*
4	MA	ns	ns	ns	ns	.31* .28 [†]	.36**	-.26 [†]
4	SS	.22*	ns	.37** .27*	ns	ns	-.35** .27 [†]	-.27 [†]
5	CA	-.37***	ns	ns	ns	ns	ns	ns
5	MA	-.26** -.30*	ns	ns	-.60***	-.58***	ns	ns
6	CA	ns	ns	ns	ns	ns	ns	ns
6	MA	ns	ns	ns	ns	ns	ns	ns
7	CA	ns	.23* .50***	.23* -.54***	ns	ns	ns	ns
7	MA	.45***	.19* .43***	.19* -.54***	ns	ns	ns	ns
7	SC	ns	ns	ns	ns	ns	ns	ns
8	CA	.23*	-.23	ns	.23*	.23*	ns	ns
8	MA	.21*	-.21	ns	.21*	.21* .27*	ns	ns
8	SC	ns	ns	ns	ns	ns	ns	ns
8	SS	ns	ns	ns	ns	ns	ns	ns

*p < .05 **p < .01 ***p < .001,
[†]p < .07

Overall, the results show a great deal of variation across districts. This variation of relationship between Classroom Visits and student performance could be due to the

level of ability of students in each district, the teacher quality in each district, the instructional specialists and how they approach eMINTS and the Classroom Visits, as well as any interaction among these factors. These results, on top of the demographic differences between districts, show a limit to this analysis, but many of the findings indicate that teachers' use of instructional specialists' Classroom Visits may affect later student performance.

RELATIONSHIP BETWEEN STUDENT SCORES AND EMINTS STATUS

Analysis of program effects on student scores is not appropriate for this study. To show impact on student scores based on program, the student sample for each program would need to be matched through planned methodology, or at least have demographic information that is similar, with slight differences being statistically controlled. This would be done through an experimental or quasi-experimental design. The current study was not designed to create such populations of students.

Prior evaluation of eMINTS has utilized a quasi-experimental design in order to test program impact. This was accomplished by using comparison classrooms within schools to represent students with comparable demographics. By having comparison non-eMINTS teachers for eMINTS teachers within a school and grade level, groups of equal size and demographics from each district would be formed, allowing for causal analysis to be valid across the entire population of eMINTS and non-eMINTS students.

This study was designed to be an exploratory research project aiming to discover the relationships among Program Fidelity, Teacher Mastery, and student achievement. Student impact was the final concern; however, how student impact varied by program (eMINTS Comp PD, eMINTS 4ALL, and non-eMINTS) was not taken into consideration. This year many of the smaller districts and schools and grade levels have become all or majority eMINTS and could not provide equivalent classroom groups for comparison.

The addition of two different programs, eMINTS Comprehensive and eMINTS 4ALL, made the creation of comparison groups even more difficult. The design would have to provide equal groups across all three categories across all districts. This would require each district to implement both programs equally across grade level, or have a comparison district in which the demographics and effects would be comparable. Table 35 shows that the number of students in each program category varies substantially across grade levels. Districts did not have equivalent numbers of teachers and students in each program. This is shown in Table 36 by the disparity of program implementation across districts at the grade 4 level. This shows that the programs have different district composites. Optimally, the data should be balanced across districts for valid comparison across programs. Our analysis so far has

unveiled numerous district differences across program implementation strategies, effects, and component relationships. This district imbalance leads to program groups where comparison would not be valid.

Table 35: Number of Communication Arts MAP scores for each grade, across programs.

Grade	4ALL	Comp PD	Non-eMINTS	eMINTS Veterans
3	234	491	963	12
4	84	499	1022	101
5	467	274	952	19
6	497	97	782	47
7	528	222	736	0
8	545	518	840	0

Table 36: Number of Communication Arts MAP scores for grade 4, across districts and programs

District	4ALL	Comp PD	Non-eMINTS	eMINTS Veterans
Carrollton	16	0	55	0
Chillicothe	68	0	20	22
Francis Howell	0	131	947	21
Gasconade	0	60	0	0
Hartville	0	46	0	0
Jefferson City	0	21	0	20
North Kansas	0	67	0	0
Perry County	0	82	0	38
Sparta	0	41	0	0
Webster Grove	0	51	0	0

Furthermore, not all districts could even provide students from both programs in each grade. For example, Carrollton had eMINTS Comprehensive teachers in grades 3, 5, and 7, but only eMINTS4ALL teachers in grades 4, 6, and 8 (see Table 37). Carrollton also only had comparison rosters for the teachers from the 4ALL program. Thus the larger districts, mostly Francis Howell, provided the overwhelming majority of the control students (see Table 38).

Table 37: The number of Communication Arts MAP scores for each grade, across programs, for the Carrollton School District.

Grade	4ALL	Comp PD	Non-eMINTS	eMINTS Veterans
3	0	62	0	0
4	16	0	55	0
5	0	65	0	0
6	17	0	52	0
7	0	66	0	0
8	24	0	40	0

Table 38: Number of Communication Arts MAP scores for each grade, across programs, for the Francis Howell School District

Grade	4ALL	Comp PD	Non-eMINTS	eMINTS Veterans
3	0	180	913	0
4	0	131	947	21
5	224	22	876	2
6	434	0	730	0
7	451	0	725	0
8	489	14	791	0

To compare students grouped by program would require comparing student groups that are unbalanced by grade and district. Considering the purpose of the study, the district differences previously discussed, and the lack of valid comparison groups in most districts, comparative program analysis would not be valid and thus was not performed.

Section V: Discussion

Throughout the nine-year history of eMINTS, the eMINTS program staff have demonstrated a strong commitment to evaluation; they have been using evaluation not only to show impact but also to learn about and strengthen the program. This evaluation has generated research tools and findings that can contribute to the ongoing process of reflection and learning that the eMINTS program staff have consistently undergone.

EDC/CCT's evaluation was designed to provide the eMINTS program staff with a variety of instruments and procedures that can be used in the future for internal evaluation of the program as it scales up, and for potential future studies of the program. Some of the instruments and procedures produced through this evaluation include:

- **PD Fidelity Snapshot and Checklist Observation Instruments.** These two instruments look at how well a professional development session addresses the core eMINTS constructs. They can be used in a number of ways. Not only could they be used again to measure PD Fidelity in a future study of eMINTS program impact, they could also be used by the regional specialists or program administrators in the new expansion programs to assess professional development quality, and as a tool for PD4ETS self-assessment.
- **Classroom Visit Record Instrument.** This instrument provides a consistent and simple record of what instructional specialists do to support teachers during Classroom Visits. This instrument could also be used in further studies of the program. In addition, program staff could review data from these records to see what kinds of activities are occurring most often during Classroom Visits, and instructional specialists could use them to set goals with their teacher participants about the kind of support they want to experience and to reflect on whether those goals are being met.
- **Teacher Mastery Rubrics.** These instruments allow a reviewer to assess how well teacher artifacts are aligned with the core eMINTS concepts. Again, these could be used in a future study of the program. They can also be used by regional or central program staff to assess teacher portfolio quality for certification purposes, and they can be used as guides for teacher participants to understand what constitutes high-quality Lesson Plans, WebQuests and Classroom Websites.

In addition to the instruments, this evaluation has produced a number of findings that provide information about the fidelity of eMINTS professional development and Teachers' Mastery of eMINTS concepts. This information can, first, serve as a baseline against which to compare other programs as eMINTS scales up to other

states and countries. Before these data about Program Fidelity and Teacher Mastery were collected and analyzed, program quality and teacher impact could primarily be assessed only by those with a great deal of expertise and background with the program. The analyses in this report now enable the eMINTS program staff to provide those who are introducing the program in a new setting with clear, quantifiable expectations for Program Fidelity and Teacher Mastery.

The findings from the analyses of Program Fidelity and Teacher Mastery also highlight where the program is strong and where it may need to be improved. The PD Fidelity data from both the Checklist and the Snapshot instruments indicated that the instructional specialists are generally very faithful in delivering the professional development in an engaging manner that has participants take part in hands-on collaborative group work. Instructional specialists also appeared to structure the professional development appropriately, by introducing the session essential question and goals and reviewing these at the end. They also model some, but not all, of the key elements of Inquiry-Based Learning, such as having participants engage in independent research and analyze and synthesize what they learn. However, although instructional specialists were modeling effective instruction, they did not seem to be as effective at engaging the participants in explicit discussions of how to integrate core eMINTS concepts, such as Community Building and Inquiry-Based Learning, into instruction. The data from the Teacher Mastery assessment also suggest that teachers need extra support in Inquiry-Based Learning strategies, as well as in tailoring their instruction to accommodate student diversity.

The analyses of the combined datasets also offered some interesting information about how the program inputs were associated with teacher and student outcomes. One striking set of associations was the one between Classroom Visits and teacher and student outcomes. The more time spent during Classroom Visits on Lesson Planning, the greater the impact on both Teacher Mastery of the Lesson Plan and on student achievement. It is difficult to say whether this is causal, or if those teachers who choose to use the Classroom Visit time in this way also happen to be more effective teachers, but this finding does provide some insight into one possible “best practice” for Classroom Visits.

Another important finding from the combined analysis is how strong the associations were, at least for some grades, between PD Fidelity and student achievement. It is particularly interesting to note where this relationship exists even when there are not strong correlations between Teacher Mastery and student achievement. This suggests that high-quality professional development may be having an impact on teachers and their instruction that is not adequately captured in their portfolio artifacts.

It is important to keep the findings in perspective by noting the limitations of this study. One of the main limitations of this evaluation was that a limited amount of data was collected from the professional development sessions. In most cases, instructional specialists were observed only once, though some instructional specialists were observed twice. In our analyses, this limited data had to represent the fidelity of all professional development experienced by teachers. While practical realities of time and staffing made it impossible for this study to observe more professional development sessions, future studies of Program Fidelity would be more robust if evaluators observed more professional development sessions per instructional specialist and averaged the scores for each item across sessions.

Another limitation of the study, similar to the problem with PD Fidelity, is that Teacher Mastery was constructed, again, from a limited set of data—only the Lesson Plan for eMINTS4ALL teachers, and the Lesson Plan, WebQuest, and Classroom Website for eMINTS Comprehensive teachers. A better measure of Teacher Mastery would come from classroom observations using instruments comparable to those created for measuring PD Fidelity. However, conducting an adequate number of observations to fully measure a teacher’s instructional practices was beyond the scope of this evaluation; it would be a considerable undertaking.

A third, but less problematic, limitation was in the design of the Classroom Visit Record. Unlike the previous two instruments, this instrument produced a great deal of data about what instructional specialists did with teachers over a number of months. However, our analyses of the combined Classroom Visit and student MAP data revealed that engaging in “Other” activities was positively correlated with student MAP scores in grades 5 and 7. This suggests that there is some additional Classroom Visit activity that is not captured by the instrument that may be a very effective for teachers. It may be useful to conduct interviews with instructional specialists to find out what they are doing with teachers that they would identify on the record as “Other” and include these activities in a revised Classroom Visit Record Instrument.

A number of next steps follow logically from this evaluation. The first, already in the design of this evaluation, is to conduct a series of combined analyses with the Program Fidelity and Teacher Mastery data and a second year of MAP data. We will analyze the 2008 MAP data from the students in this year’s study, to see if the program continues to have an impact on those students, and the 2008 MAP data from the new students of teachers in this year’s study, to determine if the program continues to have an impact on those teachers and the kind of instruction they provide. This analysis will serve as a validity check on the findings of the current evaluation, and will also provide information about the persistence of program impact.

Another logical next step would be to conduct a similar evaluation in some of the new states where eMINTS is being implemented. This would be an important means of ensuring that the program maintains its quality and impact as it scales up, and of validating the findings from this evaluation.

The third next step would be to seek funding for a randomized control trial to measure program impact on students and teachers. Although, as mentioned above, a number of evaluations have provided evidence of positive program impact on students, a randomized control trial would provide a stronger, causal case for program impact, should similar results be found. The fidelity instruments designed for this study could play an integral role in a randomized control trial, because they would enable researchers to include information about Program Fidelity as a key variable in the analysis.

Over the past nine years, the evaluations of the eMINTS program have generated a wealth of important findings about the program. A strong and consistent body of evidence, produced through quasi-experimental studies, shows the positive impact of eMINTS on teacher and student learning. This new evaluation provides another lens through which to view the program and its impact. The results of this evaluation provide evidence that, not only does the program have a positive impact on teacher and student learning, but also the more faithful the program is to the core goals of eMINTS, the stronger that impact is.