Impact Report

Missouri Improving Teacher Quality Grant Program

- Cycle 11 -

Program Evaluation

Technical Report

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MDHE
Missouri Department of Higher Education
Building Missouri's future... by degrees

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Tables and Figures

1. Introduction

This technical summary offers additional detail to support the information contained in the *Missouri Improving Teacher Quality Grant (ITQG) Program, Cycle 11, Program Evaluation Summary*. More focused on the specifics of the external evaluation as it pertains to the program and each project, this report addresses the impact of the ITQG by discussing the various evaluation questions that are aligned to the program objectives and were developed in the evaluation plan. As a technical document, this report contains some repetition of executive summary and other report content appears, and no attempt has been made to refresh existing narrative from current or prior reports when it is serviceable. However, where considered appropriate additional explanation and support are provided.

The ITQG, after 11 cycles, remains a valuable support for teachers, schools, school districts and K-12 education in Missouri. With ongoing funding still not assured beyond an additional two cycles, the need to provide evidence of positive impact remains very important.

The university-based teacher professional development teams, with their collaborative partners in the projects, continue to develop, design and implement their teacher professional development with deep commitment and focused engagement. The evaluators producing this report retain their deep respect for them and for their interest in appropriate evaluation – both internal and external – of ITQG work in order to demonstrate the impact of their efforts and, where useful, refine their approaches. As evaluation always is a dynamic, ongoing enterprise requiring mutual cooperation and collegiality, the evaluators thank the teams for their work. That positive results are seen as an assistant to securing further funding, the usefulness of evaluation is tangible in other ways, and it informs the field in general about efficacious training strategies.

The evaluators also appreciate the cooperation and commitment experienced with the scores of teachers, school and district staff members, colleagues at the Missouri Department of Higher Education, and others who also have contributed to the ITQG effort to understand and improve the work of the program in Missouri, and the cause of mathematics and science learning.

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2. Evaluation Scope of Work and Methods

Scope of Work

The evaluation team is guided by the American Evaluation Association's Guiding Principles for Evaluators and the Standards for Program Evaluation (www.eval.org). Because the ITQG program is multi-faceted, several theories ground the evaluation. The overall evaluation is based on Patton's (2008) Utilization Focused Evaluation theory. This theory is appropriate for those programs desiring to make decisions regarding program continuity, revision and restructuring, with specific policy implications. The use of the evaluation outcomes becomes a focus and provides information for both cross-project and individual project decision-making. Wholey (2004) notes that policy decisions are influenced by many inputs and implemented through programs such that the programs tend to endure in much the same state as they originated.

Evaluations exist not only to report results but to improve program performance and, ultimately, serve as a tool in the development of practices that inform the field. Thus the evaluation results must be used by stakeholders to examine quality and potential for improving outcomes in order for evaluation to serve its purpose. The evaluators therefore present its report in two forms: this more-detailed technical report and an executive summary organized, it is hoped, for access by a broad group of stakeholders.

Embedded within the overall program evaluation, are individual project evaluations. The Missouri Department of Higher Education (MDHE), preparing the way for changes in the ITQG's evaluation practice, requested enhancements in evaluator-project communications in this regard starting with Cycle 9. These individual project evaluations have largely focused on formative and process matters, seeking to assist projects in maintaining fidelity to their activity plans, enhancing internal evaluation efforts, and addressing emerging challenges. With the change in evaluation practice in Cycle 9, transitional concerns existed, and continued into Cycle 11.

As in Cycles 9 and 10, formative reports with recommendations have been sent to each project, and amended versions of these reports, preserving confidentiality where appropriate, have been shared with MDHE. The evaluators also have discussed evaluative matters with projects at each summer academy and follow-up session, and many other times during the cycle in ad hoc ways. Project team members are always encouraged to make contact with any questions or concerns about implementation or evaluation, whether internal or external.

Each of the funded ITQG projects is developed around and focuses on the professional development of teachers with subsequent student achievement effects. With four returning project teams in Cycle 11, with some projects ongoing from Cycle 9, the evaluators continue to see professional development experts skilled in developing and presenting professional development, but maintaining various degrees of skill or understanding of formative, process and summative evaluation.

Given the dynamics and complexities of implementing such complex and demanding projects in the "real world," it would not be surprising for effort and attention to be devoted to administration, logistics, schedules, professional development resources, activities and the other nuts and bolts of implementation with teacher professional development projects. In fact, such a pattern remains a tendency where a commitment to evaluation plans and evidence-based consideration of results are not securely in place. This is true in all settings, not just the ITQG program.

An alternative to this process-focused type of implementation is to focus attention on implementation and then direct attention to the end-stage objective, in the ITQG's case being student achievement change. A focus on implementing effective PD and collecting student outcome data leaves closed the black box of transfer and application of teacher knowledge into the classroom setting and the quality of that transfer. This critical information informs the project's understanding of the fidelity of implementation that influences student outcomes. Without the documentation of implementation fidelity, nothing can be said with certainty about the effect of professional development on student or teacher change.

The evaluators, in recognizing this need, incorporated into the evaluation model a component of Empowerment Evaluation (Fetterman, 1996) in which project leadership and internal evaluators, along with external evaluators, focused on effective ways to collect implementation and outcome data and ways to use it to enhance project implementation in subsequent years of multi-year projects. This process mirrors the anticipated process that projects used with their teachers (Program Objective 4) in using student assessment data to improve teaching. Various challenges predictably affected progress in enhancing internal evaluation data, as lack of capacity or resources or resistance hampered efforts in some projects.

Included in the empowerment evaluation process, evaluators worked with projects to clarify their theory of change. Theory of change has two components – the implementation theory, which addresses intended implementation – and program theory, which examines the behavioral responses anticipated from those affected by the implementation (Weiss, 1998). These two components manifest in program logic models. Unless the projects' models are made explicit, either during the proposal process or in early phases of implementation, neither fidelity to a plan nor evaluation of implementation fidelity can be conducted (Weiss, 1998).

Project models also provide information about the kinds of effects that evaluators and project leadership should focus on to test the efficacy of the model. For project developers, models make explicit the implicit assumptions in the project. If the model turns out to be successful, it provides guidance as to the reasons for the success of the project and areas that may lead to further testing (Hennessy, 1995). The evaluators developed and delivered program logic models to each project team, discussing and refining results in the cycle's start-up workshop. In most cases projects' logic models aligned closely to the overall ITQG program's logic model; a variety of mandatory intervention events (summer academy, follow-up sessions, ongoing contact with teachers) are intended to enhance teacher content knowledge and pedagogical practice in a way that will improve student outcomes in science and/or mathematic. Additional aims in bolstering university preservice teacher curricula are included as a requirement. However, the extent to which project teams have been able to attend to the various components of their logic models and work plans, closely tying implementation to intended outcomes, has been quite variable.

ITQG Objectives

The Evaluation Questions (EQ) that were addressed in the ITQG program evaluation aligned to both the Evaluation Objectives (EO) found in the evaluation RFP and the Project Objectives (PO) in the RFP for the Cycle 11 projects upon which their successful proposals were based. Evaluation Questions and their alignment are of three types: formative, process and summative (In practical terms, "formative" and "process" often are used interchangeably in everyday use.).

Some EQs were not explicitly aligned but address formative and process issues involved with effective and efficacious implementation of the elements required in the RFP or cross-cutting questions.

External Evaluation RFP Objectives

Evaluation Objective 1: Increase teacher participants' knowledge and understanding of key concepts in math and/or science as aligned with each project's content focus.

Evaluation Objective 2: Improve teachers' knowledge and understanding of student-centered pedagogy that utilizes scientifically-based best practices.

Evaluation Objective 3: Enhance participants' use of assessment data to monitor the effectiveness of their instruction.

Evaluation Objective 4: Improve student achievement in the math and/or science content areas.

Evaluation Objective 5: Demonstrate a measurable impact on pre-service teacher education programs at the partnerships' higher education institutions.

Project Cycle 11 Objectives

Project Objective 1: Improve student achievement in targeted mathematics and/or science content areas.

Project Objective 2: Increase teachers' knowledge and understanding of key concepts in targeted mathematics and/or science content areas.

Project Objective 3: Improve teachers' pedagogical knowledge and practices that utilize scientifically-based research findings and best practices in inquiry-based instruction.

Project Objective 4: Improve teachers' knowledge and skills in designing and implementing assessment tools and use of assessment data to monitor the effectiveness of their instruction.

Project Objective 5: Improve the preparation of pre-service teachers through improvements in mathematics and/or science content and/or pedagogy courses.

Evaluation Questions

Formative and Process Evaluation Questions

EQ 1. What are the critical elements of the ITQG projects? Which elements are common across projects? How did projects use the Show-Me Standards, the GLEs and the CLEs? How did the design reflect the Common Core Standards and the Model Core Teaching Standards?

EQ 2. What is the level of fidelity of implementation for each project?

a. What challenges to implementation were encountered? How were these challenges overcome?

b. What institutional support enhanced the fidelity of project implementation? How were project objectives linked to the school improvement plan?

EQ 3. How is sustainability planned for and supported?

Summative Evaluation Questions

EQ 4. What was the effect, both by project and cumulatively of the treatment on teachers' content knowledge? (Project Cycle 11 Objective 2 (PO2); External Evaluation RFP Objective 1 (EO1))

EQ 5. What was the effect on classroom practice of each project's treatment to improve teachers' understanding of student-centered pedagogy across projects? (PO3; EO2)

EQ 6. What has been the effect of the use of assessment data on instructional practice? (PO4; EO3)

EQ 7. How does achievement of students vary due to project treatment? (PO1; EO4)

a. How does the effect vary for high-needs districts?

EQ 8. How were preservice programs affected by participation in the projects? (PO5; EO5)

a. What measurable effect did participation in the projects have on improving content or pedagogy for preservice teachers?

EQ 9. What project elements are most effective in promoting change in participants?

a. Which project elements are associated with increased teacher change?
b. Which project elements are associated with increased student achievement?

EQ 10. What are the characteristics of effective partnerships in ITQG projects?

Evaluation Methodology with Comment on Cycle 11 Experience

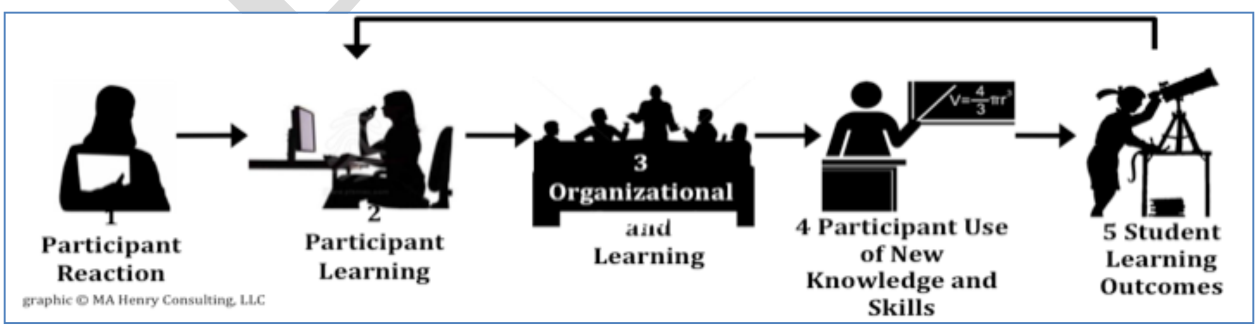
Formative/Process Evaluation

Formative/process evaluation addressed the first three evaluation questions. When interviews and observations occurred, data collected included information needed to address these questions. Evaluators worked with and across individual projects to assure fidelity to their plans and fidelity to the intent of the ITQG program. The evaluators' experience has shown that maintaining open lines of communication, "checking in" proactively rather than passively waiting for questions to arrive from projects, instituting the types of on-line forums described elsewhere, and providing stable, focused staff contacts for projects help to promote an atmosphere for the best use of evaluation for formative and process purposes. A learning curve for new projects is to be expected as professional developers and academic researchers are not necessarily grounded in evaluation and evaluative research practices.

High-Quality Professional Development

Guskey's (2000) model for high-quality professional development (See Figure 1) has been used as the overall framework for evaluation of the professional development offered in each project. Guskey's levels for evaluating professional development are (1) Participant's Reactions, (2) Participant's Learning, (3) Organization's Support and Change, (4) Participant's Use of New Knowledge and Skills, and (5) Student Learning Outcomes. Each of the five levels was addressed in either formative, process, or summative evaluation processes or analyses. The evaluation of the alignment to Missouri's High Quality Professional Development was performed by completion of the *Survey of Teachers – High Quality Professional Development* instrument (DESE, 2006) based on observational data in order to reduce both reporting burden and the potential effects of self-reports.

Figure 1. Guskey's Model for High-Quality Professional Development



Introductory Meeting

The evaluators attended and presented at an RFP workshop October 12, 2012. After funding awards were announced, an initial one-day meeting was held March 18, 2013, a short time after new awards and renewals were announced. The meeting included external evaluators, some project PIs and their evaluators, and other project co-PIs and staff. This meeting described the external evaluation plan and the expected requirements for and with individual projects. The projects' draft program logic models, already mentioned, were shared and discussed. One project team stated its concerns about evaluative expectations for internal student test results and other evaluative requirements. Much of the concern appeared to deal with questions about RFP approvals, with a misapprehension that they would be problematic. The evaluators sought to allay these concerns and later experience showed they were unwarranted. However, it was noted that, as with Cycle 9, some teams with earlier experience with the ITQG found the transition to a better-practices evaluation model challenging, and appeared reluctant at times to adopt the expected practices.

Onsite Project Visits

Evaluators met at least once with PIs in the summer to observe the training and follow-up with implementation and at least once in the academic year when the projects were being implemented in the classroom. During these meetings, evaluators interviewed project staff, internal evaluators (where available), project TAs/GRAs, university and school district administrators, and participant teachers. During site visits, evaluators monitored implementation of the project for fidelity to the project plan and for alignment with ITQG objectives. Project staff and university administrators whose programs were potentially affected by the ITQG projects were interviewed on a case-by-case basis.

Academic-year site visits were arranged with schools/teachers selected to provide a fair representation of the ITQG program as a whole in order to better understand the projects' presence and effects in the field.

Communication

The external evaluation team maintained its online forum for project participants during the cycle. The forums were to be used for discussion of evaluation processes, access to online surveys, discussion of cross-project successes and concerns, and a place for general communications and announcements. The purpose is to have a central place for all project staff to easily communicate about ITQG issues. Access is available through login so that comments and responses remain confidential within the participant groups. Use of the forum remained minimal in Cycle 11. However, the forum remained open to provide general information when needed. Practically speaking, direct contact via email or telephone remained the usual means of communication with and between projects.

Reporting

Additional to required quarterly reports and annual formative and summative reports being produced for MDHE and the projects, a few ad hoc written reports were produced when appropriate. Frequent communications between the evaluators and project teams and MDHE staff also continued, with the evaluators quickly responding to all questions posed about processes, data needs, and other project details.

A summit meeting to close out the cycle and report on evaluation findings was scheduled for November 19, 2014, with an opportunity to discuss project experiences and results. The evaluators have sought avenues to more broadly disseminate Missouri ITQG experiences. They will continue to work towards promoting a better understanding of the program, its evaluation and its accomplishments.

Instrumentation

The evaluators continued to communicate with projects to assist in the construction of valid items for their internal evaluation tests. When the data were provided, external evaluators ran reliability tests on the instruments for projects with recommendations for adjustment in items, where necessary.

Projects largely continued to refine their practices and reported their internal-evaluation results with greater confidence. However, issues especially with student testing tactics remained problematic where teacher-developed assessment tests were applied to serve evaluation purposes. Apart from a lack of reliability testing for in-depth validation of such instrumentation, the lack of alignment between such specific student assessment tests and evaluation instruments that can serve to evaluate project results reduces the usefulness of such data. Alternatively, greater emphasis on projects' classroom observations to track and support teacher performance has yielded, at times, information helpful to indicate changes in classroom practice. However, such observation data, as projects are aware, require inter-rater reliability and a thorough agreement among observers in order for data to be consistent and therefore a fair basis for evaluative use.

The evaluators were available for assistance and support during Cycle 11 activities, and continue in their confidence that evaluation requirements are manageable and cost-effective, provided the good-faith efforts and commitment to the required processes are followed. Despite the support offered, some participating teachers continued to elude external evaluation activities when absent during testing and instrumentation. The evaluators appreciate the additional assistance in securing missing data, because as previous cycles have shown, without project team support program evaluation efforts falter. Even with the support received, additional work to capture all possible information is needed so that evaluation efforts more-completely reflect the program's impact. The evaluators remain happy to assist projects in meeting their grant requirements at any time needed.

Statistical Analysis

Specific analyses are discussed with each summative evaluation question. A major difference between Cycle 11 and the previous two cycles is the lack of availability of state-provided student standardized test data, necessitating development and testing of an alternative approach to evaluating student impact. While the results are interesting, the use of the standardized student test data, for which agreements are in place and for which it is hoped access will be possible in the next cycles, is necessary to more fully address the critical component of student effects from the ITQG. No alternative equals the potential value of this data source.

Summative Evaluation

EQ 4. What was the effect, both by project and cumulatively, of the treatment on teachers' content knowledge? (Project Objective 2 (PO2); Eval RFP Objective 1 (EO1))

Evaluators continued to support projects that requested assistance with developing and examining their internal evaluation instruments for validity and reliability. Untested instruments continue to be used.

No project has undertaken the identification of a group of students or teachers to use as a comparison group for their treatment teachers. With no comparison groups, evaluators continue to urge the use of effect sizes rather than or in addition to t-tests and measures of central tendency to claim effects of the professional development.

As in the previous cycle, the external evaluators' content test was focused on an environmental education context, and included mathematics and science questions in the framework of problem solving. The final instrumentation was aligned with the National American Association for Environmental Education (NAAEE, 2007) standards identified by projects as their focus standards. The evaluators constructed a test with content relevant in some way to most of the range of math and science coursework teachers were teaching. By framing the content in a problem-solving scheme, the test aimed at assessing change in teachers' approach to thinking through content-related questions, which would be an outgrowth of the pedagogical practice to be exemplified by the projects. The test underwent face, construct and content validity testing with a team of authorities, followed by reliability analyses. A Cronbach's coefficient alpha of .49 on the pretest was low but acceptable for determining a group's achievement. A coefficient alpha of .63 on the posttest indicated that the items were not highly correlated. Items identified to be measuring the same skill and those within scenarios were analyzed and were low as well.

The Cycle 11 environmental education tests were purposefully reduced in size by one question in order to reduce the testing burden on teachers. Individual projects were increasing their testing and teachers in many projects were undergoing testing for one day each pre/post. External evaluators did not want to add significantly to that testing burden. Analysts believed that the confounding factor of the pretest was that too few items affected the reliability on the posttest. The additional posttest question increased reliability but was still below desired levels.

EQ 5. What was the effect on classroom practice of each project's treatment to improve teachers' understanding of student-centered pedagogy across projects? (PO3; EO 2)

Eight focus teachers were observed at least two times over the nine months of the academic year. These observations followed the summer institutes so teachers would have had the advantage of potentially having increased content knowledge and exposure to inquiry pedagogy.

The *Inside the Classroom Observation and Analytic Protocol* (ITC) (Horizon Research, Inc., 2002a) was used. The ITC observation tool is divided into four domains: design, implementation, mathematics or science content, classroom culture. Each domain has numerous items that are coded according to a 1 through 5 ("not at all" to "a great extent") scale, and a "synthesis rating" is applied to each domain. Finally, a capsule rating with a different coding system but also with scores of 1 through 5 (again, lowest to highest) is used to rate the lesson overall. The three rating is divided into 3Low - somewhat effective teaching, 3Solid - effective teaching, and 3High - very effective teaching but not quite proficient. Each of the levels has an accompanying rubric to differentiate the levels.

EQ 6. What has been the effect of the use of assessment data on instructional practice? (PO 4; EO 3)

NCATE (2010) calls for teaching faculty to model appropriate uses of assessment to enhance instruction and student learning. Evaluators examined the extent that university partners and other project leadership modeled use of assessment during the project trainings and as an indicator of change in the preservice program. Data were obtained through higher education administrators, project faculty interviews and surveys, during observations at the summer trainings, and from project reports.

As in the past, all projects in Cycle 11 shared an objective to improve teachers' knowledge and skills in the design and implementation of assessment tools and the use of assessment data to monitor the effectiveness of their instruction. Projects continued to address the objective in different ways, interpreting the requirement of integrating "data-driven assessment" across a range of possibilities.

Fewer projects brought in outside experts than in the previous cycle. These outside experts tend to address the subject from a rather broad perspective, encouraging development of data teams and discussing emerging large-scale assessment systems and requirements.

As an alternative, most projects continued to embed the subject more integrally within project curriculum and worked with development of assessment tools aligned with teacher-identified curricular and classroom needs. These assessments have already been cited as also used at times for evaluation purposes, with mixed results in terms of applicability, validity and reliability. Development approaches included teachers working together as data teams within their schools and promoting action research among individual teachers. Some projects specifically focused on teacher-identified issues in assessment, attempting to identify particular issues within the teacher's school context.

Additionally, assessment (not necessarily "data-driven") was incorporated by having teachers create their own assessment instruments for project-developed lesson plans. An intention to apply such instruments as part of internal project evaluation created some questions about adequacy of results to inform project impact on students. Lack of validity and reliability testing, or inclusion of such methods as a part of substantiating assessment tools for evaluation purposes, hampered the usefulness of this approach. While teachers appreciated the need for refinement of assessment practices and described wanting to integrate project-related assessment work into ongoing assessment activities at their schools, they often seemed unprepared to incorporate technology or more refined methods into their actual practice.

Classroom observations did indicate thoughtfulness among some teachers about how to apply assessment within the larger instructional context, with a more dynamic, collegial and inquiry-based approach to working with quizzes and their results. Continued adoption of pretest/posttest assessment methods, already in place in some schools, added to a more focused and specific way to understand knowledge gains.

As suggested in the past, project leadership could incorporate the gathering and use of student data in a more systematic way to better meet this objective. Some projects have done so. It is possible that discussion between the MDHE ITQG staff and project teams on how best to prioritize and implement this component would be of assistance in enhancing its effectiveness within the ITQG program. Some uncertainty on prioritization appears to exist concerning this component.

During school site visits during the academic year, as in prior cycles, the effect of the use of assessment data was examined through observations, conversations with the teachers and through extant documentation provided by the teachers. Data were analyzed through qualitative analysis.

EQ 7. How does achievement of students vary due to project treatment? (PO 1; EO 4)
a. How does the effect vary for high-needs districts?

Unlike in previous years, student level data were unavailable to evaluators so extant data were the source for evaluating student achievement. An evaluation plan modification focused on examining trends in the percentage of proficient plus advance students for each project school across the five years from 2010 to 2014. These data are available on the Department of Elementary and Secondary (DESE) web site (dese.mo.gov) and are publically available. Schools in which a Cycle 11 teacher taught were examined for mathematics and science achievement in grades tested. The small number of schools in each subject and grade level limited the type of analysis that could be performed. Trend lines for each school were graphed along with the state trend for each subject and grade level tested.

This visual inspection of the comparison graphs showed that there is no consistent pattern either across grades or content areas.

Without individual level data and a limited number of schools at each grade level, use of inferential statistics has many limitations in this situation. The power to detect significance is greatly reduced and the parameter estimates are likely to be biased and limited in their ability to be replicated. With these limitations in mind, some multilevel models were used to examine if there were any trends across the years that might offer some insight not apparent in the graphs.

The multilevel models used schools as the level 2 variable and the five years as a repeated measure within schools for level 1. Year was included both as a linear and quadratic term to account for linear and curvilinear trends that increase or decrease overtime.

As expected, the statistical power was very low due to the limited number of schools. No statistical significant trends were found for science. For math, fourth grade showed a significant quadratic trend in which scores tended to increase in the early years and then decrease in later years. Algebra I showed a significant decreasing linear trend across the years. Given the limitation of small number of schools, there were no significant upward trends for 2014 in the percent of proficient/advanced for schools in mathematics or science.

Since evaluators were not aware that the student level data would not be available until late in the cycle, after sustained communications following prior cycles' processes, this analysis plan was substituted as an alternative to the standardized test data. Additional refinements will be made to the analysis process for student outcomes for Cycle 12 if data continue to be unavailable from the state. However, as noted, it is hoped that the various reasons preventing data access in this cycle are resolved.

EQ 8. How were preservice programs affected by participation in the projects? (PO 5; EO 5)
a. What measurable effect did participation in the projects have on improving content or pedagogy for preservice teachers?

In Cycle 11 evaluators saw a decline in the participation of preservice teachers or graduate students in the projects. No projects incorporated preservice teachers in their treatment in an integrated way. One project, SEQL, had graduate students as assistants and has attempted to incorporate them in a more meaningful way than in past years. SEMO's MM project has not directly involved preservice teachers but the project teachers are being used as placement sites for SEMO's student teachers. Unfortunately, the student teachers did not select any of these sites as their placement, according to one source of information. Alternatively, another source indicated that at least one student teacher was placed with an

ITQG participant, and that another student teacher has obtained a position in a partnering district and is participating in the project in Cycle 12.

The 4E and TRIM projects, both based at MSU, did not involve preservice teachers directly, though TRIM describes some activities incorporated into their preservice classes that were taken from the summer sessions.

Program effects on preservice programs and teachers continue to be one of the weakest areas of the ITQG program. This pattern will continued until recommended emphasis is placed on it during the proposal review process and projects are required to show progress in this area. At the same time, the evaluators recognize the variable positions of the project teams vis-à-vis teacher preparation programs at their universities, and that universities as a whole have varying scales of teacher training. A later section of the report discusses some of the inherent complexities of the expectation of content faculty and education departments, where they exist, to collaborate at the degree necessary to integrate preservice teachers within ITQG projects in the recommended way. Nevertheless, the objective remains as an important link between the temporal work of projects and the institutionalization of their efforts, as well as the optimal preparation of STEM-focused teachers, or at least teachers who ultimately will teach STEM classes.

EQ 9. What project elements are most effective in promoting change in participants?

a. Which project elements are associated with increased teacher change?
b. Which project elements are associated with increased student achievement?

Analysis of student achievement variables, as available, were examined by considering extant student MAP test results in schools with concentrated ITQG presence versus general trends over time. In addition, as evaluators were in the schools of focus teachers, additional school environmental factors were noted as supporting data for the analyses. These factors range from specific teacher variables, support of the university administration for faculty to participate in professional development, university support for curricular changes, school administrators' support for changes from established curriculum blueprints and pacing schedules, equipment and supplies for inquiry-based classrooms, and, of course, the effective implementation and support elements of the project design.

Each of these types of variables were documented during data collection processes, through surveys, interviews, or direct observation and incorporated into the analysis processes. It was anticipated that with the nested characteristics of these data – student within teacher within school – a more refined analysis would be possible to elaborate on some variables associated with teacher and student change, without relying on self-reports.

Strong partnerships have been thought to contribute to enhancing knowledge and pedagogy. Federal Math and Science Partnership projects funded through the National Science Foundation have produced research into the components of effective partnerships. An analysis of research on partnerships has shown that groups describing themselves as partnerships have generally failed to define what that partnership is (Clifford & Millar, 2008). They may define their organization as a group of people of more than one organization working together, or in terms of other organizational partnership criteria, or may call themselves a partnership with no specific indicators of what that entails. Partnerships may be defined legally or loosely composed of people who occasionally interact in dyads but have no whole-group interactions.

Any of these loosely connected partnership structures pose problems for evaluators. If relationships, membership, or function are not defined, success or characteristics of those successes are difficult to attribute to a particular source (Clifford & Millar, 2008).

These school-university partnerships may be examined in terms of Goodlad's (1991) definition describing such a partnership as representing a planned effort to establish a formal, mutually beneficial, institutional relationship. These partners bring dissimilarities among institutions, an overlap in some functions, and a mutual "commitment to the effective fulfillment of these overlapping functions to warrant the inevitable loss of some present control and authority on the part of the institution currently claiming dominant interest" (Clifford & Milar, 2008, p. 59). Of special interest to federal and state education communities is how to attract, retain and reward higher education content faculty to participate in such partnerships (Foster, et al., 2010).

Partnerships can also be evaluated horizontally and vertically (Clune, 2009). Horizontal partnership elements are found across school and teachers within a particular project. Are all teachers implementing focused content or pedagogy? Are teachers participating in cross-teacher/cross-school professional learning communities? Vertical partnership elements focus on each school or district. If multi-level grades are involved, is there coordination between grades and across staff levels? Are administrators aware of and supportive of the intervention? Do parents understand new pedagogy? Is funding available to support the changing need for classroom supplies?

Evaluators, through interviews, observations and surveys, considered models of each project partnership, identifying the variations in interactions across partnerships. Social Network Analyses were conducted on each partnership using feedback from teacher participants on interactions among each project's participants. Questions focused on whom participants went to for assistance with pedagogy and content for each project. The planned intensity rating for this variable was determined to be less illustrative than the SNA analysis in beginning to identify the components of successful partnerships identified in Clifford and Millar's research (2008).

Evaluation Tools and Measures

1. Teacher Participant Data Questionnaire. The evaluators continue to find that generally poor or non-existent quality control by the school, school district and project staff compiling and reporting Participant Data Forms to MDHE considerably lessens their reliability, despite the considerable weight placed upon the data they provide. They provide starting and ending data on participants, participant types, location, number of

students, and other valuable information. The evaluators have balanced these reported data with data collected through evaluation activities; a few discrepancies remain, leading to slight variability in participant counts in selected domains of interest. The evaluators recognize the dynamic and sometimes fluid nature of participation in the projects. However, unfilled data items and other lapses challenge accuracy both for evaluation purposes (internal evaluation presumably requiring these data as well) and for administration of the projects.

2. Professional Development Observation Protocol. This observation protocol, was dropped in Cycle 10, as the ITC (see number 3) itself was found to be relevant and appropriate without modification and allowed comparison of the PD model to actual classroom implementation.

3. Inside the Classroom Observation and Analytic Protocol (ITC) (Horizon Research, Inc., 2002a) was used for external evaluation classroom observations. Horizon reports reliability coefficients from .95 to .97 on the four domains plus the Capsule rating (Horizon Research, Inc., 2002b). Analysis of outcomes (Henry, Murray, & Phillips, 2007; Henry, Murray, Hogrebe, & Daab, 2009) and wide use of this instrument by professional education evaluators assure evaluators of alignment to reform-based pedagogy.

2. Teacher, Administrator, and Higher Education interview protocols were designed to align with evaluation questions. Also, open-ended interviews were applied for emergent issues.

3. Project Staff Interview Protocols were designed for alignment with evaluation questions.

4. Environmental Education Teacher Test was constructed, subjected to validity and reliability testing, and applied as already described.

5. Technology Implementation was documented through sections on the ITC and items directly addressing technology usage were included on existing teacher and administrator surveys during adaptation for Cycle 11. These items were informed by the ISTE Standards for Teachers (2008) and Students (2008).

6. High Quality Professional Development Survey (DESE, 2006) was completed by the evaluation team for each project. The items were scored based on observations both on-site in the summer academy, observations of classroom teachers, interviews with teachers and administrators, and extant documentation.

Method for Identifying, Collecting, and Analyzing Data in the Evaluation of the PD Projects

Qualitative analysis was undertaken on all text and extant document artifacts. Sources included online discussions, project professional development plans, open responses from surveys, and secondary sources such as project reports. No preservice documents with evidences of university/college change in preservice programming with subsequent preservice teacher change were available from the projects. Where appropriate, descriptive statistics were applied.

Teacher content tests were analyzed for teacher pre/post gains. Two-tail t-tests for statistically significant differences were applied. Effect sizes provided some cross-project comparisons.

The external evaluators provided guidance on validating projects' internal tests, performing reliability assessment, and appropriately analyzing results for several of the projects

Student knowledge gains were analyzed using a variety of extant and publicly available standardized test scores by selected school, compared to the state, over time.

Table 1 presents the Evaluation Logic Model in its original form for the external evaluation. Such products inevitably undergo refinement as the reality of program evaluation presents divergent experience and needs, but the logic model remains substantially current.

Table 1. Evaluation Logic Model

Evaluation Question	Indicator	Instrument	Analysis	Source of Data
EQ 1. What are the critical elements of the ITQG projects? Which elements are common across projects? How did projects use the Show-Me Standards, the GLEs and the CLEs? How did the design reflect the Common Core Standards and the Model Core Teaching Standards? (Formative)	Projects are aligned to CLE, GLE, CCS and MCTS; Critical elements identified	Professional Development Observation Protocol, Sets of standards for alignment, project proposals	Qualitative analysis of documents; alignment to most applicable components is present	Projects, observations and field notes from evaluators
EQ 2. What is the level of fidelity of implementation for each project? (Formative)	Implementation of projects is aligned with the plan from their proposals, implementation aligns with Missouri High Quality Professional Development Standards and Guskey's levels of PD implementation	Survey of Teachers - High Quality Professional Development; Guskey's rubric for PD Implementation, PD Observation Protocol	Qualitative analysis of field notes, ITC, interviews, and survey information	Extant documents, field notes, ITC ratings and notes, teachers, project staff
2. a. What challenges to implementation were encountered? How were these challenges overcome? (Process)	Challenges were identified by projects, strategies for meeting challenges identified and evaluated by projects	None	Qualitative analysis of field notes, interviews, project reports	Project PIs and staff, teachers and administrators
2. b. What institutional support enhanced the fidelity of project implementation? How were project objectives linked to the school improvement plan? (Formative)	Institutional support is identified by projects, project objectives are aligned with school improvement plan	Administrator, teacher and project interview protocols, school improvement plans and project proposals	Qualitative analysis of field notes, interviews, project reports; analysis of alignment of project objectives and school improvement plans from partner schools	Project PIs and staff, teachers and administrators; schools, projects
EQ 3. How is sustainability planned for and supported? (Formative)	Plans are in place, resources allocated, administrative support in place for sustainability of projects	Administrator, Teacher and Project Interview Protocols, Higher Education Impact Survey	Qualitative analysis of interviews of teachers, administrators, and faculty, analysis of surveys	Project PIs, faculty and staff, teachers and administrators

Evaluation Question	Indicator	Instrument	Analysis	Source of Data
EQ 4. What was the effect, both by project and cumulatively of the treatment on teachers' content knowledge? (PO2); (EO1) (Summative)	Teacher gains pre/post are statistically significant; treatment students' scores indicate discontinuity in positive direction from comparison group	Project teacher tests, EE evaluator constructed and validated test; MAP and EOC scores from treatment and state students	Significance tests (appropriate for groups with various n's) for statistically significant gain analysis for teacher tests; Regression Discontinuity Design analysis for student scores	Teacher test scores from projects; MAP and EOC scores from DESE with DHE assistance
EQ 5. What was the effect on classroom practice of each project's treatment to improve teachers' understanding of student-centered pedagogy across projects? (PO3; EO 2) (Summative)	Teachers show increases in pedagogy indicators on the ITC across the years of their projects	ITC and field notes	Analysis of ITC Synthesis ratings - comparison of synthesis ratings for four domains across term of the projects	Evaluator observations of teacher classrooms
EQ 6. What has been the effect of the use of assessment data on instructional practice? (PO 4; EO 3) (Summative)	Teachers can identify changes in instructional practice due to results of analysis of assessment data	Teacher interviews and surveys	Qualitative analysis of interviews of teachers and analysis of surveys coded for indications of changes in instructional practice	Teachers
EQ 7. How does achievement of students vary due to project treatment? (PO 1; EO 4) (Summative)	Students from different projects will show differing effects based on project variables	MAP and EOC tests	Quantitative analysis of student data from treatment teachers pre- treatment to post- treatment for each project on MAP and EOC gains	MAP and EOC scores from DESE with DHE assistance
7. a. How does the effect vary for high-needs districts?	Students in high-needs schools will show the same increases as students in non-high-needs schools	MAP and EOC schools	Analysis from student data from treatment teachers pre-treatment to post-treatment for high-needs compared to non-high-needs students	MAP and EOC scores from DESE with DHE assistance
EQ 8. How were preservice programs affected by participation in the projects? (PO 5; EO 5) (Summative)	Preservice programs in all HE institutions show indications of change due to participation	List of course offerings, syllabi from affected courses, faculty interviews, HE administrator interviews, project staff interviews, Higher Education Impact Survey	Qualitative analysis of interview scripts, surveys and extant documents	Extant documents, HE faculty, administrators, project staff

Evaluation Question	Indicator	Instrument	Analysis	Source of Data
8.a. What measurable effect did participation in the projects have on improving content or pedagogy for preservice teachers?	Artifacts from preservice teachers from courses affected by projects show indications of change due to project	None	Qualitative analysis of extant documents coded for content or pedagogy improvements	Professors in courses affected by projects
EQ 9. What project elements are most effective in promoting change in participants? (Summative)	Specific teacher and project variables identified and analyzed, correlations identified	Teacher Participant Data Questionnaire, all test instruments, ITC	Quantitative analysis of teacher, project and HE variables and teachers and student outcomes	All project participants
9.a. Which project elements are associated with increased teacher change?	Specific project elements are identified with their contribution to teacher content gains and increasing ITC scores	Project and evaluators constructed tests; ITC	Quantitative analysis of teacher and project variables for the effect of each variable on teacher outcomes	Project participants, qualitative analysis outcomes
9.b. Which project elements are associated with increased student achievement?	Specific project elements are identified with their contribution to student content gains	MAP, EOC	Quantitative analysis of teacher and project variables for the effect of each variable on student outcomes	Project and DESE data
EQ 10. What are the characteristics of effective partnerships in ITQG projects? (Summative)	Specific unique qualities of projects are correlated with positive effects on teachers and students	All instruments	Quantitative and qualitative analysis of all project data analyzed for specific qualities of projects with highest outcomes	All project participants

3. ITQG Cycle 11 Projects

Four projects were in the field in Cycle 11, down from six projects in the previous year, primarily reaching central and southern regions of the state. Most projects achieved their projected participation targets, an achievement in today's education environment that reflects both recruitment success, a perceived need by districts invited to join the projects, and the fact that most projects represented newly funded projects from teams having prior ITQG funding and established participant pools from which to draw.

Projects included two from different departments at one university, both of which have been funded in past cycles. Another project comprised the core of a previously funded ITQG team, and a returning project with an intact team from a previous cycle rounded out the Cycle 11 projects. Two projects focused on mathematics, one in science (expressed through environmental education content), and one in combined mathematics and science. Three projects worked primarily with elementary school teachers, and one concentrated on high school. However, several also included middle school teachers, one explicitly so.

Cycle 11 Projects and Their Schools and Districts

Participants in the four Cycle 11 projects totaled 149 teachers, understandably fewer than the 205 reported for the five projects in Cycle 10. Table 2 shows the names and locations of the four Cycle 11 projects.

Table 2. Improving Teacher Quality Grant (ITQG) Program Cycle 11 Projects

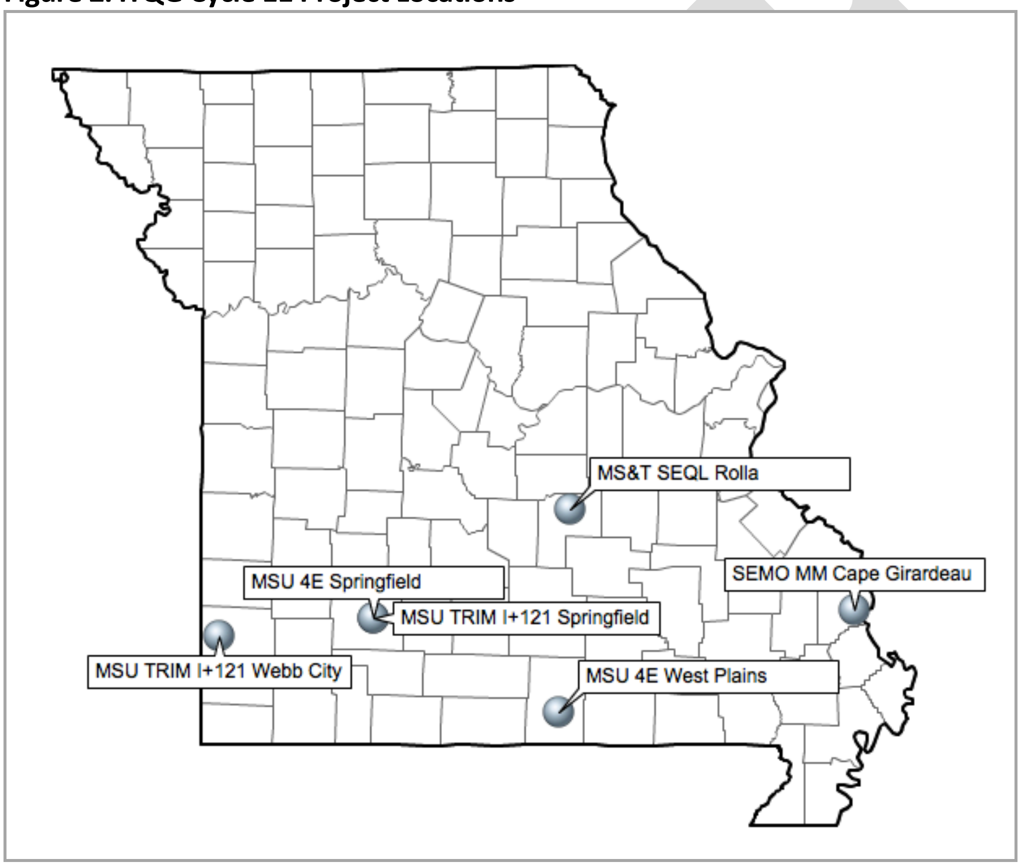
Project Title	Lead Institution	Targeted Grade Levels	Focus	Years (Proposed)	Primary Region	Participants
Science Education and Quantitative Literacy: An Inquiry-Based Approach (SEQL)	Missouri University of Science and Technology	3-5	Integrated Mathematics and Science	3 of 3	Mid-Missouri	39
Transforming Mathematics Instruction Using Inquiry and One-to-One Environments (TRIM I+121), Year 3	Missouri State University	9-12	Mathematics	2 of 3	Southwest Missouri	34
Early Elementary Environmental Education: A Field-Based Approach (4E)	Missouri State University	K-4	Environmental Education	1 of 2	South Central Missouri	36
Making Mathematicians: Learning to Think and Apply (MM)	Southeast Missouri State University	K-6	Mathematics	1 of 3	Southeast Missouri	40

The table indicates that a concentration of participating teachers and school districts in the central and southern parts of the state continued, with larger urban areas and the northern regions not represented. It is understood, of course, that funding is limited, needs are generalized throughout the state, and grant funding involves a competitive and objective process with annual changes in projects and locations.

Figure 2 shows the “home bases” of the Cycle 11 projects, the university locations and, for two projects, the other primary sites of most of their professional development activities.

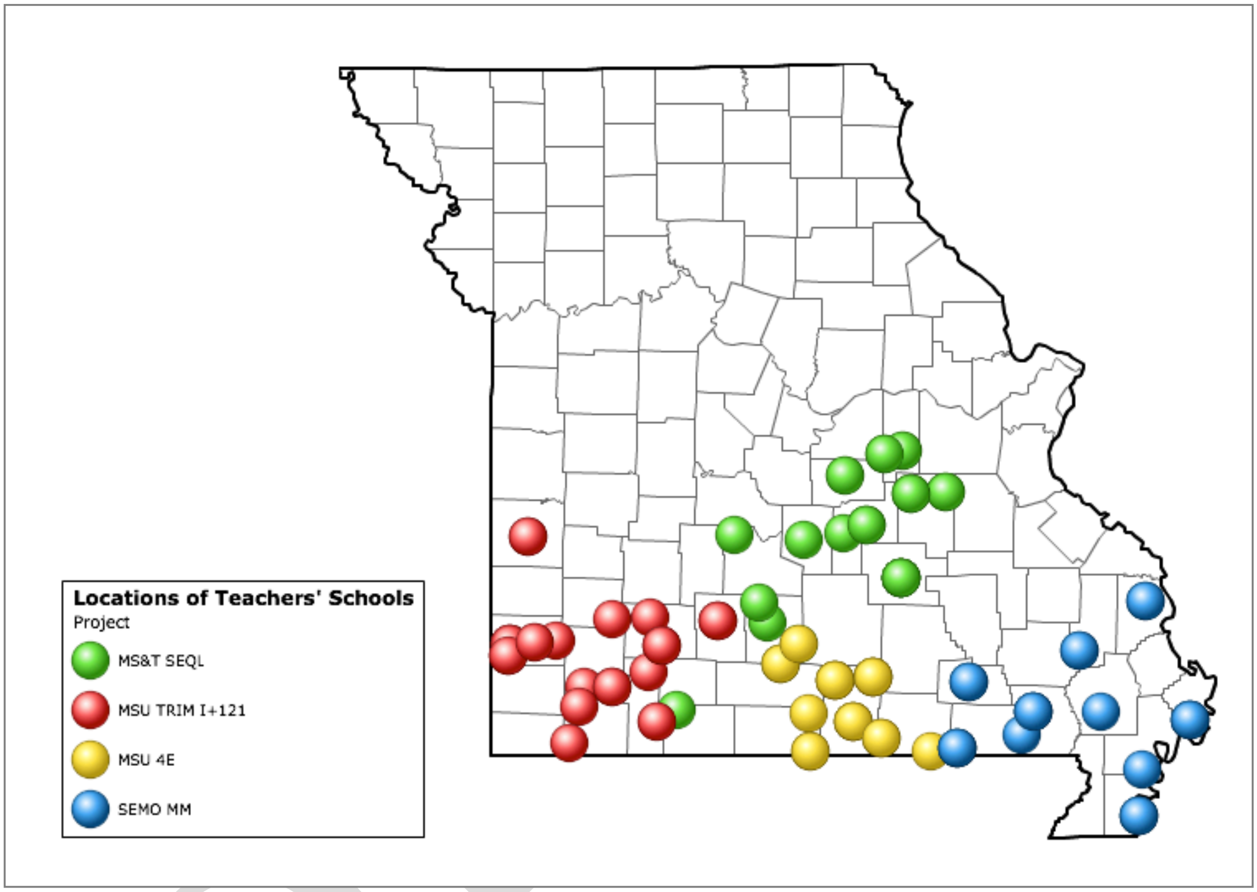
The two Missouri State University projects delivered their professional development outside their Springfield campus. The TRIM I+121 project, as in previous years, worked largely from the Southwest Center for Educational Excellence in Webb City, as well as other sites in the southwest area of the state. One project co-director was employed at the Southwest Regional Center. The 4E project worked largely from facilities at Missouri State University-West Plains. The Making Mathematicians project worked both from Southeast Missouri State University locations in Cape Girardeau and from the Southeast Missouri Regional Professional Development Center, also on campus there. The SEMO project actually is primarily managed through the RPDC. SEQL’s activities were conducted at the campus of the Missouri University of Science and Technology in Rolla. Projects also often convened activities at school settings or in the field.

Figure 2. ITQG Cycle 11 Project Locations



The map in Figure 3 shows the locations of Cycle 11 teacher participants by project. Some locations had more than one school or teacher, and therefore the symbols do not add to the total number of teachers. Projects in Cycle 11 could all be called “regional,” serving schools and school districts in their general areas in the state. One school in the southeast part of the state and one in the south central part had teachers in two projects. As can be seen, projects generally served teachers in their vicinities, often based on prior associations with both teachers and school districts, and teachers were centered in the southern part of the state, mostly near or south of Interstate 44.

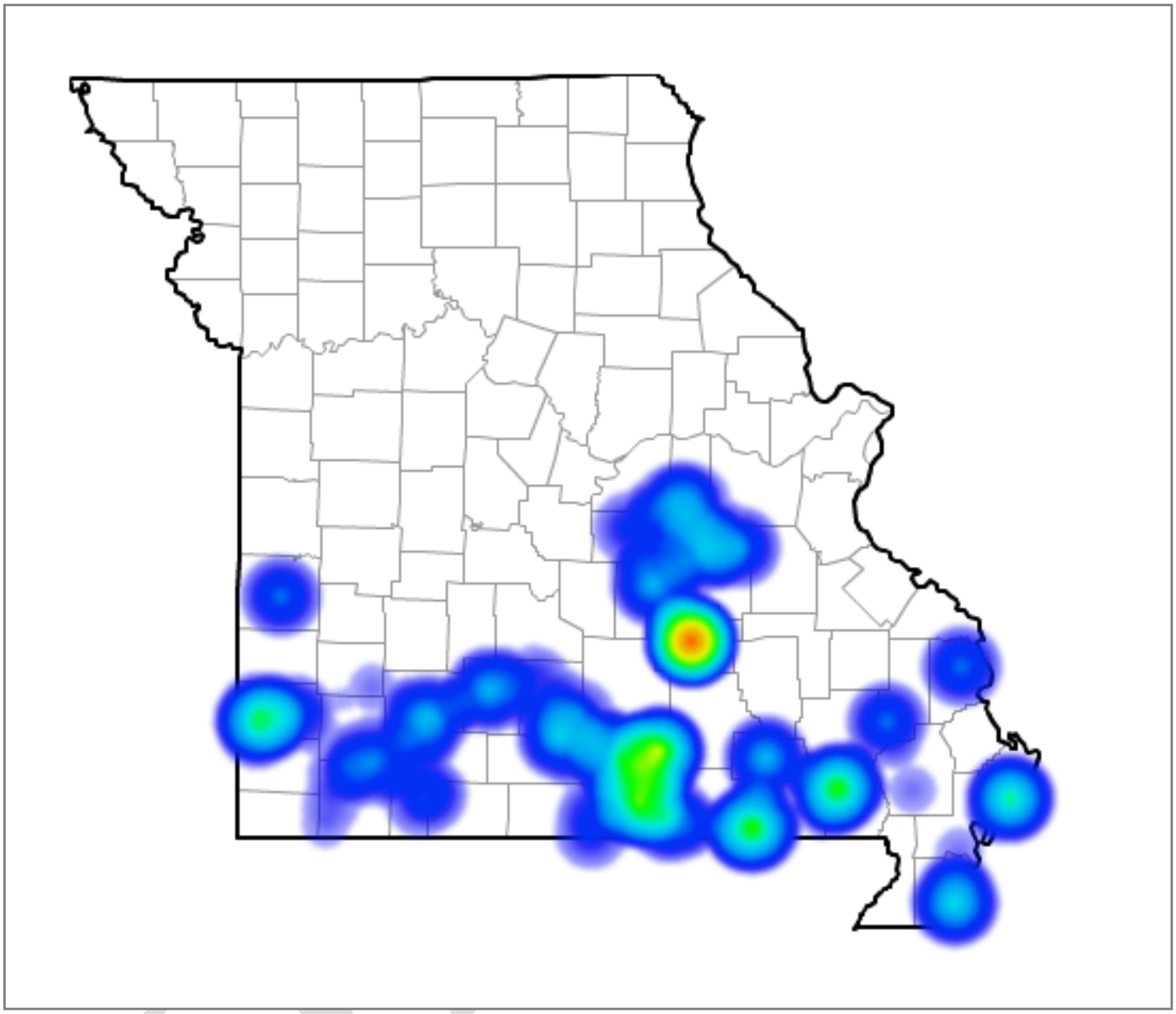
Figure 3. Locations of Teachers Schools by Project in Cycle 11



Numerous schools and school districts had more than one teacher participating in the ITQG in Cycle 11, as in previous cycles. Figure 4 displays a map that indicates where concentrations of teacher participants were greater or lesser.

As the map shows, larger concentrations of teachers were seen in the Joplin area, a combination of school districts in the central part of the state close to the southern border, and in school districts relatively close to Rolla. Participation in the ITQG program by multiple teachers in a school offers obvious direct opportunities for networking; collaborative learning, teaching, curriculum and lesson development; and possibly institutionalization. Participation by multiple teachers at different schools within a school district offers a similar, if less routine, chance for projects to have an effect beyond a particular classroom.

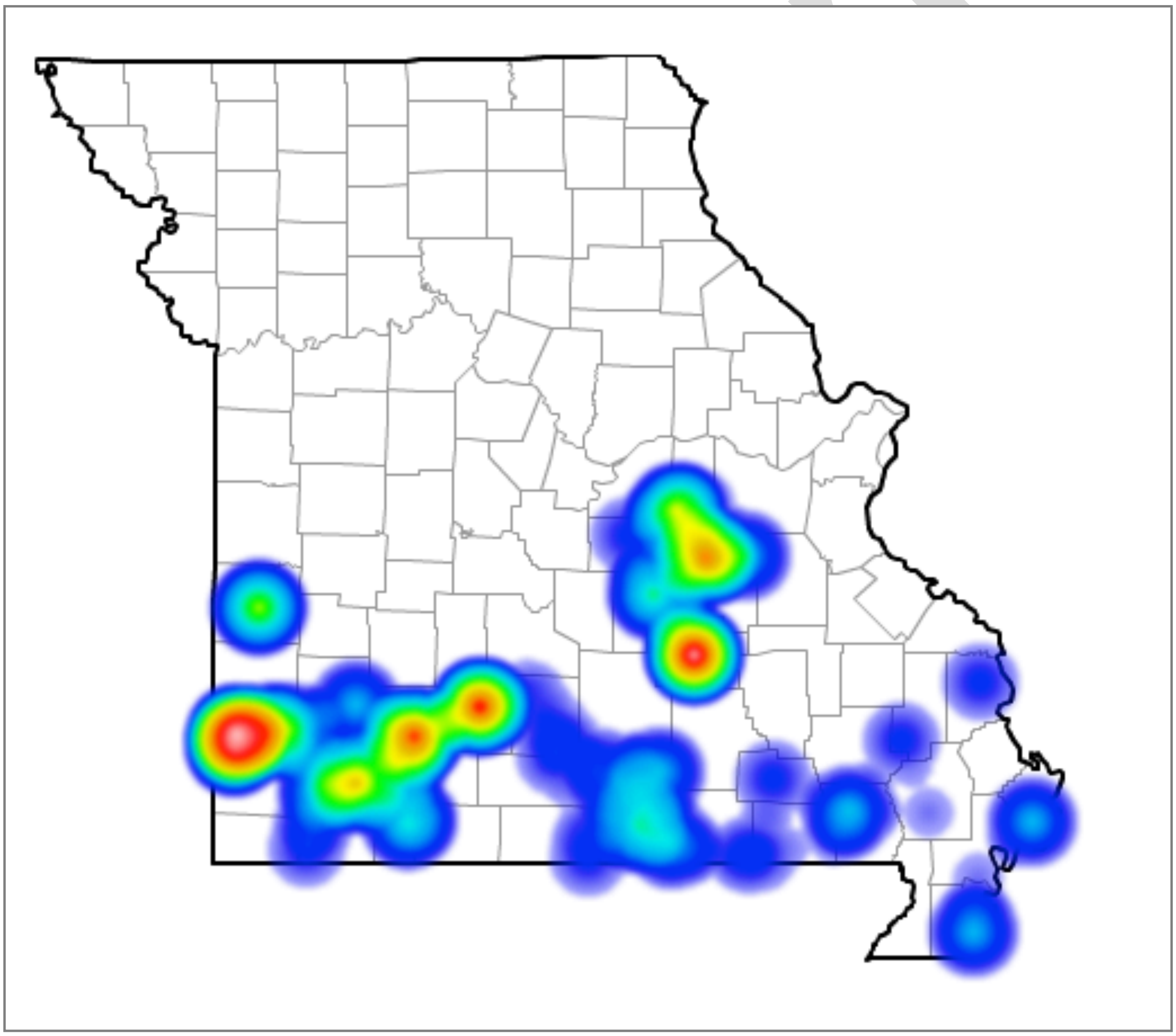
Figure 4. Concentrations of Teachers Participating in Cycle 11



The relatively close proximity – in rural terms, at least – of many teachers in different school districts provides a third level of possible collaboration and networking. In some areas, examples being areas around Rolla, Salem and Poplar Bluff, numerous school districts operate closely in geographic terms. Given shared contexts and community experiences among these rural schools and school districts, participation in the ITQG by multiple teachers in adjoining school districts could provide a source of mutual support often cited as challenging in rural education settings.

Another way to consider the coverage of the ITQG projects in Cycle 11 is to look at the relative concentrations of students directly affected, meaning those whose teachers were in the projects. As teachers in different geographical areas and teaching in different grade levels work with widely divergent numbers of students, a concentration of teachers does not automatically reflect where the greatest concentration of affected students attend school. Figure 5 shows the relative concentrations of numbers of students of teachers in Cycle 11. Counts are estimates based on reported numbers of students and may be incomplete. Comparison with Figure 3 shows close comparability and no surprises in concentrations of students compared to locations of teachers. While middle and high school teachers tend to teach more students than do elementary-level teachers, the rural nature of most school locations appeared mostly to even out the student distributions. Nevertheless, the greater relative number of students affected by middle and high school teachers' participation can be seen to some extent in the southwest corner of the state, and the high concentration of teachers in the east-central area also is evident.

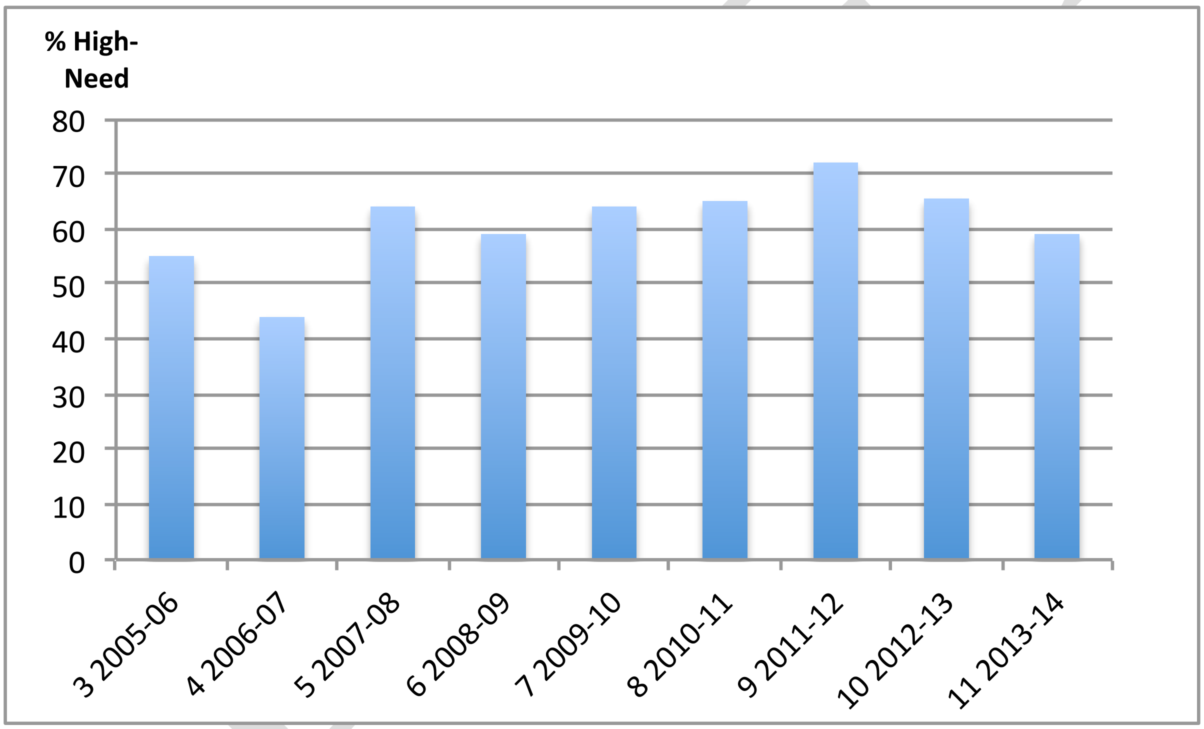
Figure 5. Concentrations of Students Whose Teachers Participated in Cycle 11



As has been noted, all projects covered mathematics and/or science content areas across a range of grade levels. All projects in Cycle 11, including those with a math focus, were to incorporate environmental education into their curriculum. All projects were required to involve a minimum of 20 teacher participants, with at least half coming from high-need school districts. All projects met these requirements.

By the end of the cycle, 59% of participating teachers were reported to have been from designated high-need schools. This proportion was lower than the 65% in Cycle 10 and 72% in Cycle 9. Figure 6 compares high-need participation since Cycle 3. A complication for maintaining high-need participation for returning projects is attrition among participants from year to year, which ranged between 2% and 15% for Cycle 11 projects. The high-need school district list changes annually, and some projects have seen substantial alterations from year to year, and new districts have had to be recruited in the midst of implementation.

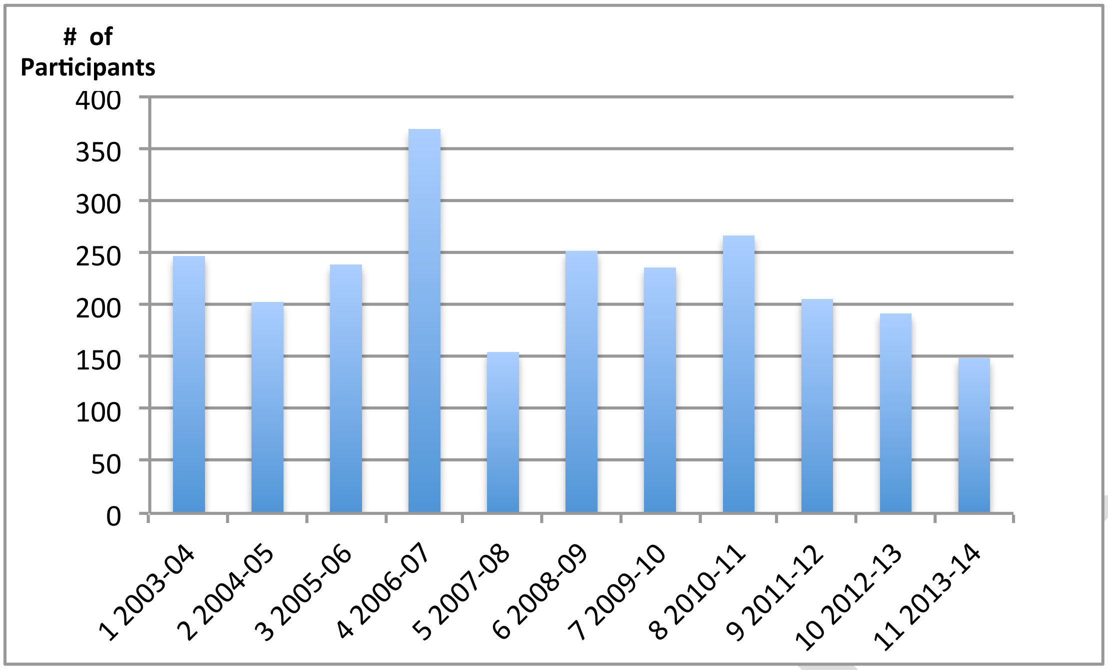
Figure 6. Participation of Teachers in Designated High-Need School Districts Across Cycles



Project Participants

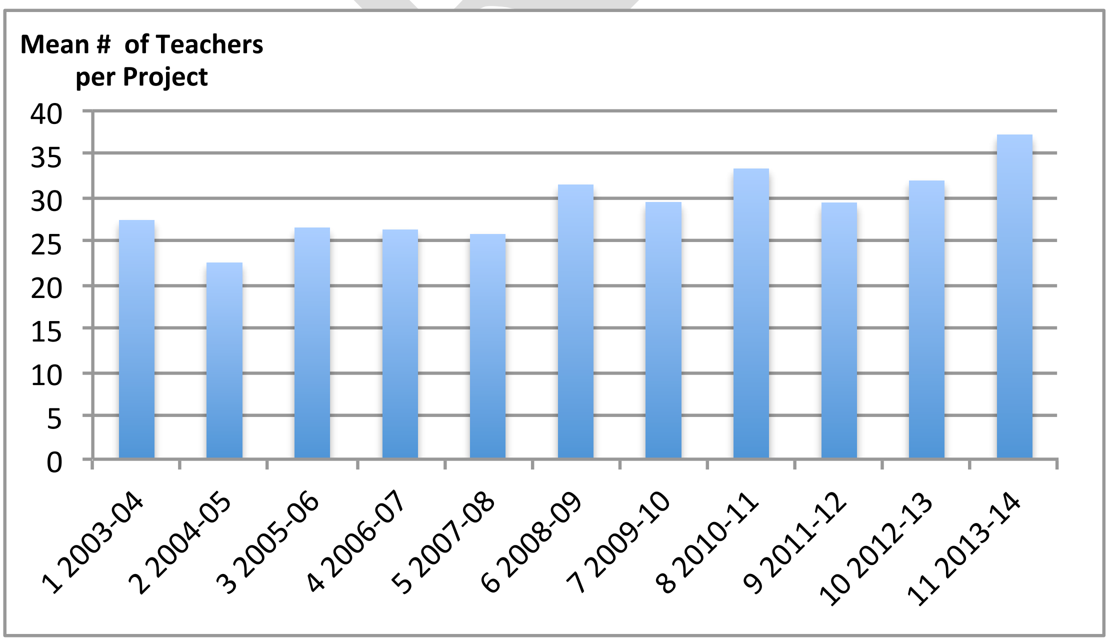
A total of 149 educators participated in Cycle 11, down from 192 in Cycle 10 and 206 in Cycle 9. Of course, the fact that there were four projects in Cycle 11 versus six in Cycle 10 and seven in Cycle 9 simply explains much of the decrease. Compared to the previous cycle when 15 participants were administrators or preservice teachers, all participants in Cycle 11 were classroom teachers, although some also held additional staff responsibilities in their schools and districts. Figure 7 compares ITQG participant counts across cycles.

Figure 7. Number of Teachers Participating in ITQG Across Cycles



The relatively large number of teachers in Cycle 4 resulted from a one-cycle change in implementation strategy in which more projects were funded for a shorter period of time. Much of the difference in participant counts over the years is the result of the different number of projects per year, of course. To account for these changes over cycles, Figure 8 shows the mean number of teachers per project over time. In contrast to the differences in

Figure 8. Mean Number of Teachers per Project Across Cycles



the number of participants over time, with a comparatively low number in Cycle 11, it can be seen that, in fact, projects in Cycle 11 has included more teachers on average than in any other cycle since the ITQG began.

Teacher Characteristics

Figure 9. Teachers' Educational Attainment in Cycle 11 (n=147)

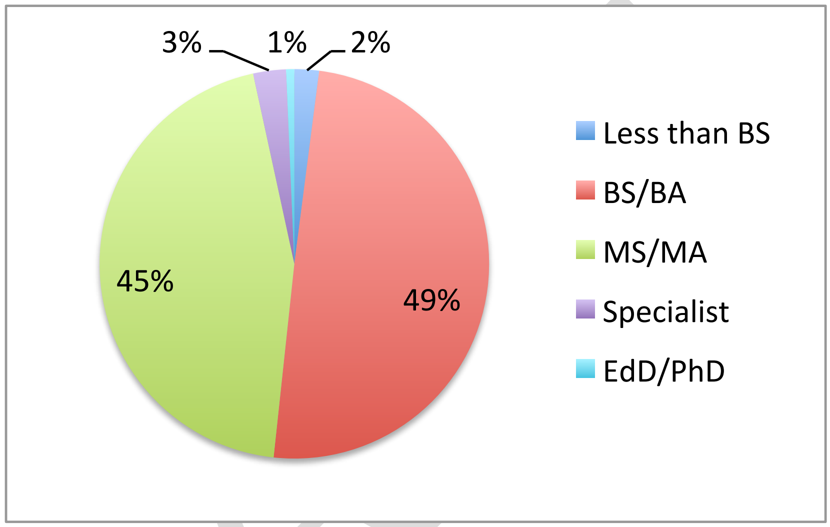
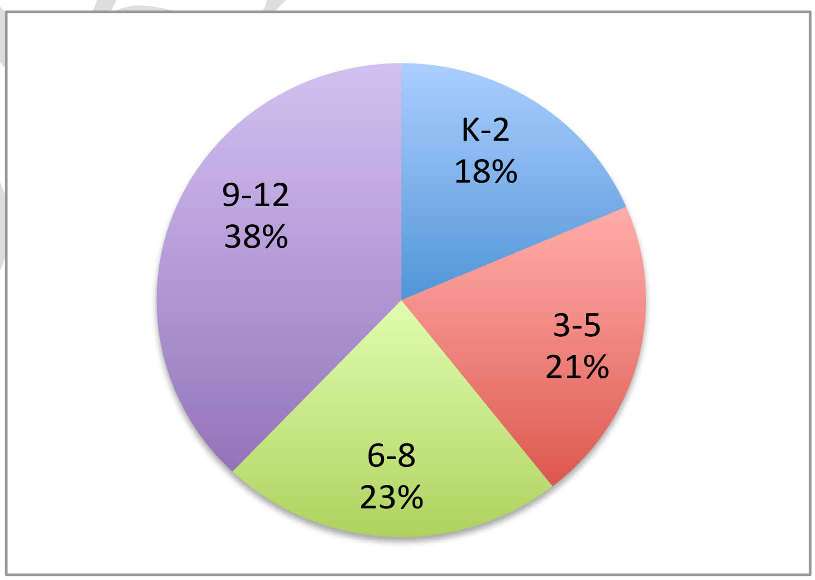


Figure 10. Percent of Teachers Teaching at Various Grade Levels in Cycle 11 (n=147, with many teachers teaching at multiple grade levels)



Cycle 11 teachers who reported their teaching experience averaged 9.5 years in the classroom, compared to 12.5 years in Cycle 10 and 11 years in Cycle 9. Teachers continue to represent a substantially experienced group, although new and less-experienced teachers, as in the past, did participate.

Forty-five percent of teachers for whom educational attainment was reported have master's-level degrees, down from 60% in Cycle 10 and the 54% in Cycle 9. Figure 9 shows the distribution of teachers by educational attainment in Cycle 11. The greatest proportion of teachers – about half – had bachelor's degrees.

The grade levels taught by Cycle 11 teachers remained well-distributed across grades. Many teachers taught at more than one grade level, as in the past. For example, high school level math and science teachers often taught more than one grade, as did middle school teachers. Higher-grade teachers are more likely to be science- or math-focused, while earlier-grade teachers often are generalists working across subjects. As Figure 10 shows, with all grades taught by teachers a fairly even grade distribution is seen.

ITQG Cycle 11 projects, considered together, therefore reached the full range of grades, K through 12. The largest change from the previous cycle was seen among high school teachers participating, up to 38% from 17% in Cycle 10. Cycle 11, with only four projects, had a greater-than-usual proportion of high school projects simply because one of the four aimed at these grade levels.

Figure 11. Distribution of Grade Levels at Which Teachers Taught in Cycle 11, by Project (n=147, with many teachers teaching at multiple grade levels)

Grades	Project and Project Grade Focus				
	MST	MSU TRIM	MSU 4E	SEMO	Total Reported
	4-6	9-12	K-4	K-6	
Pre-K			2		2
K	1		13	4	18
1	1		8	9	18
2	1		8	9	18
3	1		10	7	18
4	6		4	7	17
5	12		4	8	24
6	13		3	8	24
7	10	4	2	4	20
8	9	7	2	3	21
9	4	23			27
10	3	24			27
11	3	23			26
12	3	22			25

(dotted shading) Indicates outside of focus grades

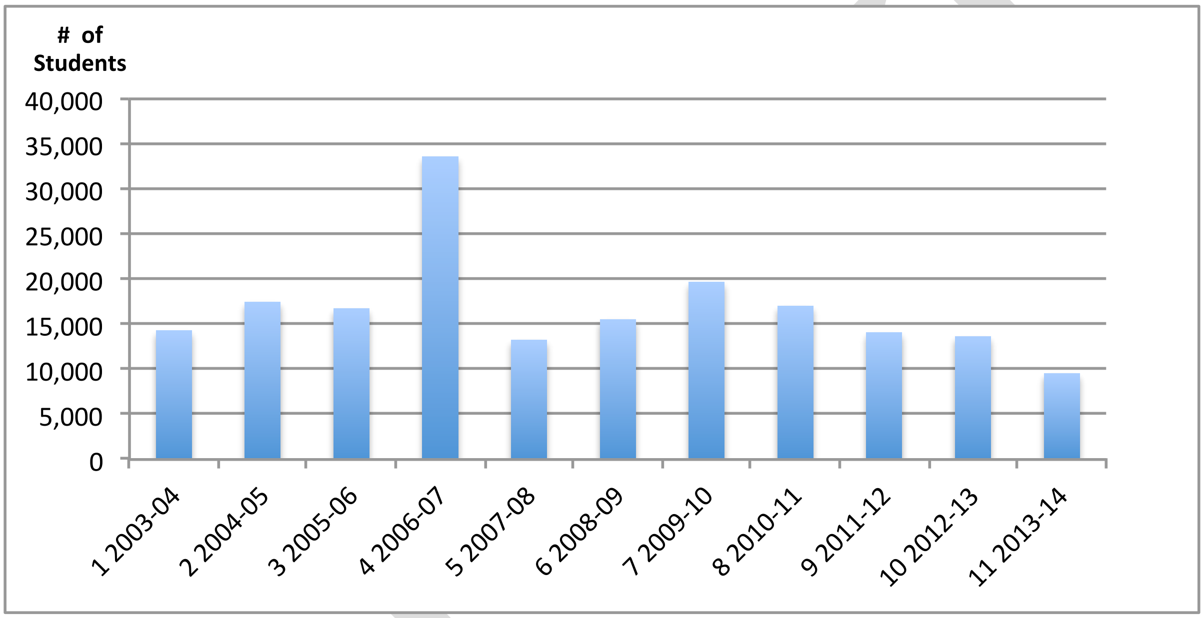
Another way to see how grade levels were affected in Cycle 11 appears as Figure 11. Here the grade distribution in the four projects is shown. The apparent number of teachers exceeds those in the project because of many participants teaching at multiple grade levels. As can be seen, all projects had teachers outside their primary focus grades. The ITQG program encourages strong school district partnerships, and some exceptions are made in grade focus. Also, special education teachers often reach students at numerous grade levels. The breadth of grades reached by the program is evident. As project curricula are prepared with particular grade focuses in mind, additional refinement and accommodation is required when other grade levels are included. Relevance of content and activities at multiple grade levels can be challenging, particularly when issues of differentiation for different learners within grade levels already call for attention.

Students Affected by Cycle 11 Projects

The number of students estimated to be directly affected by their teachers participating in the four Cycle 11 projects totaled 9,531, down from 13,650 in the six projects in Cycle 10. Teachers each taught an average of 64 students each in Cycle 11, down from 71 in Cycle 10 and 68 students in Cycle 9.

Variations in grade level and proportions of larger or smaller schools over time are mostly responsible for changes seen. Content focus also affects the number of students reached by a teacher. Where special education teachers are concerned, for example, those working in mathematics or science often work with smaller numbers of students than other teachers do. Date reporting also affects estimates. Figure 12 compares Cycle 11's student counts with those reported in previous cycles. Over time, numbers of students were affected by such factors as funding level, number of projects and teachers, and grade level. Cycle 4, as with teacher participant counts, is an obvious outlier because of many small one-year projects funded in that period.

Figure 12. Estimated Number of Students Across Cycles With Teachers Participating in the ITQG (Counts across years may be affected by differing reporting or estimation)



Costs per Teacher and Student

Comparisons of funding and the mean cost expended per teacher and student offer a different way to evaluate the reach of the ITGQ. Figure 12 shows total ITQG funding granted to projects in Missouri through the Federal Title II, Part A Improving Teacher Quality Grant program, operating under the No Child Left Behind (NCLB) Act of 2001 (CFDA 84.367). As can be seen, the $1,042,306 available in Cycle 11 was the least of all cycles, with amounts decreasing in each cycle since Cycle 8

Calculating cost by participating teacher offers a different, perhaps better way to compare funding effects across cycles. These data do not assess specific funding details, such as stipends to participating teachers, resources, faculty costs or evaluation. Rather, the mean cost per teacher simply shows how funding levels and recruitment levels contrast. Figure 14 presents mean costs per participant across ITQG cycles.

Figure 13. Federal Funding for Missouri's ITQG Program Across Cycles

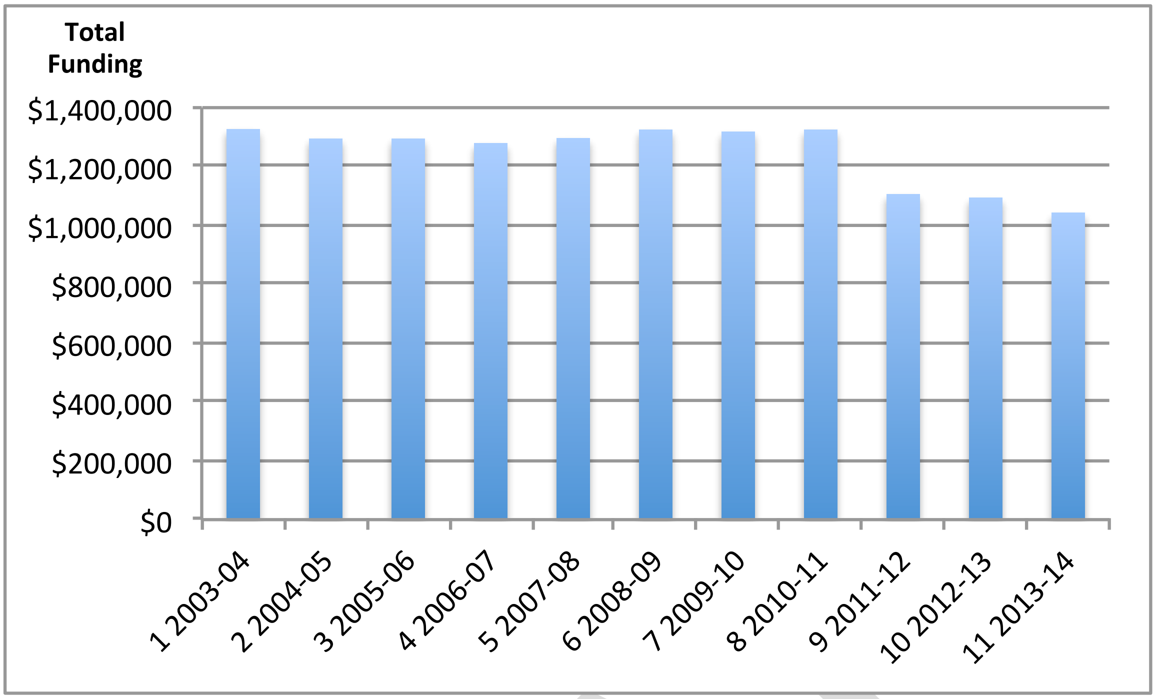
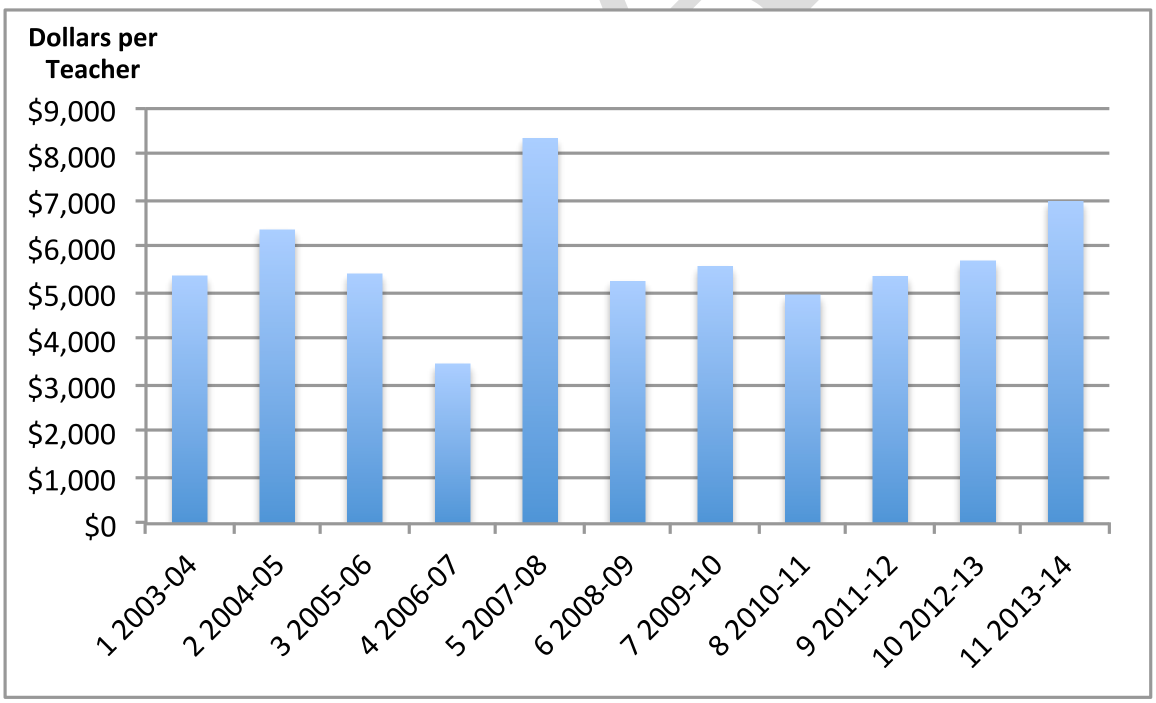


Figure 14. Mean Cost of ITQG per Teacher Across Cycles (Total budget divided by number of participants)

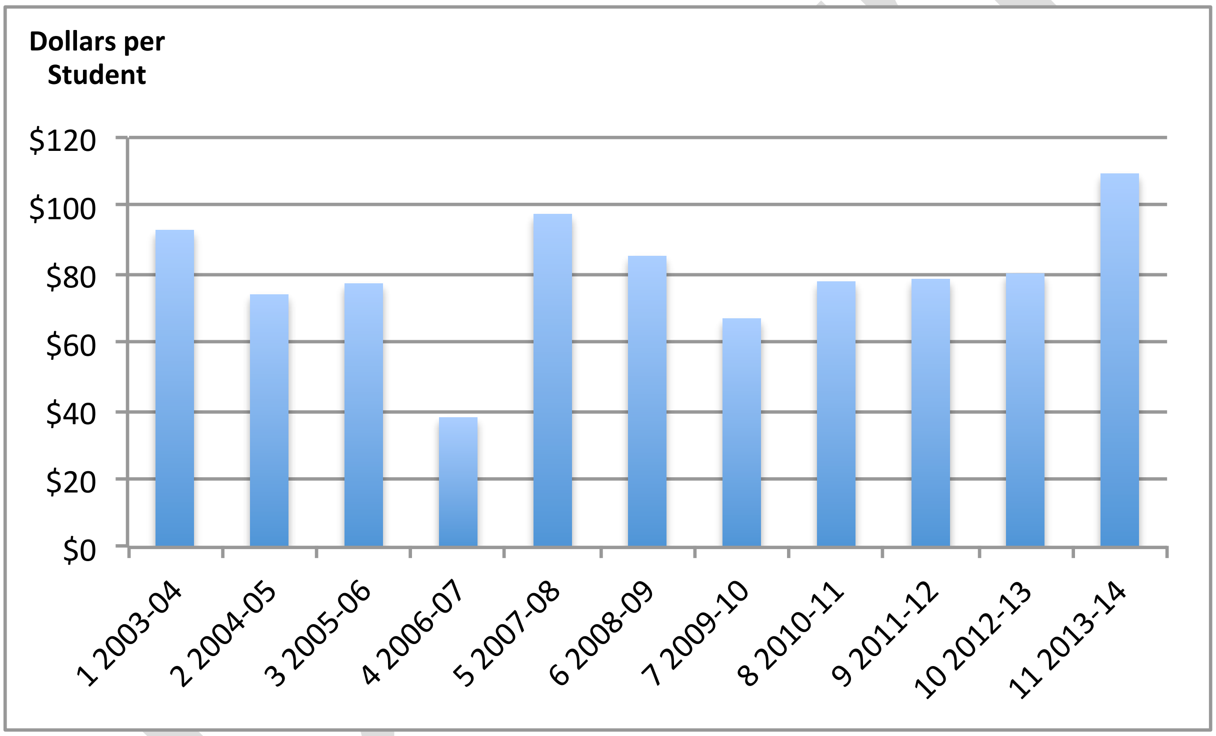


As can be seen, the mean cost per teacher of $6,995 in Cycle 11 was higher than that experienced in any cycle since Cycle 5. The mean cost per teacher across all cycles is $5,715, an amount affected in part by different implementation strategies in various cycles.

A further way to consider the relative value of the Cycle 11 experience versus other cycles is to assess the mean cost per student. Figure 15 shows mean costs per student across ITQG cycles directly affected (taught by participating teachers) in each cycle. Greater values indicate years in which fewer students and larger funding combined to increase the mean "costs per student." Lower values represent years with greater numbers of students compared to relatively lower funding levels.

The mean cost per student in Cycle 11 was $109, up from $80 in Cycle 10, $79 in Cycle 9 and $78 in Cycle 8. This amount was the largest per-student cost seen across all ITQG cycles in Missouri.

Figure 15. Mean Cost of ITQG per Student Across Cycles (Total budget divided by number of affected students)



Analysis of Project Activities for Formative/Process Purposes

The Inside the Classroom Observation and Analytic Protocol used for observing the projects' activities is designed for specific scoring in items across four domains that align with classroom observations: Design, Implementation, Math/Science Content, and Classroom Culture. Each domain closes with a Synthesis Rating determined by the observer that generalizes what was observed for that domain, and the entire protocol closes with a Capsule Rating that applies a single score to the entire professional development activity observed.

Table 3 shows the results of observations of each project's summer academies by two observers. The maturity of these projects is reflected in the higher ratings – 3's, 4's and 5's – with the exception of one project in one category. Again, it is in the area of Design and Implementation that projects are tending to perform less well, based on the evaluators' observations. This is a trend continuing among these projects over several cycles and reflects a lack of movement toward modeling of inquiry pedagogy more than anything else.

Similar to what was found in the final Cycle 10 observation, no projects rated below 3 on the Capsule rating – the overall rating of the professional development experience. Ratings of 3 or above represent good to proficient professional development, to be expected for projects with mature, experienced leadership as represented in most of these projects. These data will be used as baseline for academic year observations.

Table 3. Frequency of "Synthesis" or Summary Rating Scored for Each Domain during Cycle 11 Project Activity Observations, Summer, 2013 (N=4)

	Design	Implement-ation	Math/Sci Content	Culture	Capsule
MST	4	4	4	4	4
MSU1	4	4	4	4	3h
MSU2	4	3	4	4	3
SEMO	2	3	4	5	3h

1 = lowest, 5 = highest. Capsule rating 3 = evidence of effective instruction, 3h = higher evidence of effective instruction.

Projects all entered with higher capsule ratings than their final ratings in previous cycles of funding. Most projects rated low to middle 3's and one 4 in Cycle 10. If projects concentrate on the design of inquiry lessons, rather than off the shelf activities, and combine that with true modeling and infusion of inquiry systematically across project leadership's presentation, evaluators would expect to see a significant increase in the quality of professional development offered.

Some projects continued to express concerns about the day or the time of observations.

Evaluators have been mindful that there are elements that are not observed. Each session is evaluated on its own terms without an expectation that an entire summer academy's worth of implementation will be observed in one or two days. Additional data are obtained from other sources and confirmed through interviews and observations of follow-up sessions and teachers.

At the same time, the evaluators wish to report the high scores seen in other domains, and note consistent 4's and 5's across most projects. At their best, the projects have presented extremely well-integrated, well-aligned professional development opportunities for teachers that encompass environmental education more intentionally than Cycle 10 and have discussed diverse ways to approach student data analysis methods. The evaluators also note that all projects are staffed by professionals engaged in their work and, again, they have heard no teacher complaints at all concerning the value of time spent in the summer academies.

ITQG Program Theory

A deeper consideration of projects may be seen in how projects' intervention plans aligned with achieving their and the ITQG program's objectives. Program theory schemas were developed by the evaluators and shared with projects for purposes of planning and assuring ongoing alignment of activities with goals.

A "program theory" tells the story of how an intervention project plans to connect its activities to the intended outcomes or impacts it seeks to cause, what change it wants to make happen. It is the "theory of change" either implicit or explicit (or both) in an intervention program's view of connecting funding, professional talent and other resources to design to implementation to measurable impact.

Figure 16 depicts the program theory for the ITQG. The ITQG program theory was unchanged from Cycle 9, which saw alterations from previous cycles in its adoption of an environmental education overlay applicable to all new projects, both mathematics- and science-focused in that cycle.

Given the preconditions seen on the left and fidelity of implementation, through the activities and processes shown, the ITQG proposes that the desired outcomes will be achieved. Objectives are largely sequential. Teacher intervention is a necessary precursor to change in the classroom, for example. Student achievement improvements in science and mathematics are the end goal of the ITQG. Figure 17 focuses on the portion of the MDHE ITQG program theory dealing with project activities and objective. Most individual projects adhered closely to the ITQG program theory in developing their plans.

Figure 16. ITQG Cycle 9 Program Theory

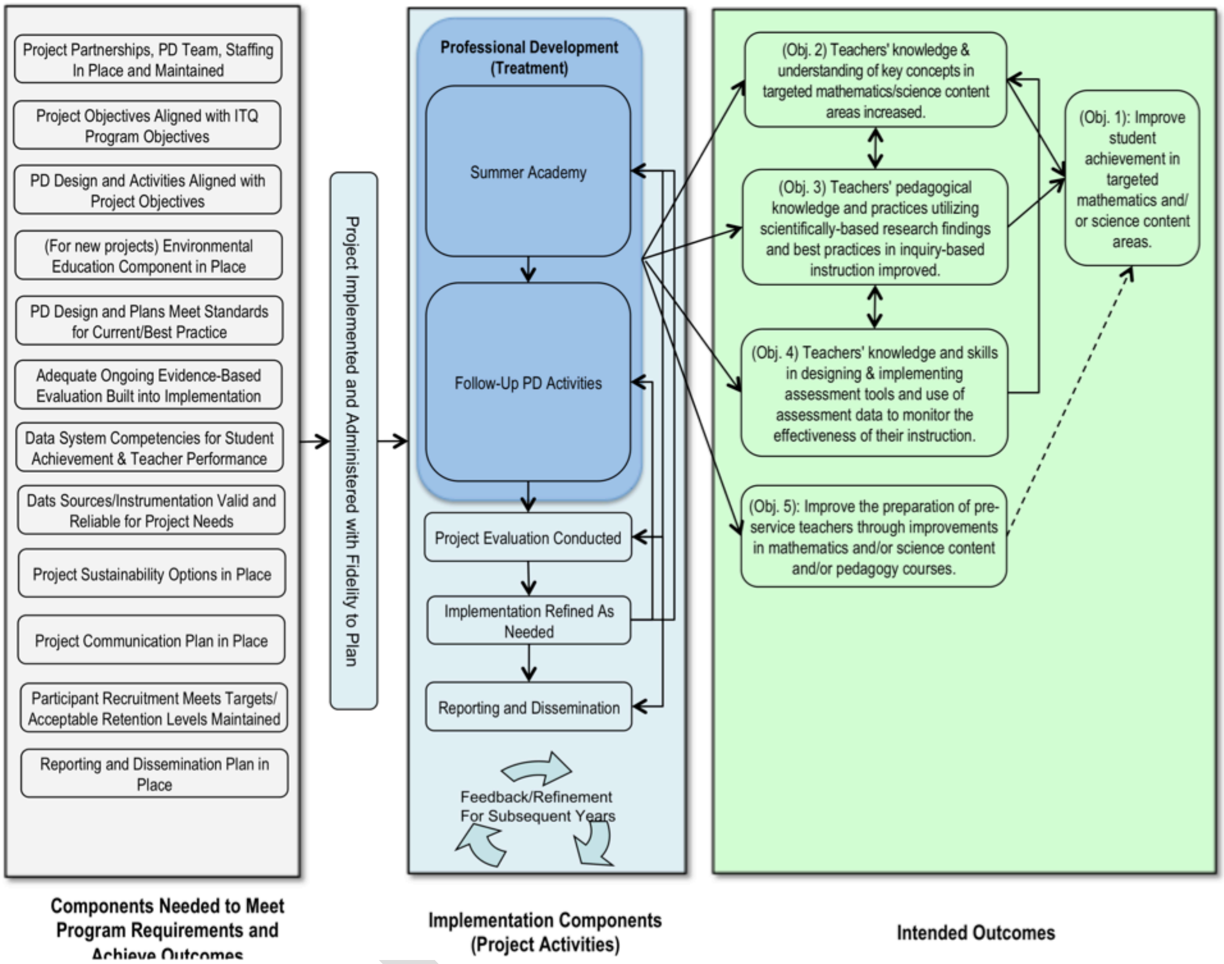
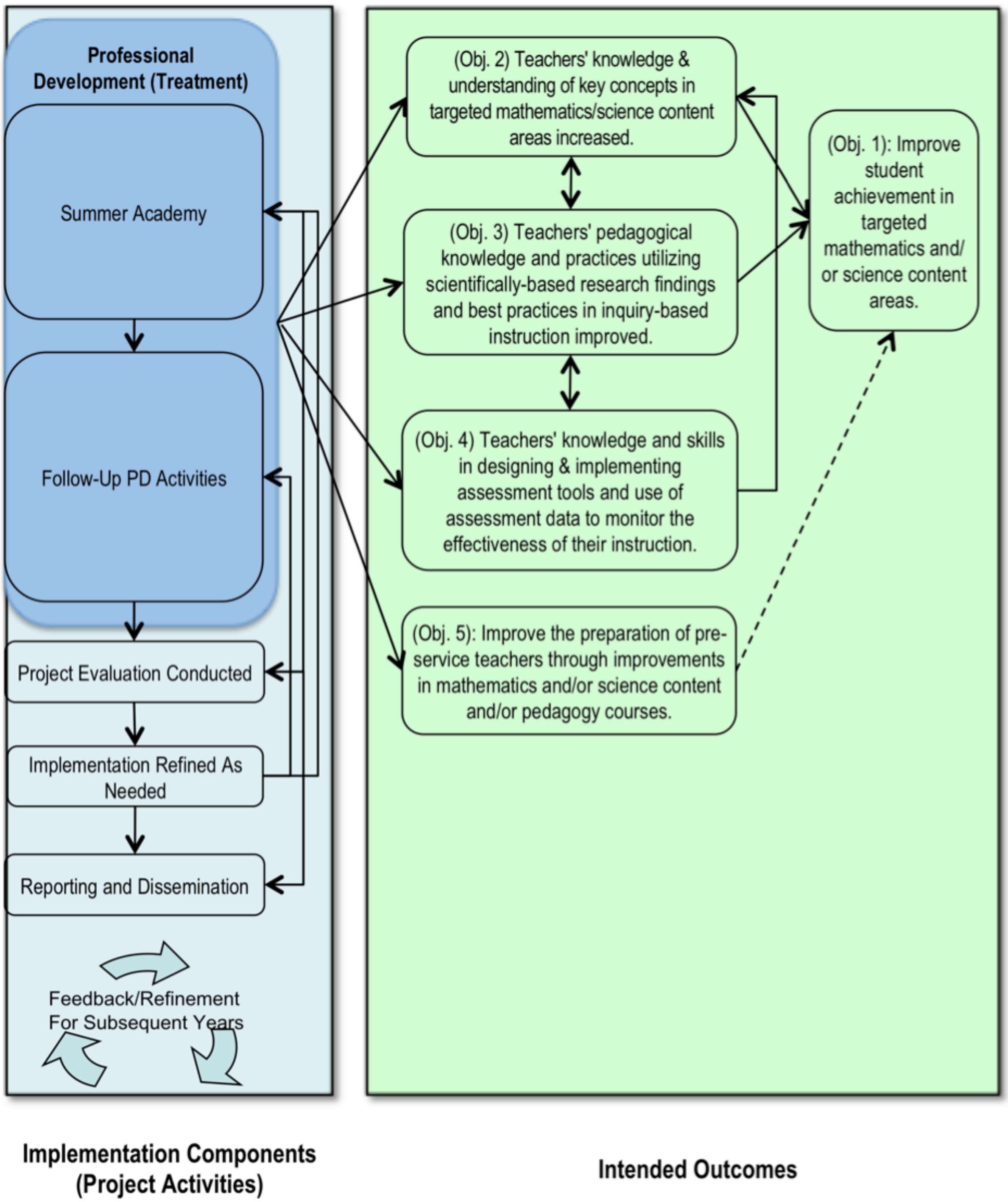


Figure 17. ITQG Cycle 9 Program Theory Detail



Formative and Process Evaluation Comments

Cycle 11 continued the change in direction for evaluation practice for the program begun in Cycle 9 and continued in Cycle 10. These changes reflected both MDHE's expectations on internal evaluation coverage by the projects and for external evaluation. The latter covers a program-wide consideration of implementation alignment and summative results, seeking to ensure that projects are conducting their work as planned so that their intended impact can be maximized (given that professional development designs proved efficacious). This impact is interpreted as projects' success in implementing their work plans so as to achieve their intended progress across the various objectives set by the funder and the program.

The evaluation and the funder do not deny the possibility of other positive effects from the projects' implementations. In fact, it is hoped that emerging forms of impact form a natural result of projects' implementing their plans with fidelity, as educational professional development, especially among so many areas where a high needs are recorded, can serve as a dynamic game changer for teachers, schools and school districts. However, primary attention here must be given to the program evaluation's specific charge of considering the over-arching objectives of the ITQG. Progress elsewhere in any general sense seems unlikely without progress also occurring in the core objective areas. Also, project leaders are always encouraged to report their internal evaluation results in a manner that best describes the work and impact of their projects, from their perspective.

All projects had prior experience with the updated evaluation process. A new project in Cycle 11 actually represented a refinement of practice and a refocus on other grade levels, but represented the return of an experienced ITQG team. Various challenges from the past therefore largely had been resolved; the Cycle 11 projects were responsive and supportive of the program evaluation's intentions and practices.

The structural components of Cycle 11 in most regards fit within the historical patterns already seen in the MDHE ITQG. In terms of scope of reach, project characteristics, school/school districts, participants and students, and application of funding resources across projects and participating, close comparability has been seen. The only broad formative difference is in the effect of a smaller number of projects, the opportunity therefore of offering additional resources and support to the four projects, and the effects already indicated on teacher and student counts and associated funding data.

As the aim of the external evaluation described in this report is to consider program-wide matters, most project-specific details have been placed in the Appendix of the report. However, Cycle 11 continued to see the implementation of a group of diverse, focused and committed projects addressing the topics contained in their action plans. All projects met the basic requirements of their grants in terms of number and type of activities. In all cases a professional, experienced, well-considered implementation reflective of funded work plans served to meet at least some of the reported needs of every teacher with whom the evaluators spoke. In fact, no teacher among the more than 100 spoken with voiced any dissatisfaction with their having participated in their projects, whatever details they saw as offering room for enhancement.

Such participant satisfaction can serve as a bridge between formative and process area and a more evidence-based consideration of impact. The kinds of perceived benefits described in Section 4's consideration of Evaluation Question 4 offer a more tangible indication of how teachers contextualize their satisfaction through varied improvements they note in their teaching.

The remainder of this report mostly will consider the available data concerning the remaining formative evaluation points and the impact of the ITQG Program as a whole in Cycle 11. Each major objective is considered and evaluated for summative results.

4. Formative and Process Evaluation Questions

EQ 1. What are the critical elements of the ITQG projects? Which elements are common across projects? How did projects use the Standards, the GLEs and the CLEs? How did the design reflect the Common Core Standards and the Model Core Teaching Standards?

Strong content faculty grounded in their individual fields, experienced in teacher professional development, who were themselves were grounded in pedagogical practice aligned with ITQG's priorities or who were joined by pedagogical specialists, remains the chief strength of the program in the field. The evaluators continue to find, through their observations, that the modeling of pedagogy within the lessons, activities, resource tool development and sharing, and other content-focused professional development made the most resonant connections between the ITQG project efforts and teacher performance improvement. While the degree to which professional development reflects what could be called best practices in such pedagogical modeling, the evaluators note a more concerted effort to deliver content in an engaging, activity-focused, often student-driven manner.

Strong organization of professional development sessions (preparedness and coordination among project teams), collegial working relationships among faculty with sharing of responsibilities for planning and delivery, commitment to tailoring ITQG interventions to teachers' specific needs, and a strong commitment to educational excellence remain noteworthy characteristics of all projects. Teamwork, to the observers' eye and in the reports of teacher participants, is seamless and projects present a united front in professional development delivery.

As in the past, a tendency remains to rely on materials and resources from earlier professional development sessions in some cases, which is not necessarily cause for concern except where a distinction in practice – the "how" of the professional development lesson or activity – appears. It is understandable, given the frequent overlap of ITQG objectives with those of other projects that material would be found reusable. However, in a couple cases some question exists whether the step of alignment was considered.

As suggested, inconsistent modeling of pedagogy remains an area where some refinement is wanted. The evaluators in some cases continue to question the extent to which some individuals are grounded in inquiry theory, although all observed session meet general standards of proficiency. It already has been mentioned that observations do not necessarily see everything at its best.

Of additional concern is continued uncertainty, already discussed, of the program's requirements on preservice course change. Also, lack of coverage of all internal evaluation requirements in a robust, fully responsible manner remains a matter calling for attention.

However, the extent to which project seek ongoing feedback from teachers on their needs, ideas, reactions and occasional confusion remains admirable. The evaluators observe and hear from teachers that the project leaders are communicative, clear about expectations, interested in any issues that come up, want the professional development to be relevant to teachers' needs and meet their expectations, and grounded in the real-life curricular demands of the various school districts.

All projects were increasingly focused on emergent Common Core Standards, as well as Model Core Teaching Standards and local districts' individual approaches to the complexity of standards in the state at this time. Teachers report concern about Common Core, and projects all have addressed these concerns in various ways. However, as in the past, the mainstay of the projects professional development, and its greatest strength in the views of teachers reporting their opinions, is strong content, differentiated by grade level, presented through hands-on activities and often incorporating technological tools accessible to students in their various classrooms. Given the widely divergent situations the teachers report in their schools and districts in terms of resources and budgets, such materials as are made available are much welcomed and used.

EQ 2. What is the level of fidelity of implementation for each project?

2. a. What challenges to implementation were encountered? How were these challenges overcome?

2. b. What institutional support enhanced the fidelity of project implementation? How were project objectives linked to the school improvement plan?

For the ITQG, fidelity concerns both alignment of project implementation to its own stated action plan and to the overall program expectations, focused on activities aimed at the five main objectives and including meeting numerous structural and administrative criteria.

In the main, projects conducted themselves with a high degree of fidelity as to alignment with curriculum plans covering major program objectives (enhancement of teacher content knowledge, pedagogy, student assessment, technology applications, integration of data systems and extant data in curricular and lesson planning). Formative reports and evaluation communications with each project throughout the cycle identified a variety of areas where projects could better align themselves to the ITQG vision and to their own original plans.

A consideration of the Survey for High-Quality Professional Development (DESE, 2006) offers a means of considering quality of the projects' intervention independent of the ITQG's specific requirements. Items fall into three parts:

Part I comprises a list for which **all** items are recommended, according to the instrument's rubrics, for professional development to be considered of the highest quality. Parts II and III list types of topics and activities, of which at least one is deemed necessary for all high-quality professional development.

Table 4 shows the number of projects meeting specific criteria in their professional development, or covering specific topics and engaging in specific activities, as far as the evaluators' knowledge extended. Admittedly, in some categories additional activities may have occurred about which the evaluators are unaware. As can be seen, all projects met almost all criteria in Part I, which this report focuses on, with the exception of district and building support and district feedback. This repeats the experience in Cycle 10. The area of strong, engaged, ongoing partnership with schools and school districts – apart from some existing relationships, remained a challenge.

School district staff usually have little additional time to be actively engaged in external professional development efforts. Given ITQG expectations, however, a lack of program knowledge is a cause of concern for institutionalization and sustaining program-related progress. Interest and support in a general way was expressed, and many teachers are participating at the recommendation of their principals. This kind of support seems unlikely to yield the deeper basis for institutionalizing and sustaining the ITQG teacher-specific effects.

Table 4. Number of ITQG Cycle 11 Projects Meeting Selected Criteria for High-Quality Professional Development

Number of Projects	Components of High-Quality Professional Development
	I. Characteristics of high-quality professional development
4	Actively engages teachers in planning, skills, and implementation over time.
4	Is directly linked to improved student learning so that all children may meet the Standards at the proficient level.
4	Is directly linked to district and building school improvement plans.
4	Is developed with extensive participation of teachers, parents, principals, and other administrators.
4	Provides time and other resources for learning, practice, and follow-up.
0	Is supported by district and building leadership.
0	Provides teachers with the opportunity to give the district feedback on the effectiveness of participation in this professional development activity.
	II. Types of activities that may be considered high-quality professional development
0	Study groups.
4	Grade-level collaboration and work.
4	Content-area collaboration and work.
4	Specialization-area collaboration and work.
3	Action research and sharing of findings.
3	Modeling.
1	Peer coaching.
1	Vertical teaming.
	III. Topics for high-quality professional development.
4	Content knowledge related to standards and classroom instruction.
4	Instructional strategies related to content being taught in the classroom.
0	Improving classroom management skills.
4	A combination of content knowledge and content-specific teaching skills.
1	The integration of academic and career education.
3	Research-based instructional strategies.
0	Strategies to assist teachers in providing instruction to children with limited English proficiency to improve their language and academic skills.
4	Strategies to assist teachers in creating and using classroom assessments.
4	Instruction in the use of data to inform classroom practice.
0	Instruction in methods of teaching children with special needs.
1	Instruction in linking secondary and post-secondary education.
0	Involving families and other stakeholders in improving the learning of all students.
4	Strategies for integrating technology into instruction.
0	Research and strategies for the education and care of preschool children.
0	Research and strategies for closing achievement gaps between diverse groups of students.

The greatest challenges to implementation remained the complex specifics of ITQG requirements, plus the organizational and logistical demands of such teacher professional development programming. As has been noted, all project teams were experienced professional development professionals with experience in implementing projects in their institutions. This experience, and the commitment that went along with it, reduced such pressures. However, as is recognized in everyday experience in the teacher participants' classrooms, maintaining focus on modeling optimal practice, not rushing inquiry activities, avoiding a perception that the faculty members are the ultimate source of knowledge, and including the differentiation among learning styles, grade levels, and content knowledge among the teachers remains a challenge. The fact that two projects operate at satellite sites, to where at least some of the faculty must travel, adds to some of the practical burden involved. With the multiplicity of funder expectations, it also is predictable that the most accessible and immediate objectives will receive the greatest attention. Content and practice, the latter often expressed through resource and activity work, remain the primary focus. Assessment matters are folded into the implementation at varying intensities. Technology, being a broad category, is integrated in a variety of ways. As noted, preservice objectives are largely set aside.

Another way to consider the fidelity of the projects, taken together in an expression of the ITQG program as a whole, is to apply Missouri Professional Learning Guidelines for Student Success as they apply to optimal professional development (DESE, 2013). The document, representing the state's guidelines for internal professional development, is applicable for external professional development as well. In fact, the guidelines offer an additional template to consider for projects undertaking public school teacher development.

The document states, "From current research we now know that in order to have teachers and students learning at high levels, professional development needs to shift as follows." (DESE, 2013, p. 78) Table 5 then details the items of high performance wanted. The evaluators applied a four-point scale to each item and evaluated, across projects and in a general way, how the ITQG program stands.

As the table shows, in the evaluators' view the ITQG program rates high in most categories of performance. The lack of integral preservice teacher participation in a generalized or sustained way reduced one item to a rating of 1. Ongoing challenges in consistency of the inclusion of inquiry in a consistent manner left that item rated at 2. Inconsistent application of assessments and the students focus, particularly in ways they attend to the potential needs of the diversity of learners with who teachers work, also left that item rated as 2.

Improvement in collegiality and shared responsibilities was apparent in some cases. However, overall that item was strong enough at a 3 for the program as a whole. The evaluators left the last item in the chart with a question mark to prompt further discussion, as the meaning of the statement was left unspecified in DESE documentation.

Table 5. Rating of ITQG Cycle 11 Projects on Missouri Professional Learning Guidelines

Categories of Optimal Performance	**Rating** (1-low through 4 high)
Focus on student teacher (preservice) learning needs and what learning teachers will need in order to help students learn at high levels	1
Focus on individual, school, and system-wide learning and improvement (CSIP, SIP)	4
Inquiry for teaching and learning	2
Job-embedded learning	4
Combination of content knowledge and content-specific pedagogy	4
Driven by clear, coherent, long-term strategic plan	4
School direction and decision-making in alignment with the CSIP	4
Professional developers as coaches, consultants and mentors	4
Professional learning a everyone's job	4
Professional learning for everyone	4
Professional learning as essential	4
Professional learning for the community of learners in support of student success	2
Professional learning that provides adequate time (49+ hours) for learning, practice and adequate follow-up	4
Collegial discussions and decisions	3
Engaging and supported "thin slices" of learning	?

The cooperation and support of the universities and regional professional development centers where professional development sessions occurred was crucial in optimizing structural elements of fidelity. Availability of computer equipment and other resources, provision of classroom and, for most projects, meal and break space was necessary.

In Cycle 11, partners in business, and governmental entities enhanced both curricular offerings and richness of curriculum. This was especially true of participation by the Missouri Department of Conservation, various enterprises included in the Missouri State University projects, and elsewhere. Where the strongest internal university capacity was evident, the less outside involvement appeared to be considered crucial.

Among partner and participating school districts, very few impediments were placed to prevent participating teachers from fully engaging in project activities. The evaluators, in speaking with administrators of focus teacher schools and school districts, encountered nothing but support for their teachers' involvement in the ITQG projects. While administrators often appeared to retain little specific information about the project except its location and mathematics or science focus, the degree of cooperation among all projects continues to exceed that experienced by the evaluators in any comparable teacher professional development effort.

School Improvement Plans, despite their prominence in the RFP under which projects were funded, still are not an area of focus for most projects. References to use of School Improvement Plans were made in some of the proposals as planning groups met. Most projects attempted to design their programs around identified needs, as much as they fit into the planned activities, rather than using the School Improvement Plans to specifically guide the planning. Several project teams lacked cognizance of the ITQG's expectations in this regard. A few projects are beginning to incorporate all participating school's plans into their planning pre-summer implementation.

Attrition

A barrier to full intervention lies not in the project itself but in the intensity of the intervention the teacher experiences. Teachers are busy with pressures of job and family and some absences are to be expected during the academic year. Projects are asked to provide numbers on those who complete the project. When calculating these numbers, projects have not received a definition of what project completion comprises. Each of the projects shown in the chart has reported calculating them in different ways - using different percentages of attendance as enough to claim completion. MST's SEQL has used the most stringent measure and shows a greater percentage of non-completion. Other projects use more a generous definition. Before this marker is meaningful to projects and the Department of Higher Education a consistent definition of project completion is required. Table 6 shows attrition rates based on available data; these figures may differ from other reporting because of the reasons noted and because of issues with some project's completeness of reporting.

Table 6: Attrition Rate by Project

	Attrition Rate			
	Number not Completing	Number of Participants	Total	Percent Attrition
MST	6	33	39	15
TRIM	3	31	34	9
4E	0	36	36	0
SEMO	1	45	46	2

EQ 3. How is sustainability planned for and supported?

Sustainability, as expressed through institutional impact of the ITQG program in the universities, educational centers, school district administration offices, school buildings, classrooms and other places where the program resides and operates, could and does take many forms. Sustaining the efforts and impact of the ITQG can be both intentional and serendipitous. Is there likely to be a sustained institutional impact from the ITQG's Cycle 11 activities? This report considers various responses and one specific way this question may be answered.

The universities in which the ITQG projects largely reside are large-scale, complex academic organizations with multitudinous, sometimes competitive interests and systems of management and collaboration. Influences extend both internally and externally across communities and beyond. A teacher professional development program, such as the ITQG, would need to be precisely set in order to have an opportunity for institutional influence. An obvious matter relates to what institutional impact would be wanted to contribute to the cause of bettering teacher preparation and performance. At the university level, affecting teacher training would be the locus of greatest potential, with particulars of influencing curriculum related to pedagogy, STEM content, assessment, and other ITQG focuses being involved.

However, ITQG projects are not necessarily embedded within the teacher training programs of universities. A strong intention, shared at the national level, to secure the leadership engagement of STEM experts – real mathematicians and scientists – necessarily can mean that ITQG projects operate outside the education departments, or that the education departments are collaborative partners but do not serve from a vantage where large-scale university institutionalization can result.

Also, as discussed, many universities do not have large teacher-training programs. Teacher professional development is a distinct area of work, as the leadership roles taken by a regional professional development center and a local education center among the four projects show. While the ITQG encourages preservice-teacher components and involvement in the project, this has seldom occurred recently and did not seem to work in ways that may have been expected when it did occur. Finally, the impact of an ITQG project at universities is subsumed in the larger-scale priorities of the institutions. Educational training grants differ from research grants. Therefore, ITQG projects aim to do the best they can, with nuanced effects on internal processes and priorities. The visibility and influence of specific project leaders has made a difference at their institutions. Perhaps the greatest effect that can be cited at the university level is the development and sustaining of committed professionals across disciplines at the university sites who work as teams and encourage inclusion among their colleagues. These are the professional development teams who most actively internalize the ITQG priorities of content and practice noted at the beginning of Section 4 of this report.

At the school district level – despite district staff in smaller districts especially often closely cognizant of buildings and individual teachers – institutionalization is likewise challenging. The diversity of priorities, the practical difficulties of day-to-day management, the carefully and strategically planned curriculum already in place, and other matters make any easy institutionalization impossible. A lack of prioritization of science classes at the elementary grade levels, as mathematics and language arts focuses have taken precedence, has meant less time for science in many classrooms. Also, many teachers cite their perceptions of pressure concerning standardized testing at higher grades as also affecting their ability to devote time to what they often see as time-intensive inquiry-based activities.

ITQG projects, with stable leadership and existing relationships with school district partners, have had an opportunity to exert some positive influence. The provision of various resources by the ITQG to participating teachers is usually seen as a boon and in itself can assist in altering practice, where technology is meaningfully incorporated. ITQG projects also can affect in-school dynamics, with or without explicit involvement of building administrators, by encouraging cross-disciplinary collaboration, networking, and collaborative work among teachers. The evaluators have seen several examples of ITQG teachers working together in a school, within and across grade levels, both in terms of planning and in direct classroom learning.

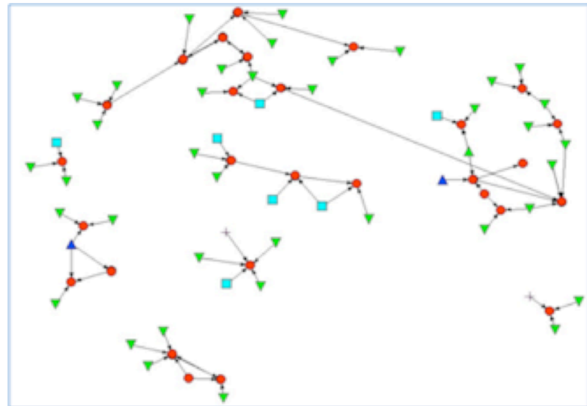
It is, then, among teachers that the opportunities for sustained effects may be greatest. A consideration of how the ITQG affects teachers as they work – who they work with, where they turn for assistance, who comes to them for assistance – may go a long way to assist in understanding how project participation works in the longer term.

Social network analysis was introduced in evaluation reports in the previous cycle. Teacher networking analysis discussed here provides an updated, more extensive look at how the ITQG program in different projects appears to develop and be sustained. Figures shown (Figures 18) show content and pedagogy networks for the four projects as described within the narrative.

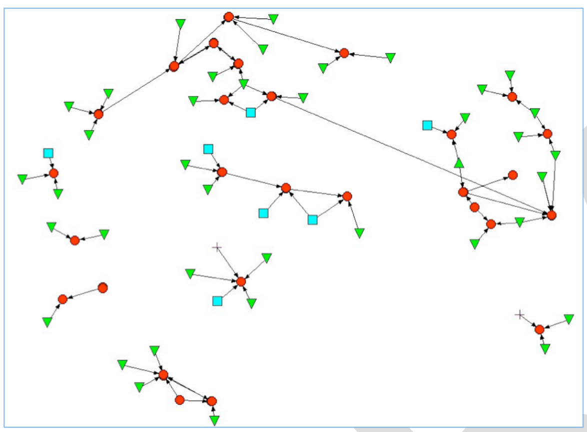
(Figure 18 – Series of Content And Pedagogy Social Networks Reported by Cycle 11 Teachers by Project)

Missouri University of Science and Technology – SEQL

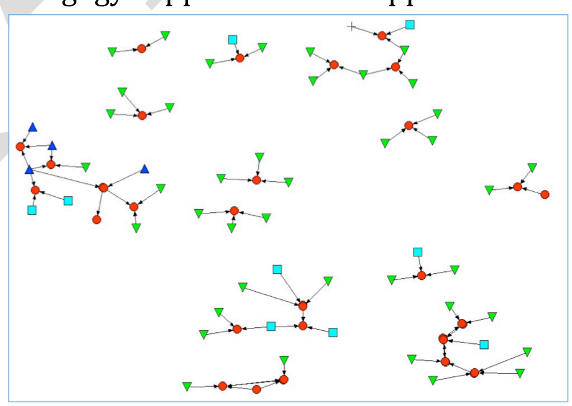
In its third year, SEQL has developed several medium to large networks of support in content (right). They have developed connections among themselves or through other educators that allow reinforcement of content within and outside of project participants. Only three participants are outside of a network associated with another project participant. This is a network with promise for sustainability.

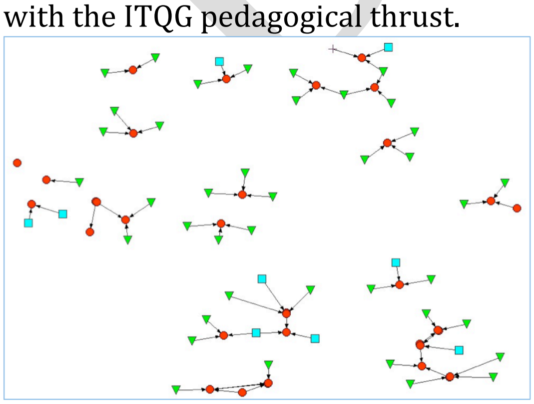


Leadership (blue triangle) plays a minor role in the larger network in the upper right and center left. When leadership is removed no significant harm is done to the network of project teachers. This results in a group that still has strong connections and the promise of sustainability of teacher support across participants.



Pedagogy support does not appear to be as strong as content. Contrasting the two, you can see that more isolates appear in the diagram that includes leadership participation. These seven participants are getting support from other teachers or administrators who may not be familiar with the ITQG pedagogical thrust.



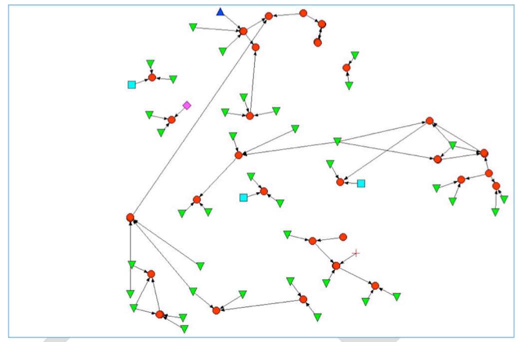


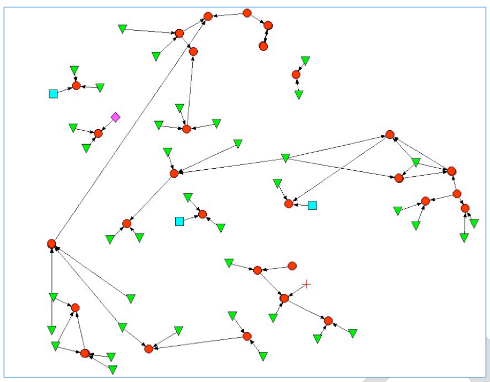
When pedagogy is examined without the inclusion of the leadership staff of the projects, a more serious situation occurs. Three more teachers are disconnected from any network and have support from only other teachers and administrators. In the third year of the project with a focus on inquiry, this network would be expected to be stronger. This is the final year for SEQL with this middle grade level focus. With the start of Cycle 12 with an elementary focus, SEQL has the opportunity to examine how and why the pedagogy networks have not developed and to encourage them so as to support the sustainability of the project's efforts.

Missouri State University - TRIM

TRIM is also a returning project that has been working with its high school teachers over many cycles. Most are returning teachers who have worked through face-to-face and online modes through at least three cycles.

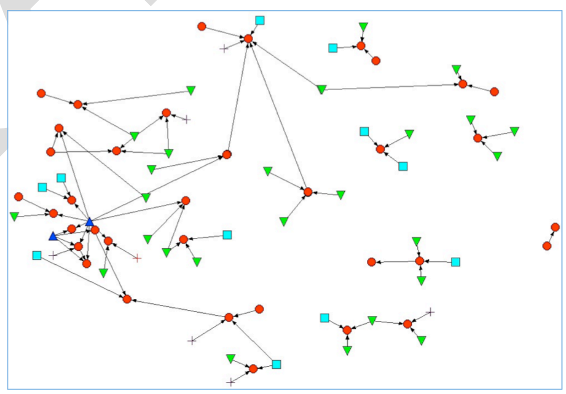
The content support network is extensive (right). Only four teachers are outside any network. For a sustaining network, this is a model example.

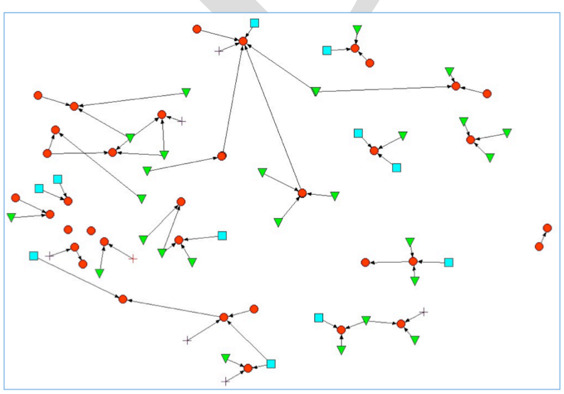




Because leadership staff (blue triangles) played such a small role in this network their removal does not change the integrity of the established content support network (left), boding well for the possibility of sustaining the content support network following the end of support for this high school group.

When the pedagogy is examined, another close network emerges with only two teachers out of touch with any project teacher (right). Note that leadership (blue triangle) plays a strong role at the node of one part of this large network.

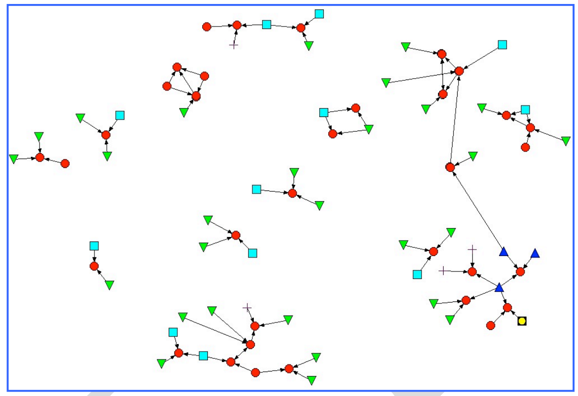


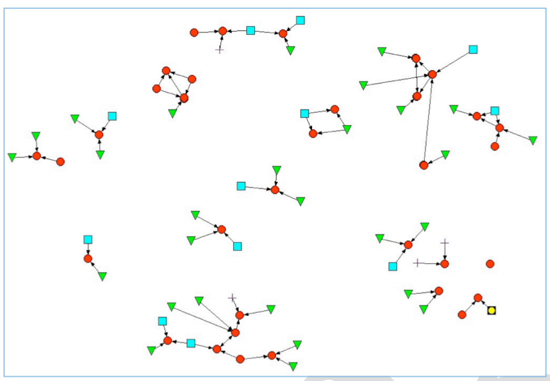


The removal of the project leadership (left) shows a shattering of the tight network at the left of the figure. This is the danger of dependence on university leadership. Though they can be an excellent resource, once they are removed from the network, the support is gone. This may be the case for TRIM in that the two primary leadership staff for TRIM are retiring and will not be available for supporting teachers. The sustainability of project pedagogy may be threatened going forward.

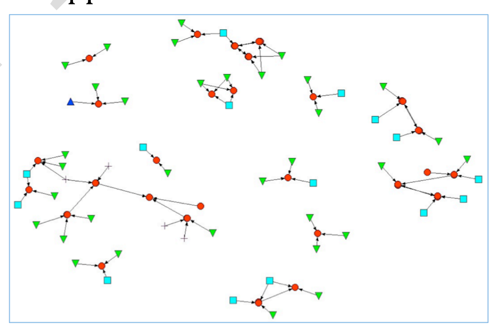
Missouri State University - 4E

Missouri State University's 4E project is also a returning project of elementary school teachers that illustrates a different content-support networking pattern from other returning projects. There is one larger group (right) and several smaller groupings with four single teachers not connected to any project teachers. When examining the larger group, we see that it is held together by one of the leadership team (blue triangle) and two other staff also appear in that group.

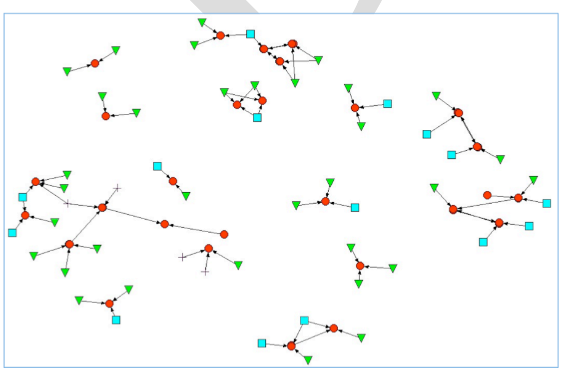




When the leadership is removed (left) the cluster containing the leadership staff splinters leaving four additional teachers disconnected to other project members. Any ongoing work that this team undertakes should include ways to build networks among its teachers so that their gains can be supported and sustained.

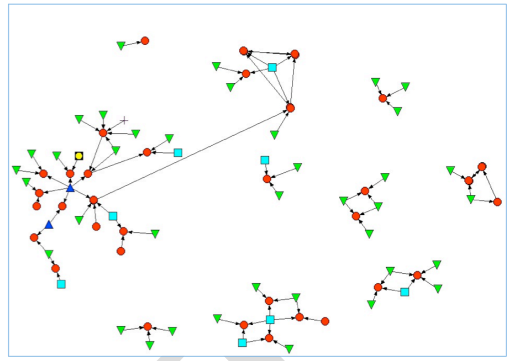


4E's pedagogical support networks look similar to the content support networks. There is a larger grouping with one leadership staff member playing a small role for one teacher of the group. Again, there are still many teachers with no support network outside of other teachers in their building (right).

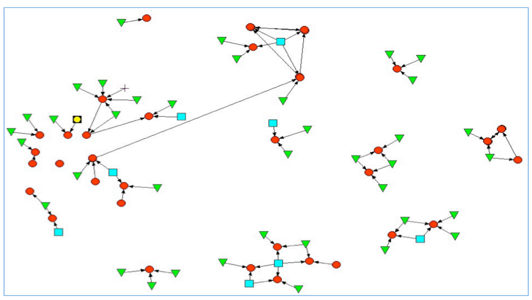


Removing the leadership does not change the network as it appeared with the leadership staff in (left). This project has the potential for growing a large network by the end of their three-year project. If that network does not develop there is danger that, lacking support necessary for content and pedagogical change desired by the ITQG program, sustaining the change will be threatened.

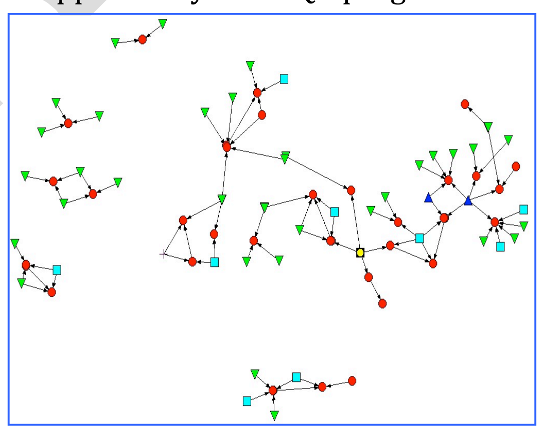
Southeast Missouri State University/Regional Professional Development Center - MM



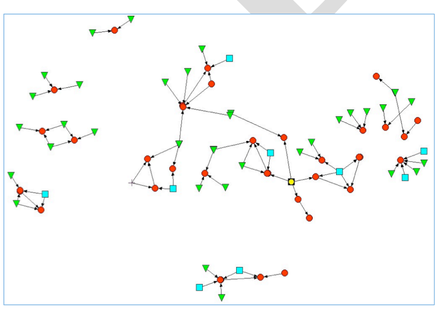
The Making Mathematics (MM) project is in its first of three years of work with teachers from small school districts in southeast Missouri. The large network shown, with smaller sub-groupings, does not resemble a typical first-year project (right). The RPDC, the major lead institution of the MM project, works in the small local school districts in the southeast part of the state as its mission. When observing the project, it is obvious that teachers are already known by RPDC staff so some networks developed later in other projects are already established in MM.



Unfortunately, the down side to this strong network built around the leadership team occurs when the leadership is removed (left). The RPDCs are state funded and struggle for continued funding. If they should disappear, or if the leadership staff should retire, as we see in other ITQG projects, many teachers would be left depending only on other teachers who may not have had the content and inquiry pedagogy intervention supported by the ITQG program.



Pedagogical support shows a stronger initial network that includes the two staff members (blue triangles) with only two people without any support from project participants (right). Note that the two project leadership (blue triangles) form the center of one arm of the network with several other teachers connected to each other only through the project leaders.



As could be predicted, the teachers connected through the leadership are left with very few support connections once the leadership team is removed (left). Only one teacher from this group retains any kind of connection to another project participant. This removal more than doubles the number of disconnected teachers with no pedagogical support in the MM project. The MM staff has an opportunity over the next two years of their project, with the already developed networks among their participants, to solidify the network of teachers so that all participants will have some support system left following the project's end in 2016.

These Social Network Analysis figures show individual projects in various stages of developing networks to support the work of the ITQG program. Three have clusters beginning to expand to incorporate the members of their ITQG project. One, serving many rural districts, has an opportunity to assist in developing networks among their teachers. Leadership staff should work to redirect inquiries to other members of the project so that the teachers will come to depend on each other rather than university faculty who may not have permanent assignments at the university.

4. Summative Evaluation Questions

EQ 4. What was the effect, both by project and cumulatively of the treatment on teachers' content knowledge? (PO2); (EO1)

Teachers were administered a pre/post content knowledge test on the first or second day of the summer session and on the last day of the follow up sessions in the spring of the academic year. The questions were released items from TIMMS, NAEP, PISA, and the Environmental Education group NAEE. The test was submitted to two content experts to assure face, content, and construct validity.

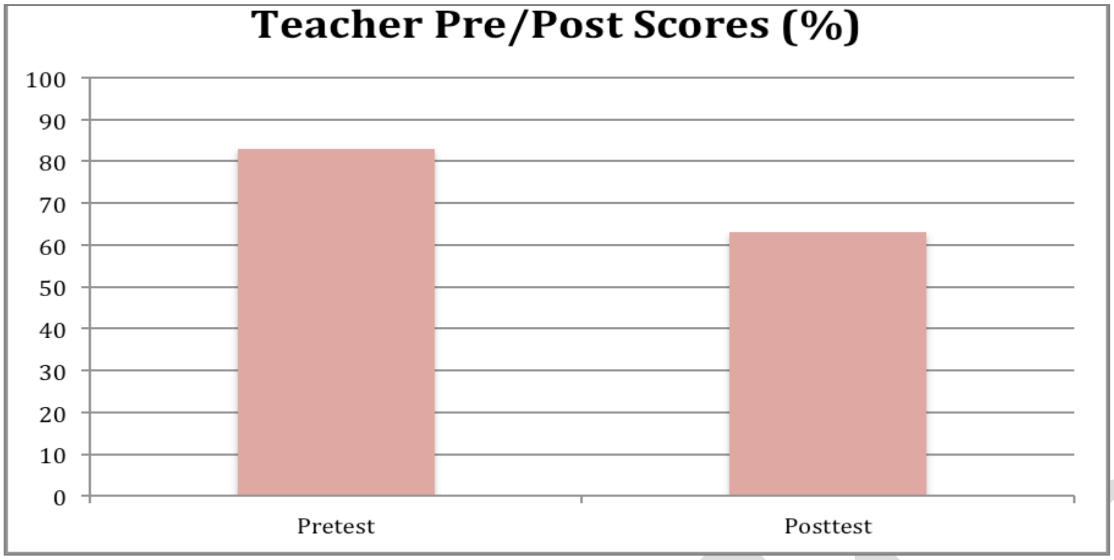
No statistically significant gains were achieved by the Cycle 11 teachers. What can be said is that teachers are still weak in reading charts and graphs and making and justifying decisions made based on data. Teachers in the elementary groups were weaker overall in mathematics than the high school teachers, as would be expected.

This is the third year evaluators have noticed weaknesses in reading graphic displays of information. With these types of displays in the popular media being more and more frequent, it would be helpful to both teachers and their students to emphasize this skill both in the science and mathematics-focused projects.

Figure 19 compares gross mean external evaluation content test pretest and posttest scores. As can be seen, a decrease in mean posttest scores from pretest scores differs from experience in the previous two cycles, where significant gains were experienced. A range of possible explanations may be offered, but all at this point must be categorized as conjectural. More teachers simply may have felt less motivated, or less concerned about test results. Alternatively, other projects have seen times when additional content in an intensive training have led to lower posttest results as a possible consequence of ongoing assimilation and uncertainty. The actual cause is not self-evident, however, and evaluators will continue to closely check environmental factors that could inadvertently lead to test issues. Certainly it does not seem likely that teachers lose ground in content knowledge as a consequence of their ITQG experience.

Individual projects reported results of their internal pre/post/postpost testing. Three of the four projects reported statistically significant gains. Two projects use the DTAMS test. Only the content knowledge portions were analyzed. The other two projects used project-constructed tests. Results are available by project in the appendix.

Figure 19. Mean Pre/Post Scores from Cycle 11 Teacher Content Tests



EQ 5. What was the effect on classroom practice of each project's treatment to improve teachers' understanding of student-centered pedagogy across projects? (PO3; EO 2)

Eight focus teachers were observed at least two times over the nine months of the academic year. These observations followed the summer institutes so teachers would have had the advantage of potentially having increased content knowledge and exposure to inquiry pedagogy.

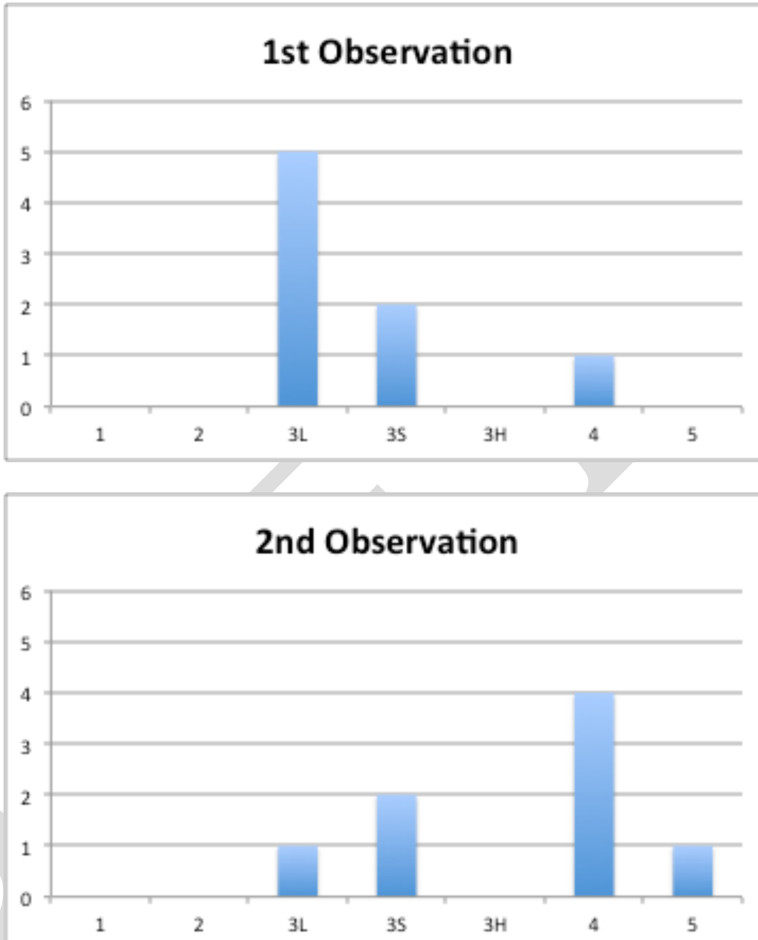
The *Inside the Classroom Observation and Analytic Protocol* (ITC) (Horizon Research, Inc., 2002aa) was used. The ITC observation tool is divided into four domains: design, implementation, mathematics or science content, classroom culture. Each domain has numerous items that are coded according to a 1 through 5 ("not at all" to "a great extent") scale, and a "synthesis rating" is applied to each domain. Finally, a capsule rating with a different coding system but also with scores of 1 through 5 (again, lowest to highest) is used to rate the lesson overall. The three rating is divided into 3Low - somewhat effective teaching, 3Solid - effective teaching, and 3High - very effective teaching but not quite proficient. Each of the levels has an accompanying rubric to differentiate the levels.

Figure 20 compares capsule ratings for early and late school year classroom observations of focus teachers. When examining the capsule ratings teachers in this cycle followed a similar pattern of moving from lower to higher levels of pedagogy as a group over the course of the academic year. In this cycle several teachers were returning focus teachers. This may have been the reason that no teacher scored initially below the 3L rating. One teacher rated a 4 - proficient - at the beginning of the year.

As seen in the figure, teachers improved over the academic year so that only one teacher remained in the 3L level.

One had reached the rating 5 - exemplary level. Most impressive is the number of teachers now at proficient (level 4). Over half (63%) of the teachers are now showing characteristics of proficient or exemplary teaching.

Figure 20. Capsule Ratings of Cycle 11 Classroom Observations (N=8, 16 observations)



Evaluators cannot claim that these teachers represent all teachers in the ITQG program, but they do serve as a representative sample of the types of schools, levels of teachers, and distribution across ITQG projects. These outcomes are representative of the work the projects are doing to enhance teaching among their teachers.

An opportunity now exists to look at the pedagogical practice across three years of consistent observation of two focus teachers from each project. Table 7 presents this information. Through these years the Department of Higher education has increased its emphasis on inquiry as the preferred pedagogical practice for ITQG teachers. Looking across cycles teachers are seen to be moving from lowest (1-3) ratings to highest rating (4-5) not only from first to last observations within one year but across years with half of the teachers in the 4 to 5 ratings at their last observation. Though we continue to see project leadership model incomplete inquiry methods in their professional development, some teachers have taken instructions for complete inquiry from these activities and implemented them fully in their classrooms.

Table 7. Comparison of Focus Teacher Classroom Observation Ratings Across Cycles

Frequency of Ratings for First and Last Observations of Focus Teachers Across Projects Cycles 9, 10, 11

Cycle	Cycle 9		Cycle 10		Cycle 11	
Rating	**Obs 1**	**Obs 2**	**Obs 3**	**Obs 4**	**Obs 5**	**Obs 6**
1	1	1	0	1	0	0
2	3	1	0	2	0	0
3	7	6	9	3	7	3
4	2	4	2	5	1	4
5	0	2	0	1	0	1

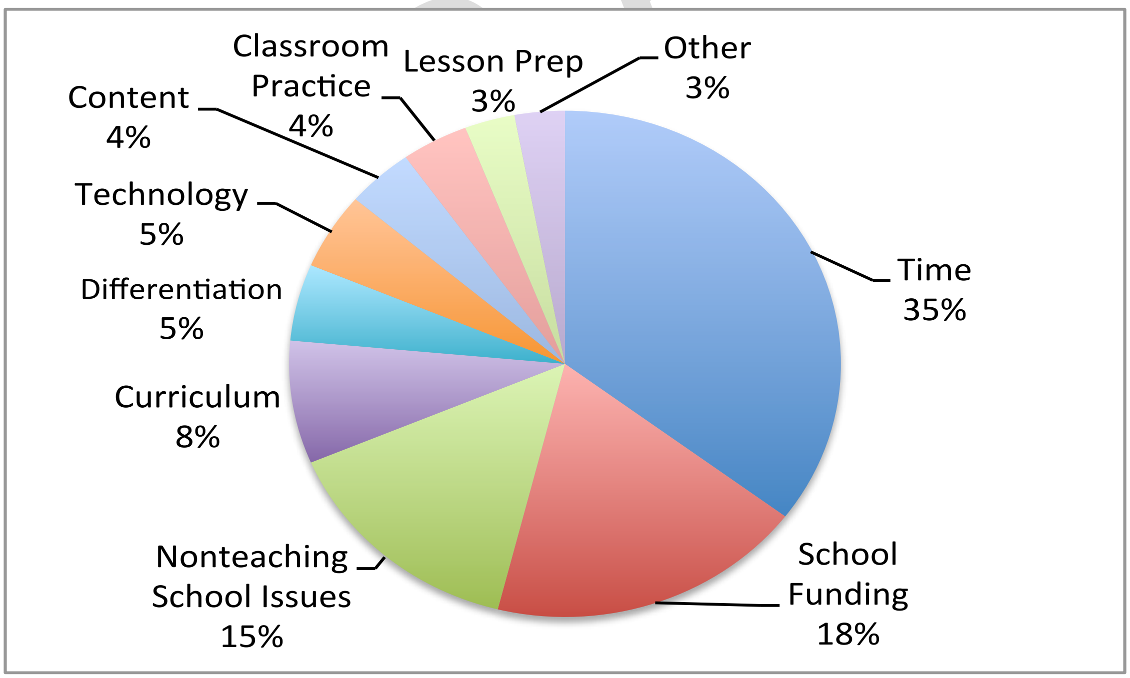
Teachers' Obstacles and ITQG-Based Improvements in Teacher Performance Based on Self-Reports

An additional source of information on the teacher experience, which perhaps contextualizes some of the information in this report, is data provided by teachers to the evaluators via surveys. Two questions asked about challenges the teachers felt were the greatest obstacles to their optimal performance and what benefits they feel they have received from their ITQG participation that have improved their teaching. A comparison of the results of these two answers offers a qualitative basis to consider ITQG teacher impact, as well as a means of understanding better possible mitigating factors that can hamper effects.

Teacher-Reported Challenges to Their Classroom Performance

Teachers were asked to share with the evaluators the challenges or obstacles they were encountering in their schools and classrooms that they thought were affecting their teaching performance. A total of 76 teachers reported 102 issues that they experienced that were preventing them from doing a better job at teaching. While such data is self-reported, it offers a view of teachers' self-perception on their performance and what may be holding them back and intruding on their success. Figure 21 shows the results of teacher surveying on this question.

Figure 21. Obstacles to Cycle 11 Teachers' Teaching Performance, Based on Self-Reports
(n=75, 102 individual items reported)



As is evident, time – for lesson planning, for resource compilation, for lessons themselves – was the largest impediment, to their classroom performance, in teachers' views. More than a third of reported obstacles involved time issues. Time concerns were followed by lack of funding at their schools and school districts available for resources, technology, supplies and professional development. Nearly one in five of the reports were in this category. A variety of non-classroom issues at schools, such as other non-teaching assignments, uncooperative administrators and teachers, and lack of collegiality, were made up 15% of the reports. Working with the diversity of student learners was cited in 5% of the reports.

Of interest is the contrast between these admittedly general categories and the areas where the ITQG objectives focus. These categories are not mutually exclusive. For example, time constraints must be dealt with in lesson planning. But the contrast in perceived challenges and specific focuses of the ITQG can be seen.

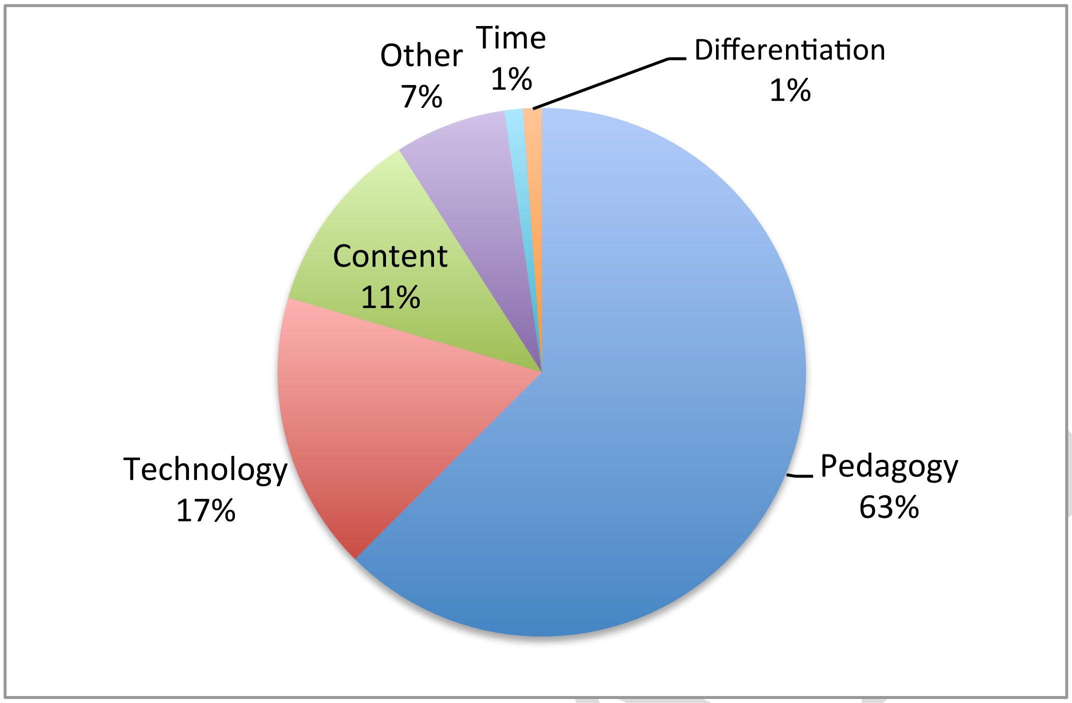
Content concerns, in this case related to math and/or science, were cited only 4 times, in 4% of reports. Similarly, pedagogy – the critical component of classroom practice, with the ITQG urging inquiry-based practice as the best source of student-driven learning for math and science, was mentioned 4 times, in 4% of reports. Lesson development and preparation, specifically included in ITQG intentions, and technology incorporation together were mentioned in 8% of the cited obstacles. Challenges external to the ITQG objectives themselves therefore represent the greatest concerns to participating teachers reporting their challenges. Again, projects do deal with time issues and encourage teachers teaming together within participating schools. However, the external pressures that teachers see as being their biggest problems in terms of their teaching success, and that means in student learning achievement, appear outside the range of ITQG's reach.

Teacher-Reported Benefits to Their Teaching from Participation in the ITQG

Areas where teachers reported believing the ITQG positively affected their teaching performance also were reported to the evaluators. A total of 75 teachers responded in this category, with 88 different items of improvement or assistance noted. It should be noted that one project was new in this cycle, and therefore teachers had not yet had the opportunity to apply ITQG effects in their schools and classrooms. These reports, therefore, are from teachers who had returned with ongoing projects in Cycle 11. Figure 22 presents these reported ITQG project-derived benefits.

Interestingly, this self-reported information shows that 63% of all reports related to benefits in classroom practice, whether citing inquiry-based teaching, greater use of hands-on lessons involving more active student learning, or improvements in and incorporation of activities related to their mathematics or science teaching. Seventeen percent of responses dealt with incorporation of technology, in this case closely allied to pedagogy. Content area enhancement was mentioned in 11% of reports. As this chart shows, teachers reported benefits in the areas in which the ITQG most explicitly is concerned, even as those items were not mentioned as the greatest areas of challenge or need.

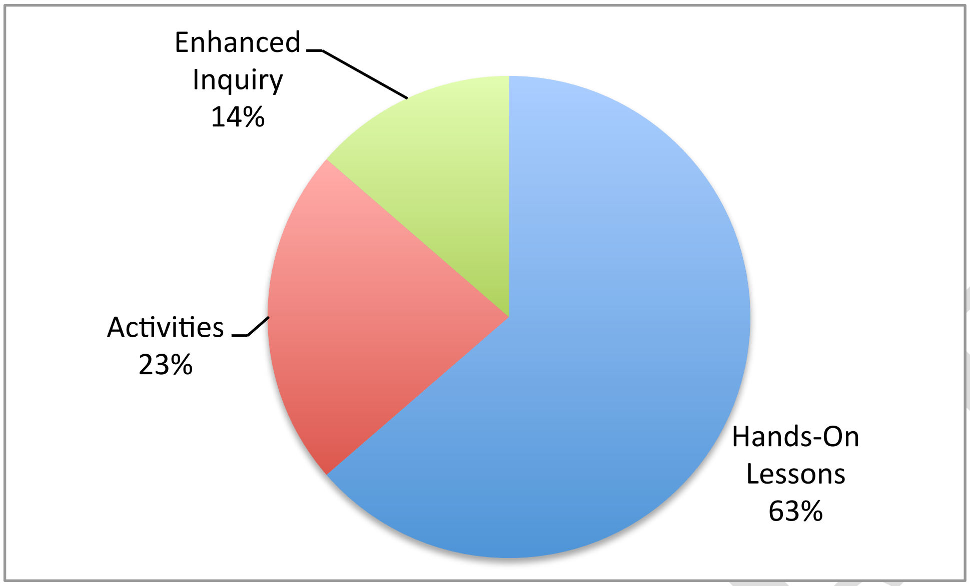
Figure 22. Benefits and Improvements to Cycle 11 Teachers' Teaching Performance, Based on Self-Reports (n=75, 88 individual items reported)



One way of looking at these self-reported data is that the ITQG program is meeting its objectives in terms of meaningfully addressing areas where teachers see their performance improving. Another way to look at the data, however, is that while content, pedagogy and incorporation of technology are extremely important other challenges perhaps outside the program's purview are likely to impede the program's impact. Perhaps ways to more explicitly address the concerns of time, so lacking as an identified benefit in Figure 22 versus the one-third of teachers reporting it as a major challenge, and other reported challenges are possible. Additional contextualizing in the professional development could help mediate obstacles' deleterious effects on teacher performance and increase the opportunity of the ITQG projects to reach their fuller potential.

A final way to consider these data on benefits is to apply the reports in attempting to understand how teachers perceive pedagogy and the improvements they see in classroom practice. The ITQG's emphasis on inquiry is based on the conviction, as mentioned before, that students encouraged and supported in their own investigations, informed by teachers as appropriate for grade level, content and context, will learn in a more deep, meaningful, lasting way, and will be able to apply their emerging knowledge on "how to learn" to other areas of their schoolwork and life. Time constraints often are noted as a hindrance to fully implementing inquiry-based lessons, although inquiry-infused learning is conducted in a range of styles and methods and can be applied even in a lecture-style lesson mode. So how do teachers express the improvements they see in their performance? Figure 23 breaks down self-reported pedagogy benefits into the three areas in which they fall: Inquiry, Hands-on learning, and better activities.

Figure 23. How Teachers Appear to See Their Pedagogical Improvements from ITQG Participation (n=55 teachers, 66 reports)



As can be seen, only 14% of the reports involved citations of inquiry-based learning or expressed pedagogy enhancements in terms that reflected inquiry. The greatest number of pedagogical enhancements involved the conceptualization of "hand-on" learning – having the students use manipulative, computers or otherwise be actively engaged. "Activities," a more general description that can apply to any student-participation classroom work, was noted in 23% of the classroom-practice-related teacher benefits from the ITQG.

These results indicate that the ITQG program may be able to increase the benefits of its classroom practice work by focusing more explicitly on the underlying pedagogical underpinnings of inquiry. More often than not, the evaluators have found that lessons where the term "activities" drive the lesson often are less-grounded in better practice than are those more specifically aligned with overt inquiry-based lesson planning. The point, of course, is not the activities themselves, but how the activities are conducted. Likewise, hands-on student engagement in itself does not necessarily encompass better practices, as lessons focused simply on calculator work, while hands-on, do not necessarily reflect advancements on more traditional blackboard lesson solving.

EQ 6. What has been the effect of the use of assessment data on instructional practice? (PO 4; EO 3)

As in the past, all projects in Cycle 11 shared an objective to improve teachers' knowledge and skills in the design and implementation of assessment tools and the use of assessment data to monitor the effectiveness of their instruction. Projects continued to address the objective in different ways, interpreting the requirement of integrating "data-drive assessment" across a range of possibilities.

Fewer projects brought in outside experts than in the previous cycle. These outside experts tend to address the subject from a rather broad perspective, encouraging development of data teams and discussing emerging large-scale assessment systems and requirements.

As an alternative, most projects embedded the subject more integrally within project curriculum and worked with development of assessment tools aligned with teacher-identified curricular and classroom needs. Approaches included teachers working as data teams within their schools and promoting action research among individual teachers. Some projects specifically focused on teacher-identified issues in assessment, attempting to identify particular issues within the teacher's school context.

Assessment (not necessarily "data-driven") also was incorporated by having teachers create their own assessment instruments for project-developed lesson plans. An intention to apply such instruments as part of internal project evaluation created some questions about adequacy of results to inform project impact on students. Lack of validity and reliability testing, or inclusion of such methods as a part of substantiating assessment tools for evaluation purposes, hampered the usefulness of this approach. While teachers appreciated the need for refinement of assessment practices and described wanting to integrate project-related assessment work into ongoing assessment activities at their schools, they often seemed unprepared to incorporate technology or more refined methods into their actual practice.

Classroom observations did indicate thoughtfulness among some teachers about how to apply assessment within the larger instructional context, with a more dynamic, collegial and inquiry-based approach to working with quizzes and their results. Adoption of pretest/posttest assessment methods, already in place in some schools, added to a more focused and specific way to understand gains in knowledge and understanding.

A particularly strong example of the incorporation of student data into instruction continued to be seen in a project working primarily with one school district. The project's teachers, with administrators, worked to coordinate district and standardized state test data both vertically and horizontally across grades. Discussion on how to apply this information directly in instruction in remedial ways amplified the usefulness of this work. However, driving assessment to link classroom assessment with available district data to pinpoint specific areas to address in instructional decision-making appears to remain uncommon across projects. This approach is time-consuming and in a multi-district project requires substantial commitment and oversight.

Project leadership could incorporate the gathering and use of student data in a more systematic way to better meet this objective. It is possible that discussion between the MDHE ITQG staff and project teams on how best to prioritize and implement this component would be of assistance in enhancing its effectiveness within the ITQG program. Adding the emphasis on the use of data that is already available by student and teacher within the district from state testing would enhance this aspect of the program.

EQ 7. How does achievement of students vary due to project treatment? (PO 1; EO 4)

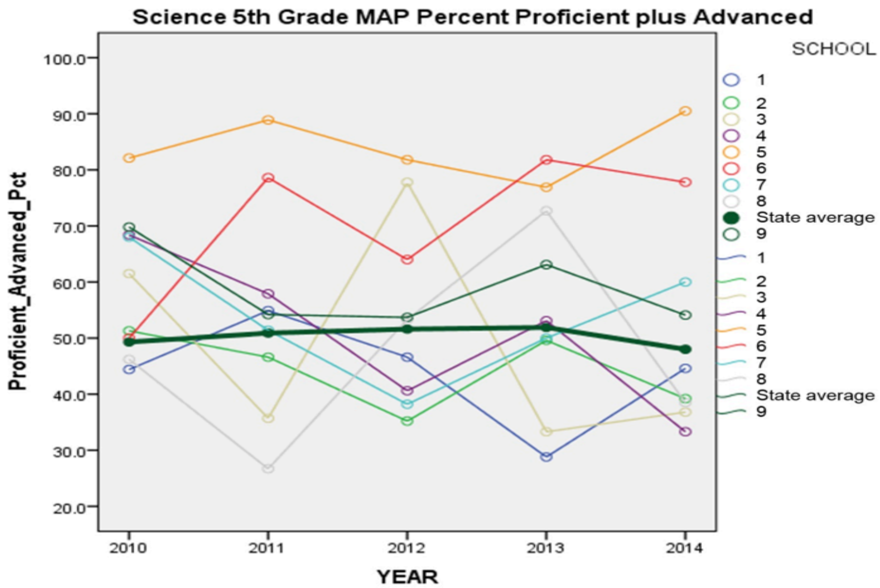
7. a. How does the effect vary for high-needs districts?

Unlike in previous years, student level data were unavailable to evaluators. An evaluation plan modification focused on examining trends in the percentage of proficient plus advance students for each school across the five years from 2010-2014. These data are available on the Department of Elementary and Secondary web site (dese.mo.gov) and are publically available at the DESE site's online database. Schools in which a Cycle 11 teacher taught were examined for mathematics and science achievement in grades tested. The small number of schools in each subject and grade level limited the type of analysis that could be performed. Figures 24 through 30 show trend lines for each school represented along with the state trends for each subject and grade level tested.

All project schools within a grade level by subject were combined into a single graph. The trend line for the state as a whole is highlighted in dark green. This shows the comparison of all project schools within a grade level and subject and how their trend line compares with the state average and the other schools. This visual inspection showed that there is no consistent pattern either across grades or content areas.

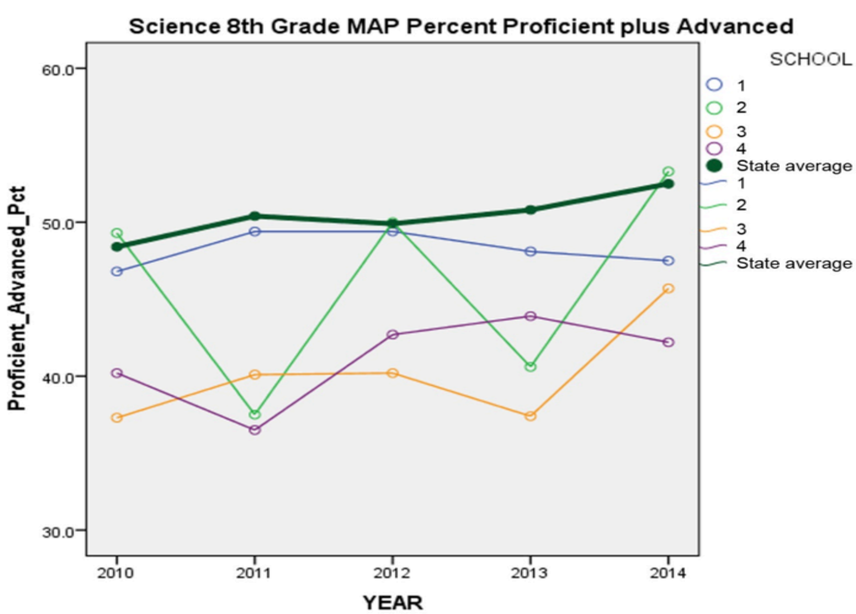
As can be seen in Figure 24, achievement for treatment teachers' schools in 5th grade science shows no consistent trend across schools. Some below the state average for 2013 now score above, and likewise, those above in 2013 now are below. Four of the nine schools show gains in 2014 from their 2013 scores leaving over half with no such gains.

Figure 24. Trend Lines for Each Cycle 11 Treatment Teacher's School: 5th Grade Science, 2014 (n = 9)



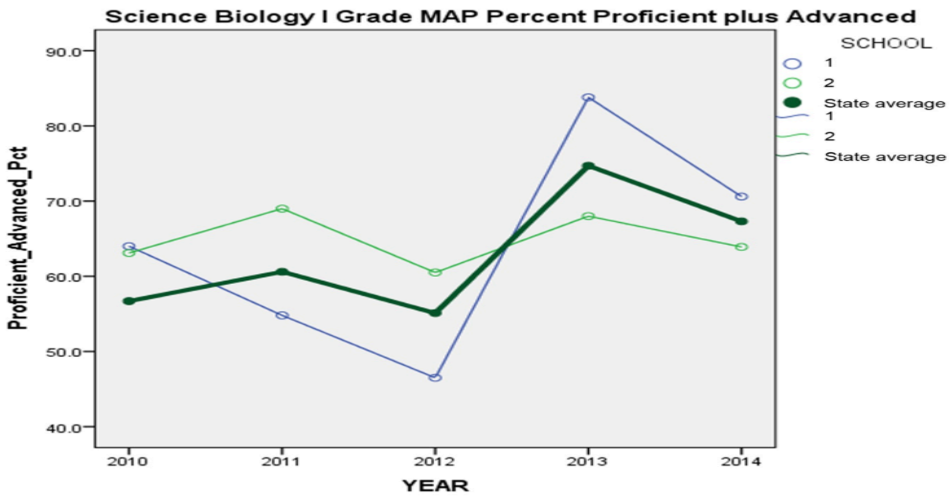
The same patterns can be seen in the following tables representing 8th grade science (Figure 25), Biology 1 EOC (Figure 26) and all mathematics grades tested (Figures 27-33).

Figure 25. Trend lines for each Cycle 11 Treatment Teacher's School: 8th Grade Science, 2014 (n = 4)



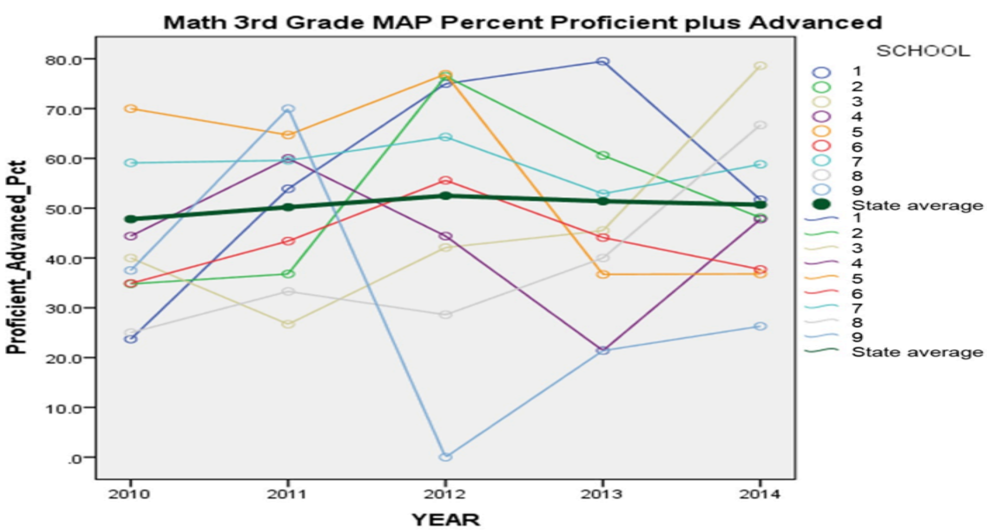
In Biology I (Figure 26) the trend lines for the two schools tracked the pattern for the state decreasing from 2013-2014, but in greater amounts than the state overall decrease. Data were only available for two schools as the high school teachers were primarily in projects focused on mathematics. These two high school biology teachers were also middle school teachers participating in science projects.

Figure 26. Trend Lines for Each Cycle 11 Treatment Teacher's School: Biology I, 2014 (n = 2)



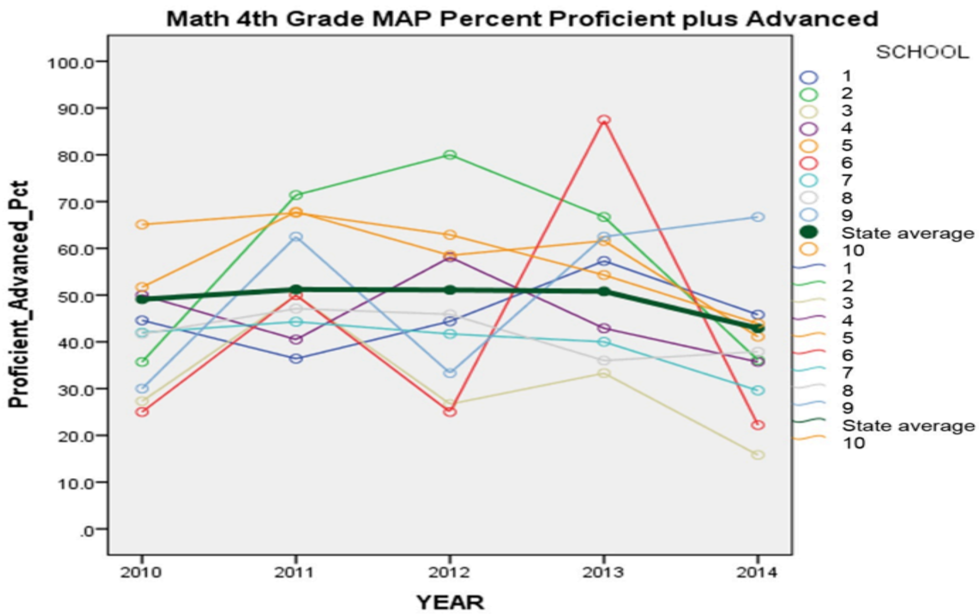
For mathematics, the treatment teachers' schools show the same results – no overall trends by grade level (Figures 27 through 33).

Figure 27. Trend Lines for Each Cycle 11 Treatment Teachers' School: Mathematics 3rd Grade, 2014 (n = 9)



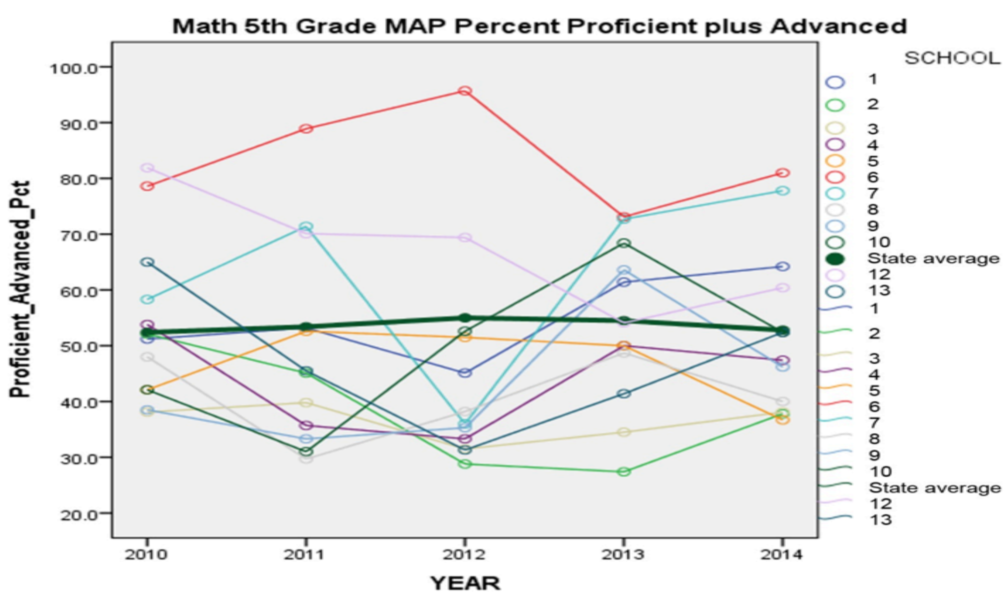
All but two of the nine schools trended downward for 4th grade mathematics, as did the state overall (Figure 28).

Figure 28. Trend Lines for Each Cycle 11 Treatment Teachers' School, Mathematics 4th Grade, 2014 (n = 9)



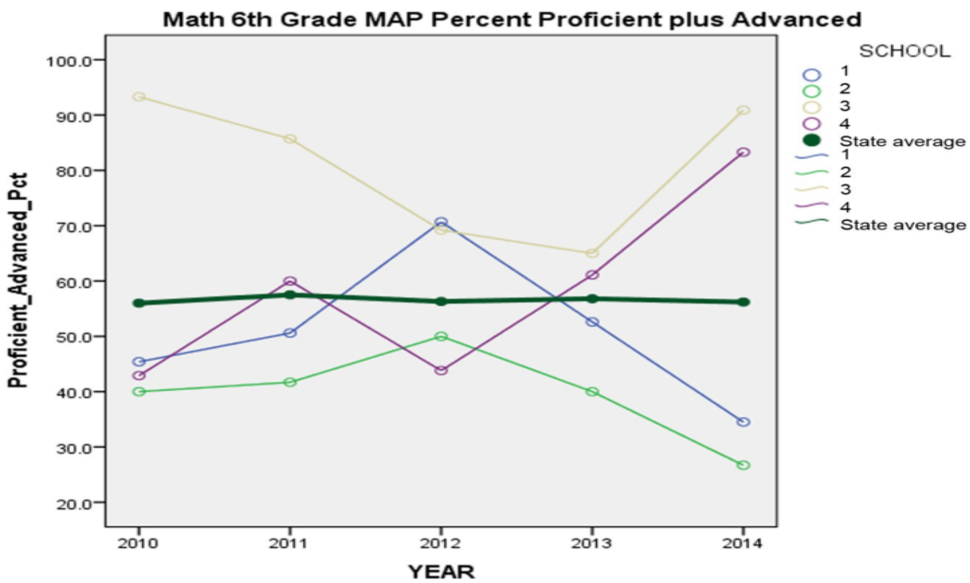
Fifth grade achievement in the treatment teachers' schools increased for about half of the 13 schools with half remaining at or below the state average (Figure 29).

Figure 29. Trend Lines for Each Cycle 11 Treatment Teachers' School: Mathematics 5th Grade, 2014 (n = 13)



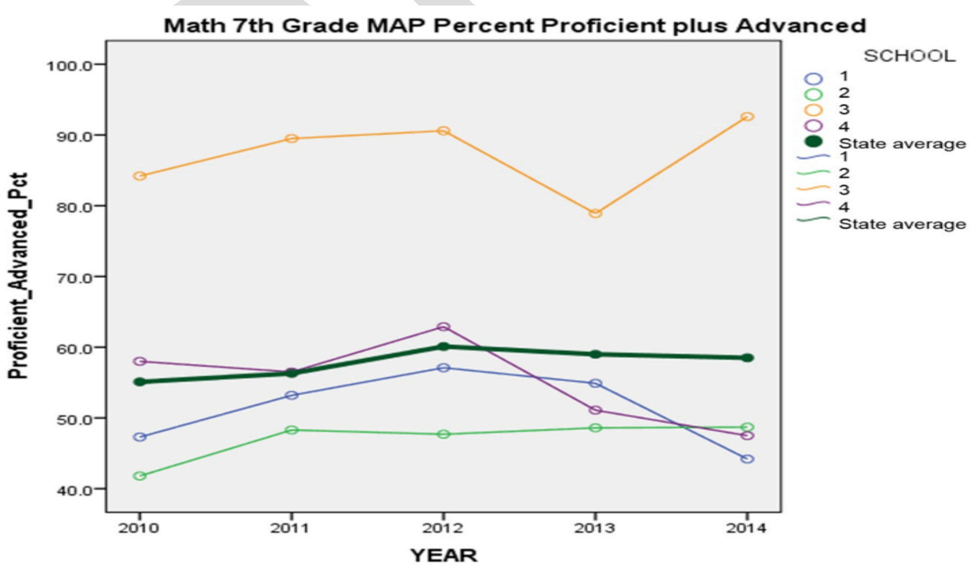
There were fewer 6th grade teachers in Cycle 11 projects with data available for only four schools. Again, half improved and half did not (Figure 30).

Figure 30. Trend Lines for Each Cycle 11 Treatment Teachers' School: Mathematics 6th Grade, 2014 (n = 4)



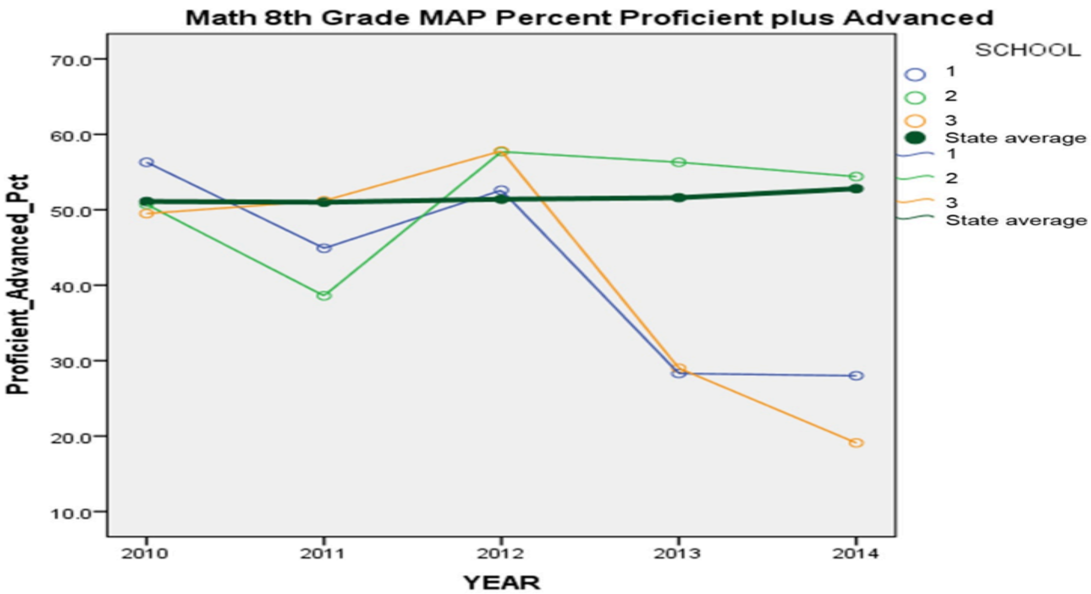
Like the 6th grade representation, 7th grade representation in the Cycle 11 projects was low with only four schools reporting information in DESE's database that is publically available. Half of the 7th grade teachers' schools showed decreases and three-fourths of the schools remained below the state average (Figure 31).

Figure 31. Trend Lines for Each Cycle 11 Treatment Teachers' School: Mathematics 7th Grade, 2014 (n = 4)



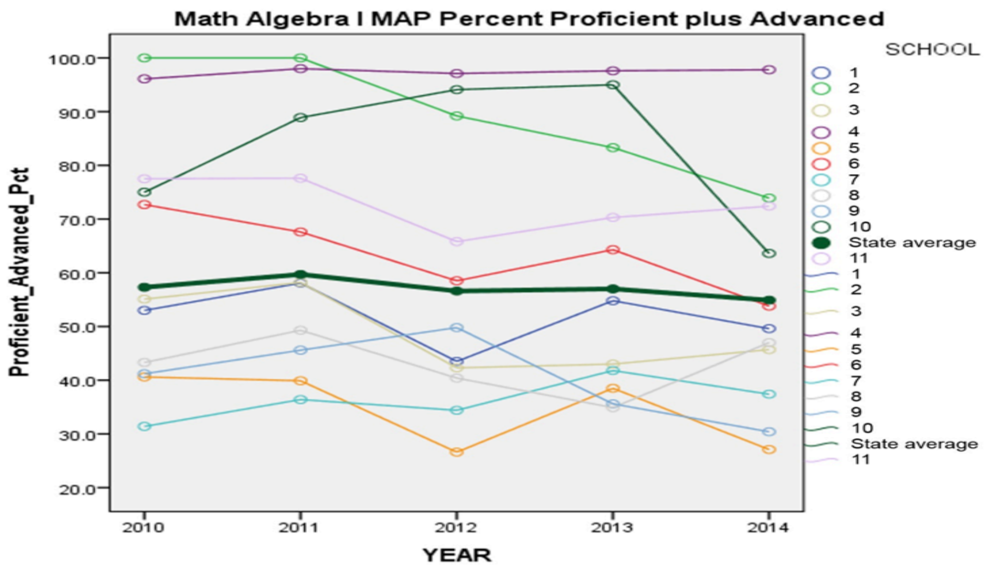
Achievement in schools containing 8th grade treatment teachers was also mixed (Figure 32). With only three schools' data available, two remain below the state average with all being above average in the 2012 testing cycle.

Figure 32. Trend Lines for Each Cycle 11 Treatment Teachers' School: Mathematics 8th Grade, 2014 (n = 3)



Because of the high school focus of one of the Cycle 11 projects, more schools with treatment teachers are represented in the Algebra I End of Course testing. Some of the eighth grade students are also represented in this figure. With one exception, the schools remained either above or below the state average where they had begun in 2010. One school above the state average and one school below moved toward the average. Seven of the 11 schools' achievement percentages declined from 2013 (Figure 33).

Figure 33. Trend Lines for Each Cycle 11 Treatment Teachers' School: Algebra I, 2014 (n = 11)



Recognizing the number of uncontrolled variables in this type of descriptive analysis, evaluators sought to examine data for only the schools that had two or more teachers within the school as participants in a Cycle 11 project. This reduced the numbers considerably, but for those for which data are available, results follow in a series of figures (Figures 34 through 41).

The figures contain trend lines from 2010 to 2014 for the schools for which two or more teachers were represented in 2014 ITQG projects, the achievement means for the state covering those years (bold green line), and the target set by the state for that grade level/subject for 2015 indicated by an asterisk (*).

Beginning with science, we see no difference in either the pattern of some schools increasing and some decreasing in achievement for 2014 for 5th grade as previous grades and content areas (Figure 34). The single school representing 8th grade with two or more students declined and remained below the state mean (Figure 35). There were no Biology I scores reported on the DESE site for schools with two or more science teachers in Cycle 11 projects.

Figure 34. Trend Lines for Schools in Which Two or More Teachers Participated in Cycle 11 Projects: Science 5th Grade, 2014 (2 or 3 Teachers/School, n = 5)

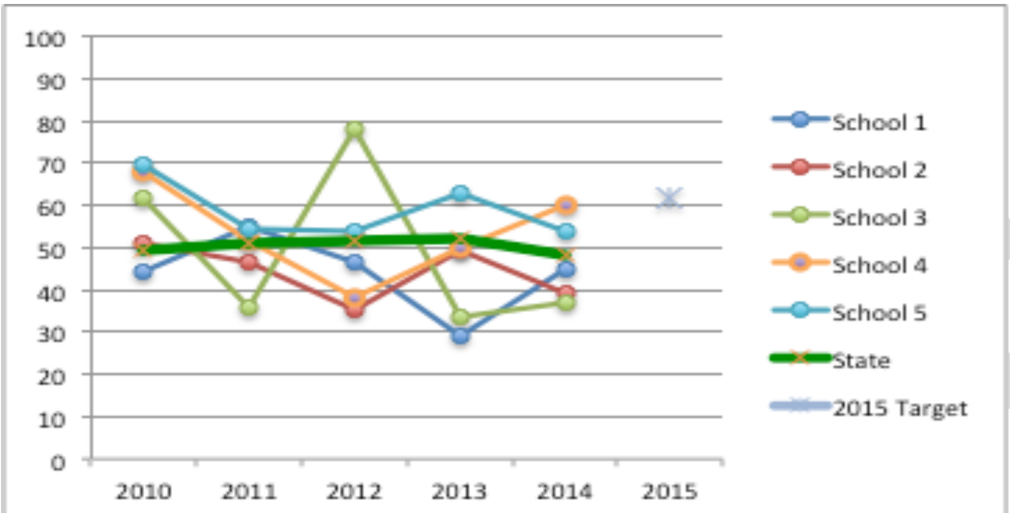
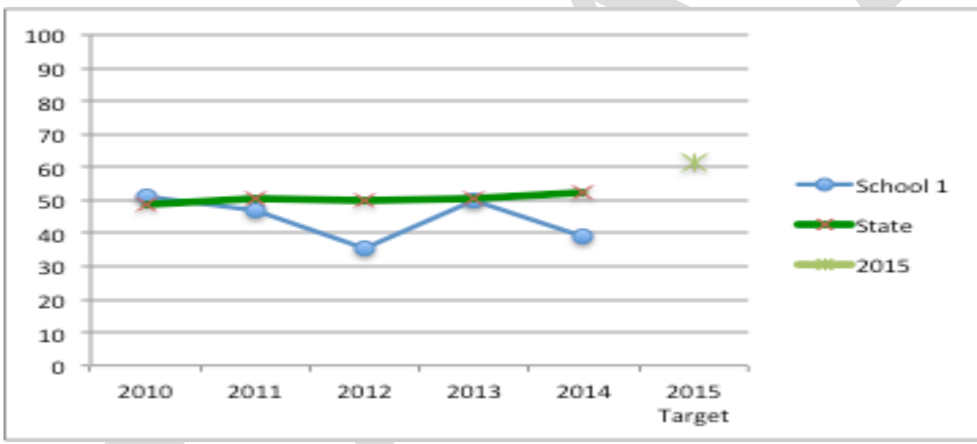


Figure 35. Trend Lines for Schools in Which Two or More Teachers Participated in Cycle 11 Projects: Science 8th Grade, 2014 (2 Teachers/School, n = 1)

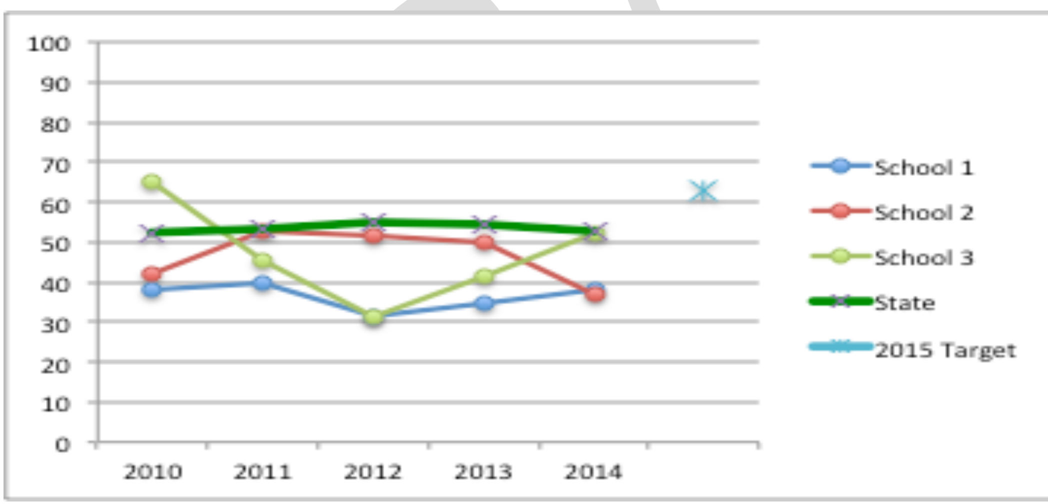


Fourth grade mathematics achievement trended down both for the two schools with two or more treatment teachers and for the state (Figure 36). The reduction in percentage of advanced/proficient for the schools was much larger than that for the state as a whole.

Figure 36. Trend Lines for Schools in Which Two or More Teachers Participated in Cycle 11 Projects: Mathematics 4th grade, 2014 (3 Teachers/School, n = 2)

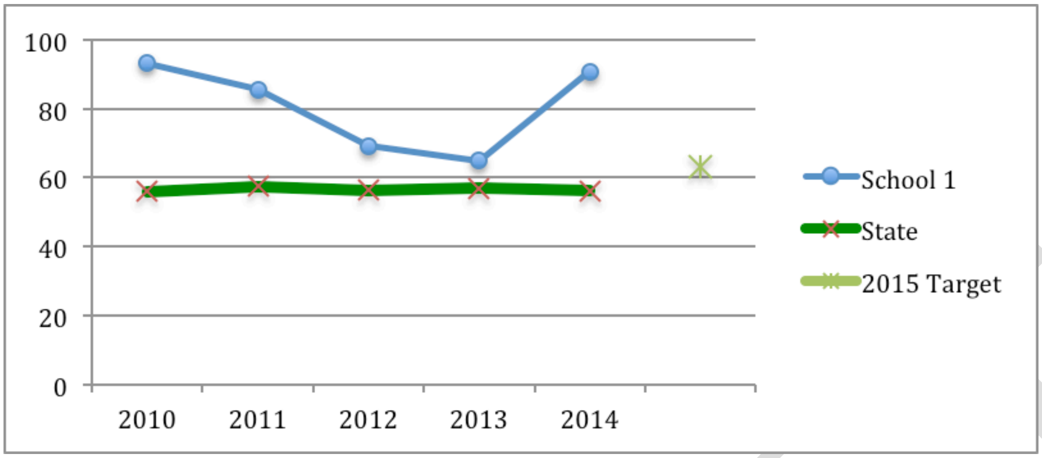
Fifth grade schools with two or more treatment teachers include one school with only one teacher per grade level (Figure 37). These three schools are all below the state mean, but two show upward growth trends from 2012.

Figure 37. Trend Lines for Schools in Which Two or More Teachers Participated in Cycle 11 Projects: Mathematics 5th Grade, 2014 (2 Teachers/School or School with a Single Teacher Per Grade, n = 3)



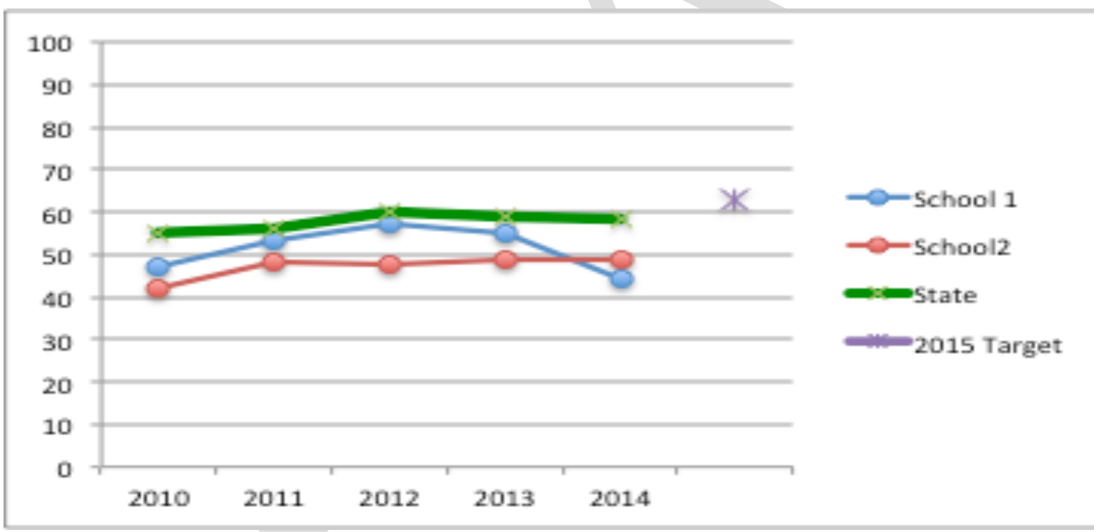
Only one school had enough 6th grade teachers to be considered in this closer look (Figure 38). This school was above the state mean prior to 2013 but its achievement was decreasing. It increased in 2014.

Figure 38. Trend Lines for Schools in Which Two or More Teachers Participated in Cycle 11 Projects: Mathematics 6th Grade, 2014 (2 Teachers/School, n = 1)



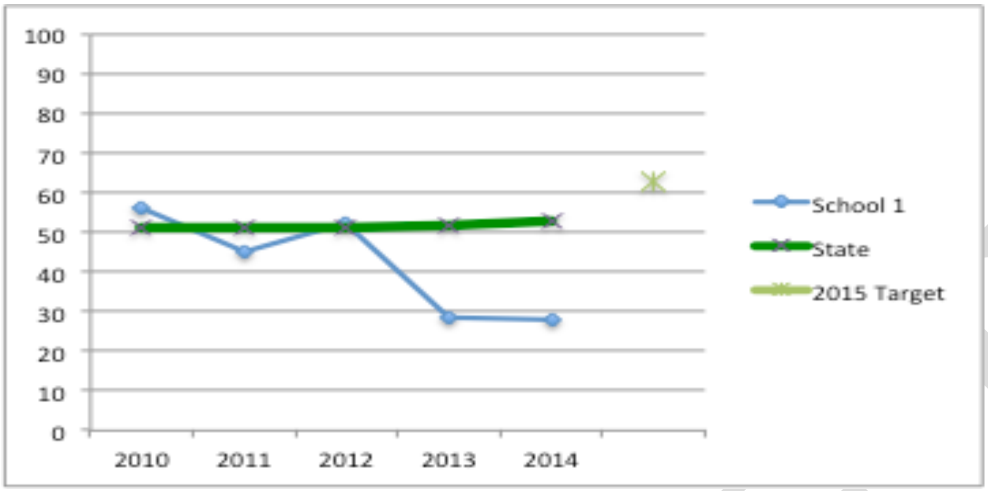
Both schools with multiple teachers in 7th grade mathematics had achievement below the state mean (Figure 39). One showed a slight increase from the previous year, one a decline.

Figure 39. Trend Lines for Schools in Which Two or More Teachers Participated in Cycle 11 Projects: Mathematics 7th Grade, 2014 (2 or 3 Teachers/School, n = 2)



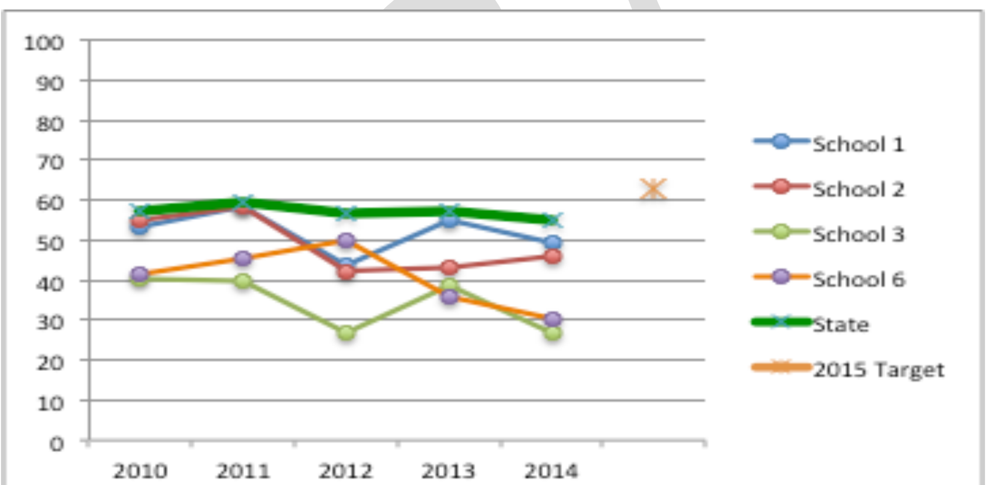
There was no discernable impact on 2014 scores for 8th grade mathematics from this school with two project teachers (Figure 40).

Figure 40. Trend Lines for Schools in Which Two or More Teachers Participated in Cycle 11 Projects: Mathematics 8th Grade, 2014 (2 Teachers/School, n = 1)



Examining Algebra 1 results we see the same kind of pattern – or non-pattern – with the achievement lines remaining below the mean, some schools improving their scores and some scores declining.

Figure 41. Trend Lines for Schools in Which Two or More Teachers Participated in Cycle 11 Projects: Mathematics Algebra 1, 2014 (2 or 3 Teachers/School, n = 4)



Without individual level data and only a limited number of schools at each grade level, use of inferential statistics has many limitations in this situation. The power to detect significance is greatly reduced and the parameter estimates are likely to be biased and limited in their ability to be replicated. With these limitations in mind, some multilevel models were used to examine if there were any trends across the years that might offer some insight not apparent in the graphs.

The multilevel models used schools as the level 2 variable and the five years as a repeated measure within schools for level 1. Year was included both as a linear and quadratic term to account for linear and curvilinear trends that increase or decrease overtime.

Math MAP percent proficient/advanced = $\gamma_{00} + \gamma_{10}$timelinear + γ_{20}timequadratic + $u_{0j} + r_{ij}$

Where: γ_{00} = intercept
γ_{10}timelinear = years 2010 through 2014 with linear orthogonal coding (-2,-1,0,1,2)
γ_{20}timequadratic = years 2010 through 2014 with quadratic orthogonal coding (2,-1,-2,-1,2)
u_{0j} = school variance
r_{ij} = within school year variance

As expected, the statistical power was very low due to the limited number of schools. No statistical significant trends were found for science. For math, fourth grade showed a significant quadratic trend in which scores tended to increase in the early years and then decrease in later years. Algebra I showed a significant decreasing linear trend across the years. Given the limitation of small number of schools, there were no significant upward trends for 2014 in the percent of proficient/advanced for schools in mathematics or science.

Since evaluators were not aware that the student level data would not be available until late in the cycle, this analysis plan was substituted. Evaluators are aware that it offers less than sufficient means to fully consider impact of ITQG teacher participation on student achievement. Nevertheless, additional refinements will be made in the analysis process for student outcomes for Cycle 12 if standardized test data used in previous cycles remain unavailable.

EQ 8. How were preservice programs affected by participation in the projects? (PO 5; EO 5)

8.a. What measurable effect did participation in the projects have on improving content or pedagogy for preservice teachers?

Some information about the Cycle 11 preservice teacher component already has been discussed. Essentially, the evaluators saw a decline in the participation of preservice teachers or graduate students in the projects. No projects incorporated preservice teachers in their treatment.

One project, SEQL, had graduate students as assistants and has attempted to incorporate them in a more meaningful way than in past years when they were used primarily for logistics. SEMO's MM project has not directly involved preservice teachers but the project teachers are being used as placement sites for SEMO's student teachers. Apparently, the student teachers did not select these sites as their placement in the first semester but two were placed with project teachers in the second semester. One has become a teacher in that district and is a participant in Cycle 12. The 4E and TRIM projects, both from MSU, did not involve preservice teachers directly, although TRIM describes some activities incorporated into their preservice classes that were taken from the summer sessions.

Program effects on preservice programs and teachers continue to be one of the weaker areas of the ITQG program and will be until appropriate emphasis is placed on it during the proposal review process and projects are required to show progress in this area.

EQ 9. What project elements are most effective in promoting change in participants?

9.a. Which project elements are associated with increased teacher change?

9.b. Which project elements are associated with increased student achievement?

Information provided here remains substantially the same as described in previous cycles. The ITQG Program Theory, as introduced in Figure 11, posits an intervention course in which an intensive, prolonged summer intervention with teachers in mathematics and/or science, addressing content (by university content faculty), pedagogical practice, curriculum/lesson planning, technology/other resources and assessment, bolstered by reinforcing academic year follow-ups, will yield improved teacher performance, leading to improved student achievement. All projects committed to implementing their work based on that program theory, which is a standard model for professional development.

In Cycle 11, teacher change was seen in pedagogical practice, affirming the ITQG Program Theory's workability in that area. Unlike past cycles teachers did not show statistically significant gains in content on external evaluation measures. Content gains were seen in individual projects among three of the four in Cycle 11. These tests, though untested for reliability, more closely matched the content focus of the individual project and may indicate content gains not able to be picked up in the broader external evaluation statewide test.

Qualitatively, the evaluators noted the power of strong, multi-faculty participation as an effective means of working towards project objectives. All projects except one provided examples of how this project team structure can vary and remain effective. A mingling of content authorities and education experts grounded in pedagogical practice and the intricacies of the Missouri educational system, supported by involved support staff, represents a powerful basis for aiming at major objectives. As has been noted, project teams and faculty that were unified in their focus while retaining their individual strengths and methods appeared to connect best with the most teacher participants. The most extreme example could be seen with the Missouri University of Science and Technology project, where a remarkably large group of science and mathematics faculty, aligned with the pedagogical practice priorities of the ITQG, served to model practice with many individual styles.

Communication patterns, as well, affected the power of projects' efforts. All projects were highly sensitive to meeting the expressed needs of teacher participants and, in most cases, the broader needs of partner school districts. Open communications, with a willingness to modify project schedules to address emerging issues or challenges, appeared to be a matter of course in all projects.

The fact that all projects evidenced committed cohorts of teachers also contributed to their success. As observers of teacher professional development can attest, the motives behind teachers participating can range widely, and in the most challenging cases include stipend acquisition, socializing, or enforced attendance because of principal or other building directives. Such challenging circumstances were not a pattern for any project.
Teachers observed in the projects' professional development sessions were motivated, attentive, and committed in every situation. Where individual teachers commented on their principals suggesting they attend, or even strongly suggesting they attend, all teachers acknowledged both their interest and their sense of the value of participation. Very few teachers mentioned the profit motive. In the evaluators' experience and given interview methods to help ease honest and frank sharing, negative bases for participation often come out when motive is discussed.

EQ 10. What are the characteristics of effective partnerships in ITQG projects?

The characteristics of effective partnership in the ITQQ program are those that connect the educational skills and content knowledge of faculty of institutions of higher education and professional developers of teachers with teachers, schools, and districts willing and capable of approaching the project as more than a mere transactional relationship. Where partnering schools and districts are dynamically involved, a strong brace ensuring relevance, in-classroom support and relevance of project activities to teachers' diverse needs is more assured.

The evaluators observed the power of content authorities' participation. Science and mathematics faculty, in bringing a deeper and more current awareness of their fields to the teacher participants, can both address misconceptions and stimulate expanded interest and understanding in teachers (perhaps especially those at the elementary school level who are not content specialists). Ultimately, the structures of the lead partnerships at institutions of higher learning were context-specific, reflecting the interests, influence and inter-departmental relationships of key project teams within each university or college.

The close partnership of Missouri State University with the Southwest Center for Educational Excellence, and the effective leadership role undertaken by the Southeast Regional Professional Development Center with its partnership with Southeast Missouri State University offered a sustained connection and support for teachers in other terms, such as additional local resources.

An additional characteristic of successful partnerships was seen in the integration of other, non-faculty content experts and business representatives into the partnership. Augmenting content with real-world contexts of science and mathematics underscored the connections between content and students' lives. The efficacy of intentional contextualizing of content within students' experience is one of the assumptions at work in the ITQG partnership framework.

At most, these partnerships reflect a vertical connection from university to school district to schools to teachers. Less horizontal connection was documented, either across university faculty outside of the project leadership or across administrators in school districts. More cross-teacher and teacher-administrator connections were seen in the SNA analysis than in the previous cycle, posing possibilities for dissemination of project effects within schools not previously seen.

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Appendix

Project Reports

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Science Education and Quantitative Literacy: An Inquiry-Based Approach (SEQL) Cycle 11 External Evaluation Final Report November 2014

The Science Education and Quantitative Literacy: An Inquiry-Based Approach (SEQL) project arises out of the Missouri University of Science and Technology and is in its last year of a three year project. It is a mature project led by content professors joined by the teacher education staff, and master teachers. The focus of SEQL is integrated science and mathematics concepts with a Cycle 11 focus on scientific research. The addition of scientific investigations incorporated within a "Big Question" was designed to help teachers develop analytical techniques used by scientists. Teachers designed, carried out and made inferences from the data, showing teachers that they can do science not just teach it.

Participants represent all grades K-12 with a focus on middle grades. Of the 39 attending the summer institute, 33 completed the project activities for a 15% attrition rate, and 26 completed the external evaluation process, based on the reports consulted. The number of teachers completing external evaluation posttests fell by 10 (30%) from the pretest administration. Because of a loss of one-third of the participants from pre to post testing, outcomes should be interpreted with caution. This is a large attrition rate and may not accurately represent the project. Project-reported participation by teacher showed that teachers participated in an average of 81.9% of the PD and follow-up activities.

The SEQL leadership team has gone beyond external evaluators' suggestions and has reflected on practice in practice, moving toward total alignment with the ITQG concept of inquiry practice. Continued attention to improvement in Cycle 12 can enhance the opportunity for teachers in this project to excel in their teaching.

Internal Evaluation

SEQL staff continue to incorporated several types of assessments concerning impact. Pre/post tests, daily feedback, reflection times, homework, and various confidence and attitude surveys all have been used.

Teachers

The project's internal analysis of the teacher content gains pretest to posttest for statistically significant differences for each class was applied by the project. The analysis method used was not mentioned in their report, nor was the reliability coefficient for the tests. By analyzing by classroom rather than by grade, the n's for each analysis were not able to be determined. In spite of this the project reports statistical significance for each class at the $p<.05$ level. N's should be reported in future reports along with the statistical test used for significance and reliability measures for each instrument used.

External evaluators applied a two-tailed t-test to the internal teacher results. Teachers show a statistically significant difference (p = .000) pre to post on the complete test (no subtest analysis was conducted) (Table 1). The effect size was .87, a large effect for a professional development project. Considering results pre to the postpost test administration at the end of the cycle, statistically significant gains were retained at the p=.004 level, a .68 effect size.

Table 1. Internal Teacher Content Test Results

		Mean	N	Mean Dif	SD	SEM	t	df	Sig. (2-tailed)
Pair 1	**Post %**	61.009	38	10.0351	6.2476	13.8226	5.368	37	0.000*
	Pre %	50.974	38						
Pair 2	**Postpost %**	64.203	23	11.4783	4.1267	18.8298	3.238	22	0.004*
	Pre %	52.725	23						
Pair 3	**PostPost %**	64.203	23	3.5942	-2.6250	9.8134	1.199	22	0.243
	Post %	60.609	23						

*Statistically significant at p<.05

Students

SEQL provided internal scores for students for each grade level on project-constructed content tests. Classrooms in the same grade who took the same subject test were combined for the two-tailed tests for significance. Results from external analysis (Table 2) indicate that all grade levels and content with n's large enough for analysis had statistically significant and meaningful gains.

Table 2. Student Gains by Grade on Internal Tests

Subject	Grade	N	Pre %	Post %	Significance
Math	4	44	29	72	0.000*
Math	5	104	33	62	0.000*
Math (A)	6	38	27	69	0.000*
Math (B)	6	22	19	29	0.000*#
Math (A)	7	17	39	72	0.000*
Math (B)	7	18	29	42	0.000*#
Pre Alg	7	35	44	62	0.000*
Math	8	18	28	34	0.000*#
Science	5	100	18	64	0.000*
Science	6	81	33	63	0.000*
Science	7	32	44	59	0.000*#

*p<.05; #=Statistically significant results but low posttest score

External Evaluation

Teachers

Teachers were administered a pre/post content knowledge test on the second day of the summer session and on the last day of the follow up sessions in the spring of the academic year. The questions were released items from TIMMS, NAEP, PISA, and the Environmental Education group NAAEE. The test was submitted to two content experts to assure face, content, and construct validity. Chronbach's alpha for reliability for the pretest was .48 and posttest .63. These reliabilities are low for use in determining reliability results for individual people. They are lower than desired for determining reliability of results for the group, but are usable.

In examining test items, evaluators found that teachers are still weak in reading charts and graphs and making and justifying decisions based on data. Teachers in the elementary groups were weaker overall in mathematics than the high school teachers, as would be expected.

This is the third year evaluators have noticed weaknesses in reading graphic displays of information. With these types of displays in the popular media being more and more frequent, it would be helpful to both teachers and their students to emphasize this skill both in the science and mathematics-focused projects.

Project teachers had no statistically significant gain pre to post. SEQL teachers had a pretest mean of 85% and posttest mean of 68%. Thirty-six SEQL teachers took the pretest with only 26 completing a posttest. Twenty-seven percent of the teachers who took the pretest did not take the posttest. This is a large attrition rate, so care should be taken in interpreting results for this project. Results may not accurately reflect the outcomes for the whole group.

Teacher Pedagogy

Two focus teachers from each project were observed. Since there is a possibility of identifying the individual teachers, aggregated results are reported in the Technical Report.

Partnership/Sustainability

At the end of the project teachers were asked to name three people to whom they go for assistance in content and assistance in pedagogy. These results were analyzed through the use of UCINET Social Network Analysis (SNA) program. The resulting diagrams are helpful in determining networks within the project and assessing the strength of the support necessary for sustaining the project effort. Each node in the analysis represents one unique person. The number of participants may not represent the full cohort of participants due to lack of response or opting out of the evaluation. Since this is the last year of the project, the development of networks across Cycles 9, 10, and 11 will be examined.

Colors and symbols have changed across the cycles but project teachers are always circles, teachers outside of the project are down triangles, project leadership are blue triangles, and administrators are squares. Other shapes represent family, other science or math professionals, such as other university faculty, the web, and non-profit professionals. Note the size and comprehensiveness of the networks at the end of each of the cycles.

SEQL had been working with teachers in this grade level for several years prior to Cycle 9. Their networks had been established and Figures 1 illustrates this network for content support. New teachers entered the group in Cycles 10 and 11 and they have not fully entered the SEQL network, finding assistance in smaller groups or other teachers within their schools. However, among those schools within the larger networks there is potential for sustaining the SEQL work in supporting content growth. (Figures 2 and 3.)

Figure 1. SEQL SNA Analysis for Project Teacher's Request for Assistance with Content at the End of Cycle 9, 2012

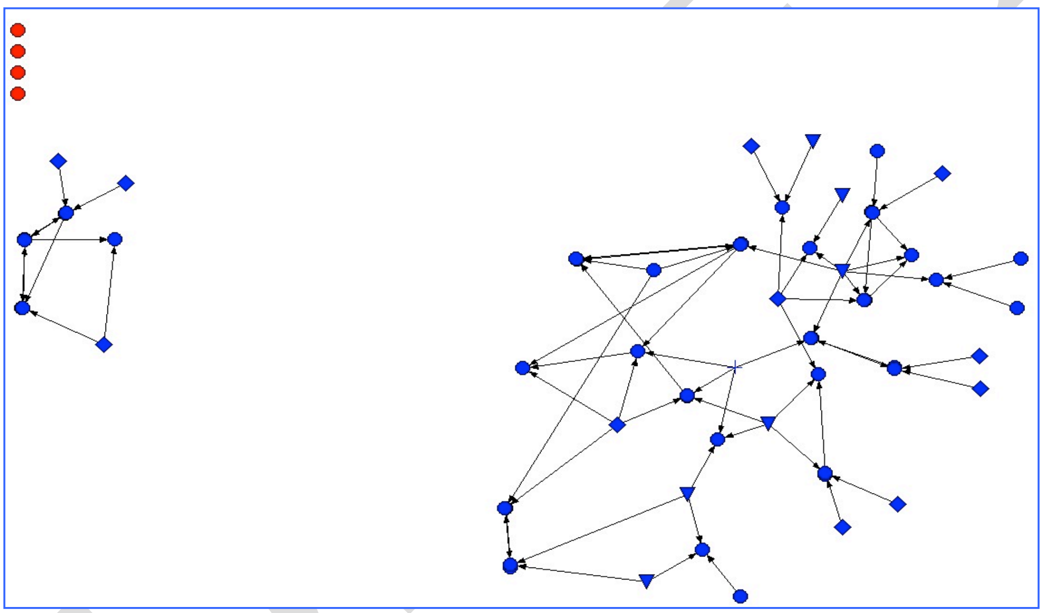


Figure 2. SEQL SNA Analysis for Project Teacher's Request for Assistance with Content at the End of Cycle 10, 2013

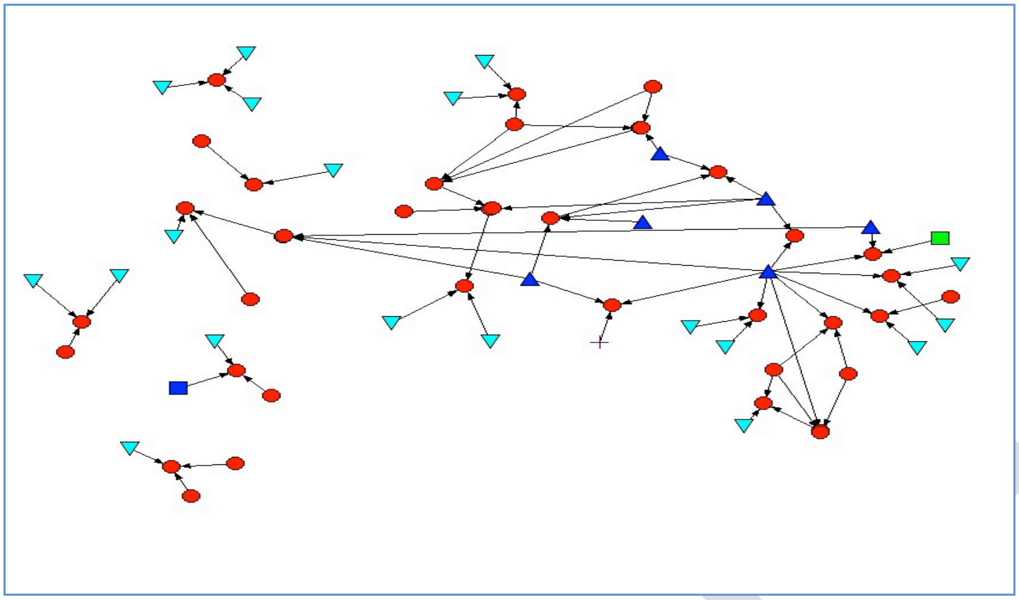
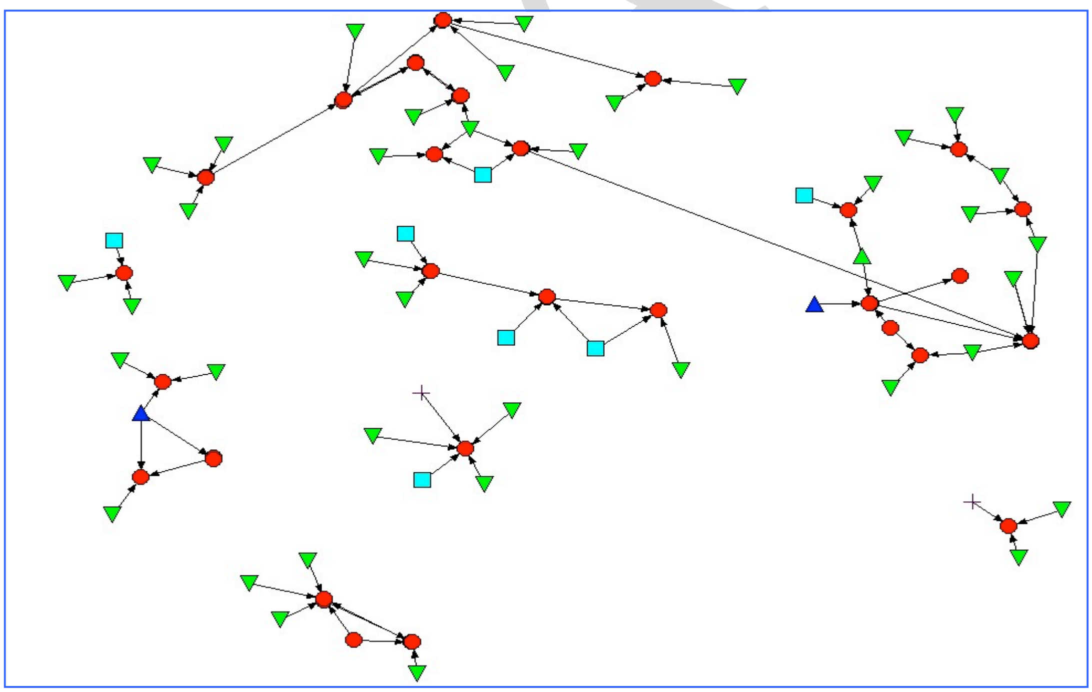


Figure 3. SEQL SNA Analysis for Project Teacher's Request for Assistance with Content at the End of Cycle 11, 2014



The pedagogy assistance SNA diagrams show some networks (Figures 4-6) but the connectedness seen in the content seems to break down between cycles 9 and 11. Instead of one larger network as seen in Figures 4 and 5 (Cycles 9 and 10), Cycle 11 (Figure 6) shows several smaller networks with many teachers dependent only on teachers outside of the SEQL program.

Figure 4. SEQL SNA Analysis for Project Teacher's Request for Assistance with Pedagogy at the End of Cycle 9, 2012

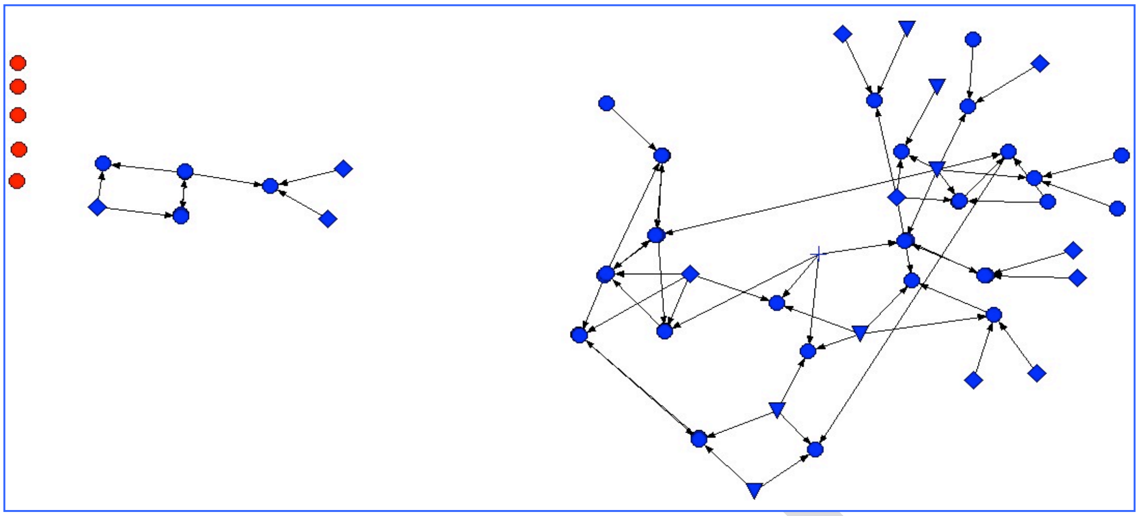


Figure 5. SEQL SNA Analysis for Project Teacher's Request for Assistance with Pedagogy at the End of Cycle 10, 2013

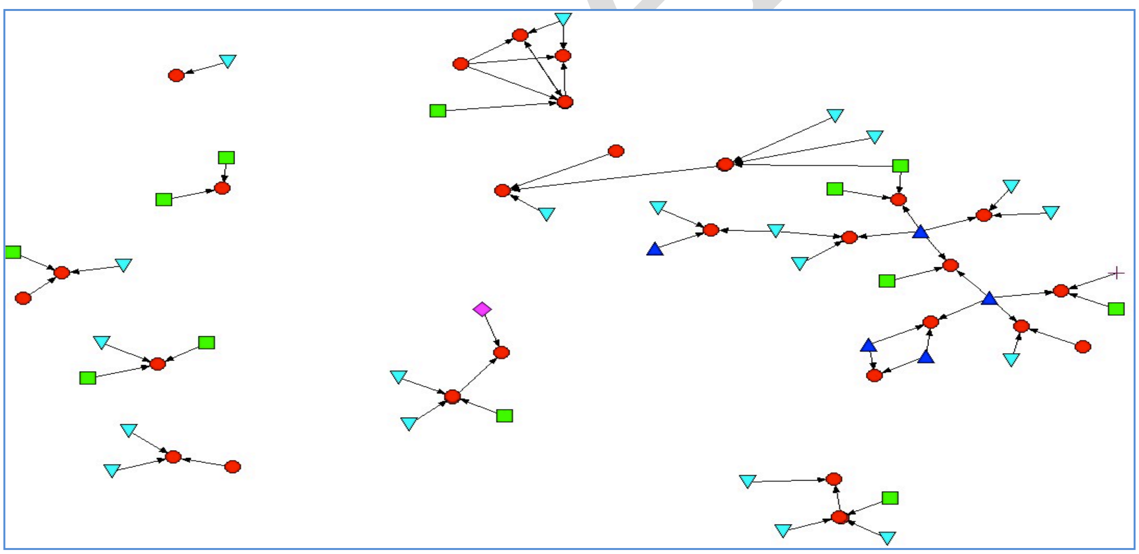
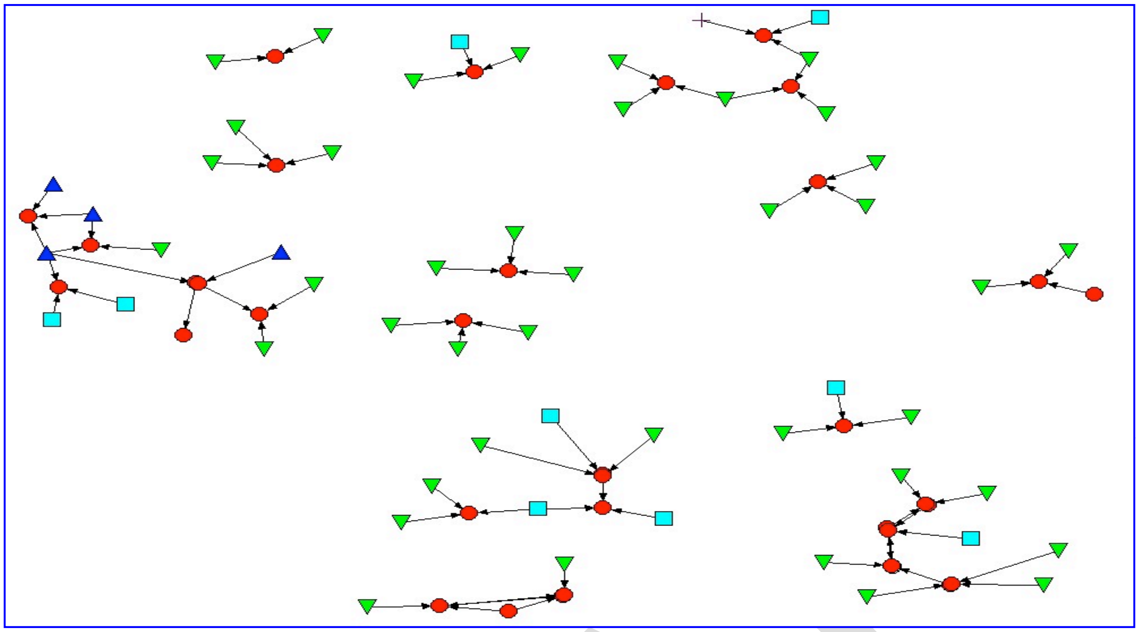


Figure 6. SEQL SNA Analysis for Project Teacher's Request for Assistance with Pedagogy at the End of Cycle 11, 2014



Comparison of Cycle 10 with the previous Cycle 9 shows a strikingly different picture. In Cycle 9 both the content and pedagogy networks were much tighter (Figures 1 and 4) than in Cycle 10 (Figures 2 and 5). This loosening of the network, continuing into Cycle 11, may represent a lost opportunity for continuing support among the teachers after the end of the project for ITQG goals of enhanced content and inquiry pedagogy.

Twenty-two of the Cycle 9 participants repeated in Cycle 10. These teachers represent over half of the Cycle10 participants. The project leadership may want to examine what happened to break up the tighter network shown in Cycle 9 since many of the teachers repeating in Cycle 11 remain from Cycles 9 and 10. Without other mechanisms to sustain the effort the effects of the project may be diluted without support in the field from other participants. This will be especially important for the Cycle 12 efforts.

The evaluators appreciate the support and communication with project leadership and note the continued efforts on behalf of the leadership to raise the quality of both its programming and internal evaluation efforts.

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Making Mathematicians: Learning to Think and Apply Cycle 11 External Evaluation Final Report November 2014

Making Mathematicians: Learning to Think and Apply (MM) was an Improving Teacher Quality Grant project in its first year of a three-year project focused on the enhancement of mathematics content and pedagogy within an environmental education setting. Incorporating teachers and students in grades K-6 they rejoin the ITQG program after a year's absence. Set within and partnering with Southeast Missouri State University (SEMO), the Regional Professional Development Center (RPDC) leads the project. The RPDC and Southeast Missouri State University have partnered with the Missouri Department of Conservation. No individual school district has been identified as core partner. Participants come from 10 southeast and south central school districts including two parochial systems.

In Cycle 11, available information showed that 45 teacher participants completed the project activities, five more than had been targeted. Several teachers who wanted to participate were not able to be accommodated by the project, indicating a need for this type of programming in the southeast area of the state. Of these participants, 30 teachers (67%) completed the external evaluation process. To lose 33% of participants in an evaluation means that anything reported through external evaluation should be taken as an indicator of project outcomes only, but evaluators cannot assure that one-third of the participants did not have characteristics that would have changed the outcomes had they contributed data. Project-reported attendance indicated that teachers participated in an average of 84% of the PD and follow-up hours.

Evaluators note the increasing inclusion of inquiry teaching among the staff in this cycle. The partnership with the Missouri Department of Conservation has added both richness in teaching and facilities to the project. Technology tools and software are a critical part of the project as teachers from these rural districts learn to use the technological enhancements found in most of their districts. Assessment activities focused on formative feedback and writing assessments to accompany units being taught from the project activities, though classroom assessments were not completed this cycle.

Building on MM activities, several groups of teachers applied for additional funds to support their activities for outdoor classrooms through the Missouri Department of Conservation. This type of sustaining funding is occurring early in this project and should enhance teachers' and students' abilities to continue to grow in content acquisition as they move into new areas of inquiry.

Internal Evaluation

MM is the only Cycle 11 project with a designated internal evaluator. The focus on collecting evidence of the project's effectiveness will serve the project as it moves into its second year.

Students

No internal student test scores were submitted for analysis.

Teachers

Teachers were given the DTAMS test, a mathematics test including content and pedagogical constructs. Evaluators examined the test for mathematical content acquisition. Pretest to posttest gains showed statistically significant gains (p=.004) with an effect size of .49 (Table 1). This is a non-trivial gain above the anticipated .26 ES for typical professional development programs. When the posttest results were compared to the results from a third administration (postpost) at the end of the academic year, additional gains were noted (p=.001, ES= .58), indicating additional content gain throughout the academic year activities.

Table 1. Teacher Content Analysis for Pretest, Posttest, and Postposttest, Cycle 11, 2014

		Mean	N	Mean Dif	SD	SEM	t	df	Sig. (2-tailed)
Pair 1	**Post %**	66.410	39	5.3205	10.7786	1.7260	3.083	38	0.004*
	Pre %	61.090	39						
Pair 2	**Postpost %**	69.595	37	9.3253	15.9714	2.6257	3.551	36	0.001*
	Pre %	60.270	37						
Pair 3	**PostPost %**	69.429	35	3.7143	13.4113	2.2673	1.638	34	0.111
	Post %	65.714	35						

Observations

Observations conducted by MM staff are used for mentoring and coaching and not for evaluation and are reported in their Final Report for Cycle 11.

External Evaluators conducted observations of two focus teachers across projects for evaluative purposes. Because of the low number of teachers per project and the possibility of identification of individual teachers, aggregate results are reported in the Technical Report.

External Evaluation

Teacher Content Knowledge Gain

Teachers were administered a pre/post content knowledge test early in the summer session and on the last day of the follow up sessions in the spring of the academic year. The questions were released items from TIMMS, NAEP, PISA, and the Environmental Education group NAAEE. The test was submitted to two content experts to assure face, content, and construct validity. Chronbach’s alpha for the pretest was .48 and posttest .63. These reliabilities are low for use in determining reliability results for individual people. They are lower than desired, but workable, for determining reliability of results for the group.

Item analysis shows that teachers are still weak in reading charts and graphs and making and justifying decisions based on data. Teachers in the elementary groups were weaker overall in mathematics than the high school teachers, as would be expected.

This is the third year evaluators have noticed weaknesses in reading graphic displays of information. With these types of displays in the popular media being more and more frequent, it would be helpful to both teachers and their students to emphasize this skill both in the science and mathematics-focused projects.

ITQG program teachers had no statistically significant gain pre to post. MM teachers had a pretest mean of 81% and posttest mean of 58%. Ten MM teachers who took the pretest did not take the posttest, possibly contributing to the steep decline from pre to post test. The pretest mean of the 10 missing MM teachers was 83%, slightly higher than the group mean for the pretest. One fourth of the teachers who completed pretests did not complete posttests. Care should be taken in assuming these individual project results actually represent outcomes for MM with so many teachers missing posttest results.

Teacher Pedagogy

Observations of two focus teachers across projects were conducted by external evaluators. Because of the low number of teachers per project and the possibility of identification of individual teachers, aggregate results are reported in the Technical Report.

Partnership/Sustainability

At the end of the project teachers were asked to name three people to whom they go for assistance in content and assistance in pedagogy. These results were analyzed through the use of UCINET Social Network Analysis (SNA) program. The resulting diagrams are helpful in determining networks within the project and assessing the strength of the support necessary for sustaining the project effort. Each node in the analysis represents one unique person. The number of participants may not represent the full cohort of participants due to lack of response or opting out of the evaluation. Though MM was not funded in Cycle 10, networks from Cycle 9 and Cycle 11 will be examined (Figures 2 through 5).

Colors and symbols have changed across the cycles but project teachers are always circles, teachers outside of the project are down triangles, project leadership are blue triangles, and administrators are squares. Other shapes represent family, other science or math professionals, such as other university faculty, the web, and non-profit professionals. Note the size and comprehensiveness of the networks at the end of each of the cycles.

At the end of Cycle 9 the MM project had developed among its teachers a tight network composed of participants, teachers and leadership with only three teachers outside of the network, two of whom are connected to each other (Figure 1).

After a year of no ongoing project, picking up the following Cycle 11 the network is not as cohesive (Figure 2). Four teachers are not connected to any project teacher, lacking the support of other teachers who have gone through the same programming. Twelve teachers are connected directly or through non-project teachers to another project teacher in scattered small groups. There seems to be a network developing in Cycle 11. With work the outliers may be able to be brought into the project network for stronger content support opportunities.

Figure 1. MM SNA Analysis for Project Teacher's Request for Assistance with Content at the End of Cycle 9, 2012

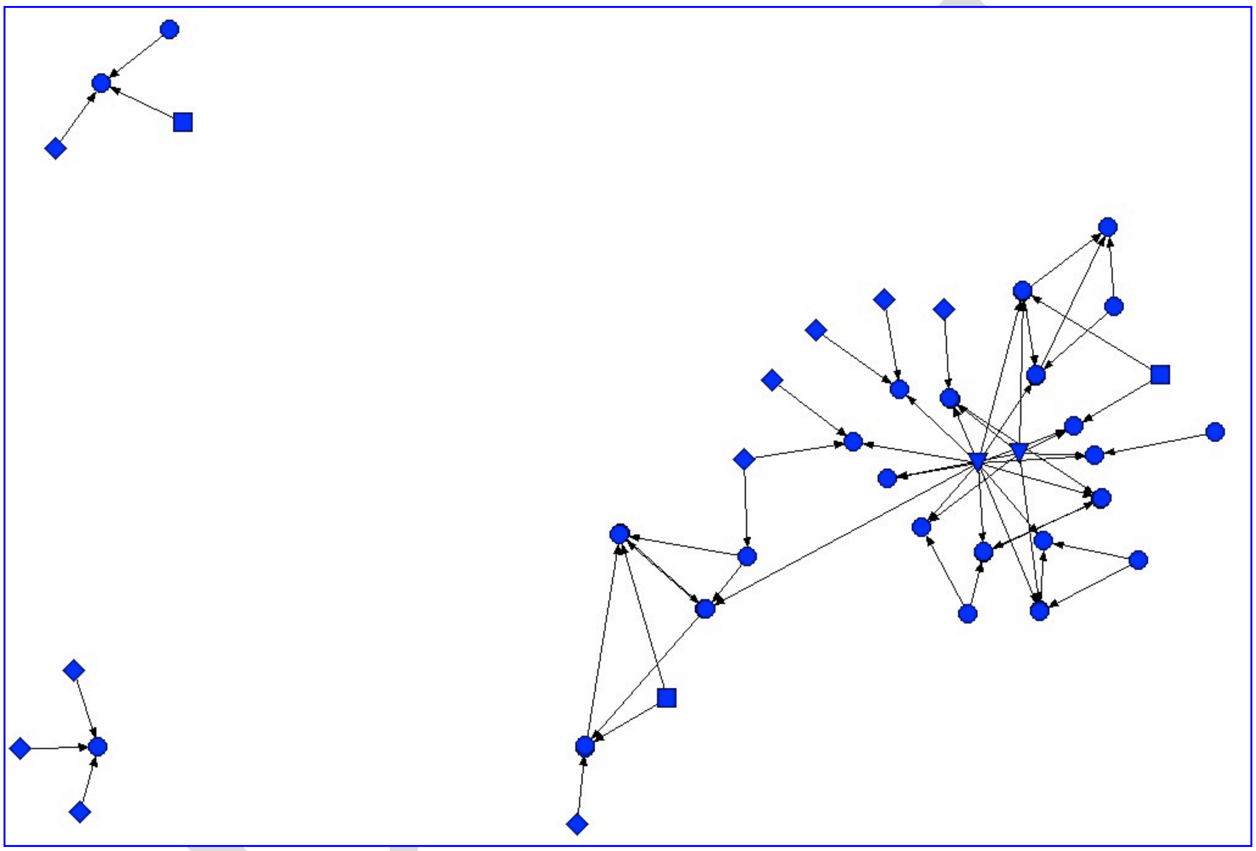
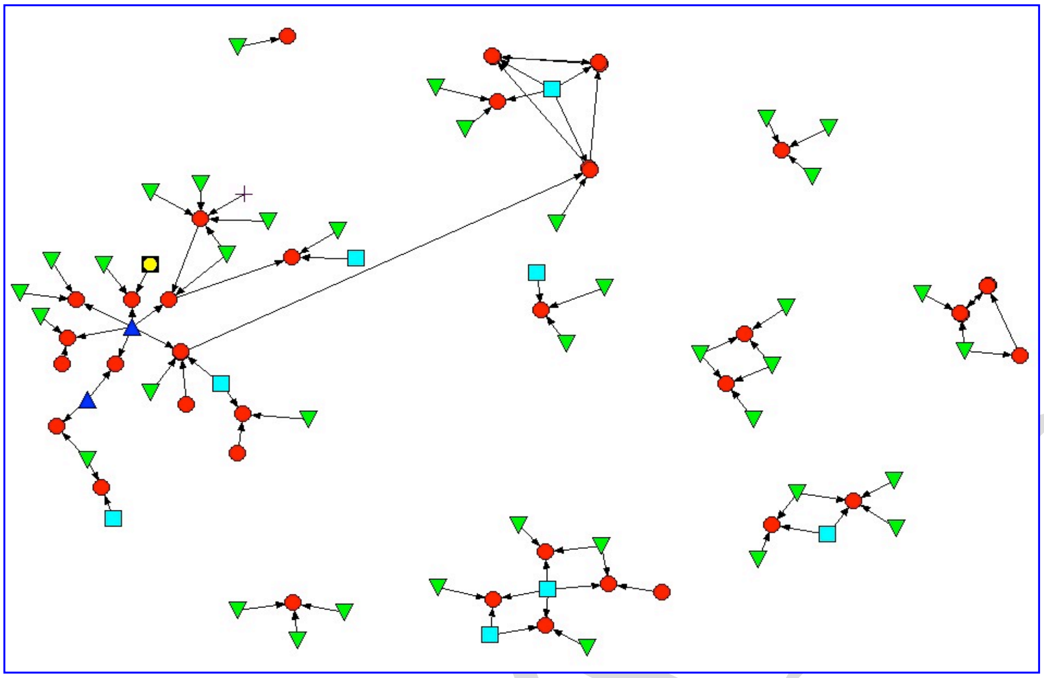


Figure 2. MM SNA Analysis for Project Teacher's Request for Assistance with Content at the end of Cycle 11, 2014



A similar picture exists when looking at the people teachers go to for assistance with pedagogy. The compact network showing in the Cycle 9 pedagogy assistance figure (Figure 3) becomes less compact with Cycle 11 (Figure 4).

Figure 3. MM SNA Analysis for Project Teacher's Request for Assistance with Pedagogy at the End of Cycle 9, 2012

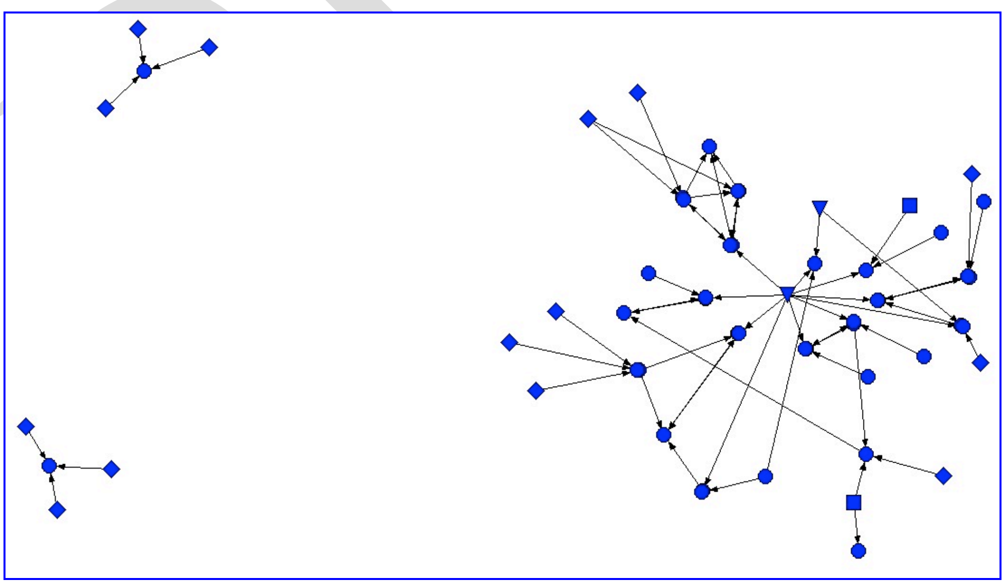
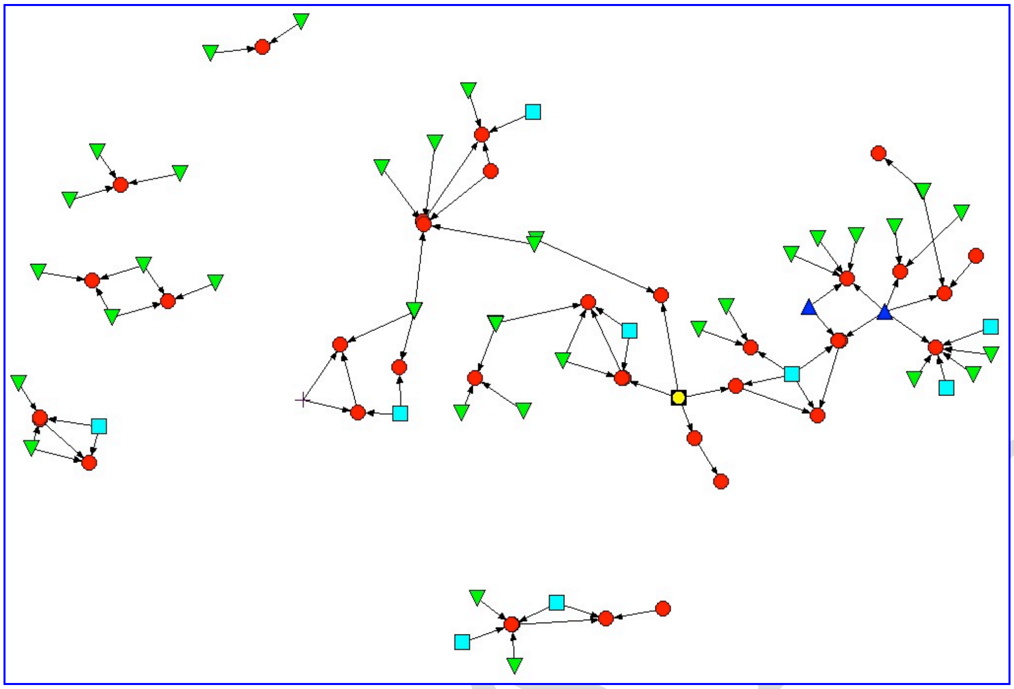


Figure 4. MM SNA Analysis for Project Teacher's Request for Assistance with Pedagogy at the End of Cycle 11, 2014



The RPDC's work centers on providing professional development for the districts in its region. It would be expected that established networks would exist in some form because of its outreach efforts. With this project, there is potential for strengthening these existing networks and sustaining the efforts of the project.

The university is contributing to sustainability in another way. Two of their preservice teachers were placed in project teachers' classrooms for spring student teaching. One of these teachers has become a participant in the Cycle 12 project. If SEMO can continue to place preservice teachers in project teachers' classrooms for their practicums or student teaching, the preservice teachers can see inquiry modeled and science and mathematics taught in ways that ITQG supports.

The evaluators appreciate the support and communication with project leadership and note the continued efforts on behalf of the leadership to raise the quality of both its programming and internal evaluation efforts.

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Transforming Mathematics Instruction Using Inquiry and One-to-One Environments (TRIM I+121)
Final External Evaluation Report Cycle 11
November 2014

Transforming Mathematics Instruction Using Inquiry and One-to-One Environments (TRIM I+121) is in its second year of a three-year continuation project, focusing the on high school mathematics population. This cycle incorporates technology-rich explorations due to the needs of Joplin schools, which are now moving to electronic texts, and a continuing focus on geometry within the core competencies. A focus on intensive online interaction among teachers, including regroups through face-to-face technology, enhances the teachers' use of technology for general communication. This focus on technology makes TRIM unique among Cycle 11 funded projects.

Thirty-four high school teachers, some of whom also teach middle grades, began the project with 31 completing the full intervention, based on available information. Thirty participants (97%) completed the external evaluation processes. Project-reported attendance indicates that teachers participated in an average of 90% of the PD and follow-up hours. Two business partners continue to participate. Participant districts included Joplin as the partner district and 14 other districts in southwest Missouri. The leadership team came from Departments of Mathematics and Department of Childhood Education and Family Studies at Missouri State University, joined by staff from the Southwest Center for Educational Excellence. This leadership team has been in place for several years providing similar service to the southwest part of the state.

Internal Evaluation

Teachers

TRIM participants were administered several tests and surveys. Content gain was assessed through the administration of a project-constructed test pre/post. Teachers had statistically significant gains (p=.000) producing a large effect size of .85. No reliability measures for this test were reported. (Table 1.)

Table 1. TRIM Teachers' Internal Content Test Analysis, Cycle 11, 2014

	Mean	N	Mean Dif	SD	SEM	t	df	Sig. (2-tailed)
Post %	73.359	33	15.5303	18.3189	3.1889	4.870	32	0.000*
Pre %	57.828	33						

An additional reminder to the project from its final report is in order. The external evaluation team does not analyze internal surveys that report on teacher perceptions or other feedback regarding the teachers' perceived quality of the professional development. These are for internal use and should be analyzed by the project to inform academic year offerings.

Students

No internal student test results were provided to the evaluators in a form that could be analyzed.

Pedagogy

No objective measure of inquiry was presented. Several self-report surveys were administered for internal evaluation but results discussed only generally.

External Evaluation

Teachers

Teachers were administered a pre/post content knowledge test on the first day of the summer session and on the last day of the follow up sessions in the spring of the academic year. The questions were released items from TIMMS, NAEP, PISA, and the Environmental Education group NAAEE. The test was submitted to two content experts to assure face, content, and construct validity. Chronbach's alpha for reliability for the pretest was .48 and posttest .63. These reliabilities are low for use in determining reliability results for individual people. They are lower than desired, but workable, for determining reliability of results for the group.

Item analysis shows that teachers still are weak in reading charts and graphs, and making and justifying decisions based on data. Teachers statewide in the elementary groups were weaker overall in mathematics than the high school teachers, as would be expected.

This is the third year evaluators have noticed weaknesses in reading graphic displays of information. With these types of displays in the popular media being more and more frequent, it would be helpful to both teachers and their students to emphasize this skill both in the science and mathematics-focused projects.

ITQG program teachers had no statistically significant gain pre to post. TRIM teachers had a pretest mean of 78% and posttest mean of 68%. Four TRIM teachers who took the pretest did not take the posttest. These four teachers had a mean average of 90% on the pretest and their absence on the posttest possibly contributed to the decline in means from pre to post test.

Teacher Observations

Two focus teachers from each project were selected and observed twice during the year. Because teachers could be identified from each project, results are reported in aggregate in the Technical Report.

Partnership/Sustainability

At the end of the project teachers were asked to name three people to whom they go for assistance in content and assistance in pedagogy. These results were analyzed through the use of UCINET Social Network Analysis (SNA) program. The resulting diagrams are helpful in determining networks within the project and assessing the strength of the support necessary for sustaining the project effort. Each node in the analysis represents one unique person. The number of participants may not represent the full cohort of participants due to lack of response or opting out of the evaluation. The development of networks across Cycles 9, 10 and 11 will be examined.

Colors and symbols have changed across the cycles but project teachers are always circles, teachers outside of the project are down triangles, project leadership are blue triangles, and administrators are squares. Other shapes represent family, other science or math professionals, such as other university faculty, the web, and non-profit professionals. Note the size and comprehensiveness of the networks at the end of each of the cycles.

TRIM had been working with teachers in this grade level for several years prior to Cycle 9. Their networks had been established and Figure 1 illustrates this network. New teachers entered the group in Cycles 10 (Figure 2) and they have not fully entered the TRIM network, with many still finding assistance in smaller groups or from other teachers within their schools. The end of Cycle 11 (Figure 3) illustrates a congealing of the network with only four teachers not directly within the network of TRIM teachers. TRIM's efforts to keep teachers connected electronically may be contributing to this large and tight network of teachers.

Figure 1. TRIM SNA Analysis for Project Teacher's Request for Assistance with Content at the End of Cycle 9, 2012

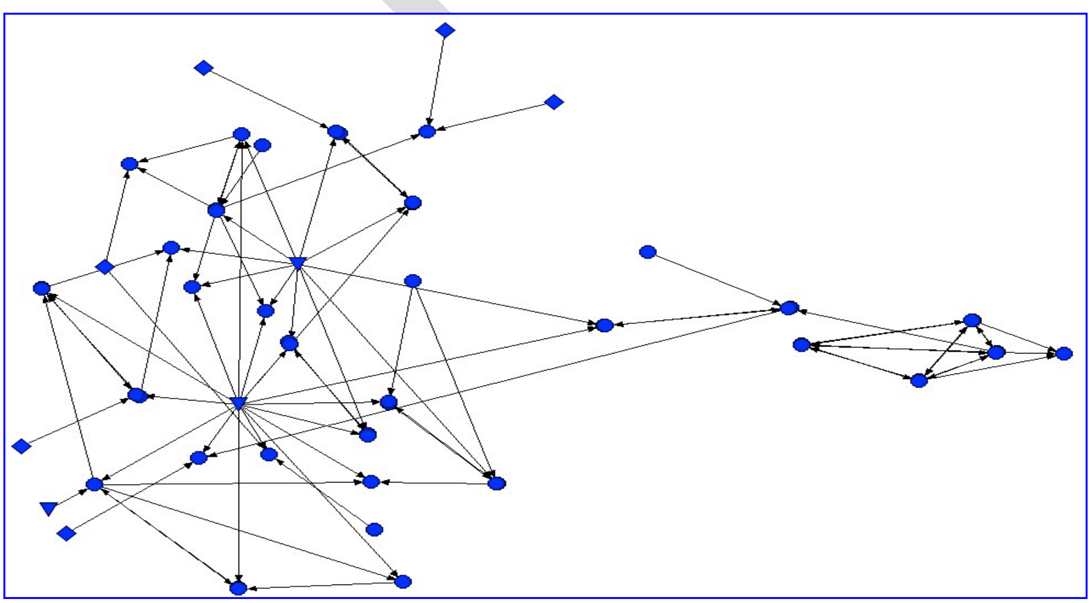


Figure 2. TRIM SNA Analysis for Project Teacher's Request for Assistance with Content at the End of Cycle 10, 2013

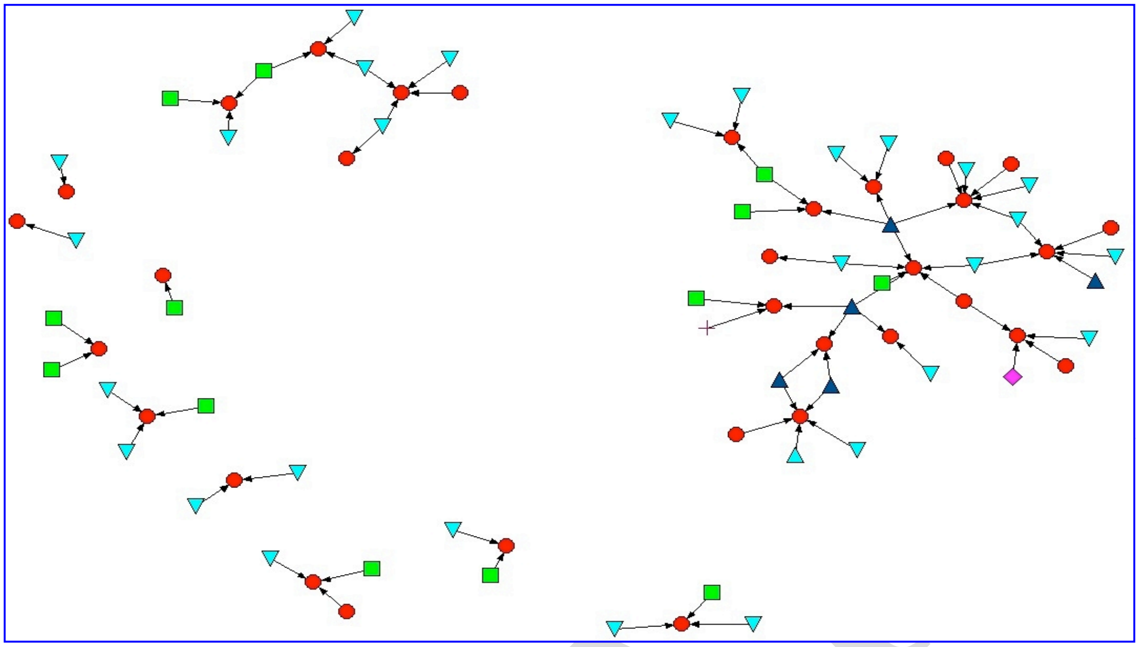
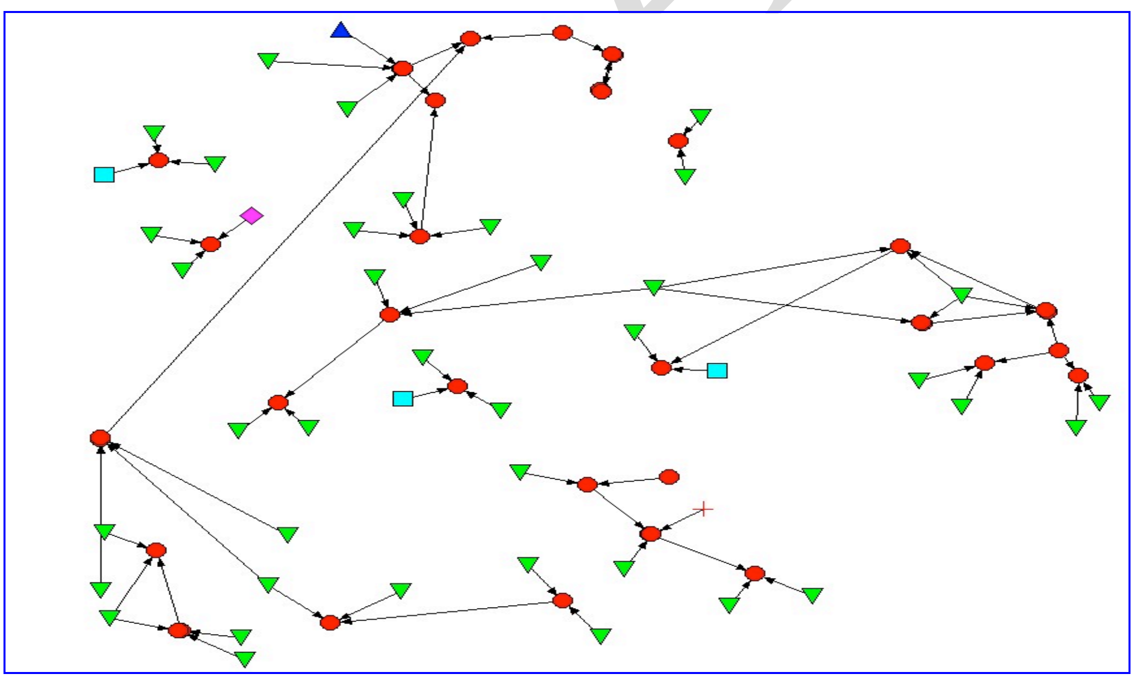


Figure 3. TRIM SNA Analysis for Project Teacher's Request for Assistance with Content at the End of Cycle 11, 2014



An examination of teachers' patterns when asking for assistance with pedagogy shows strong, intact networks for Cycles 9 and 10 (Figures 4 and 5). In Cycle 11 (Figure 6) the networks splinters with four teachers separated from other TRIM teachers, connected only to other classroom teachers or administrators. Work to bring these teachers back into the network will strengthen the possibility for sustainability of the work of the project.

Figure 4. TRIM SNA Analysis for Project Teacher's Request for Assistance with Pedagogy at the End of Cycle 9, 2012

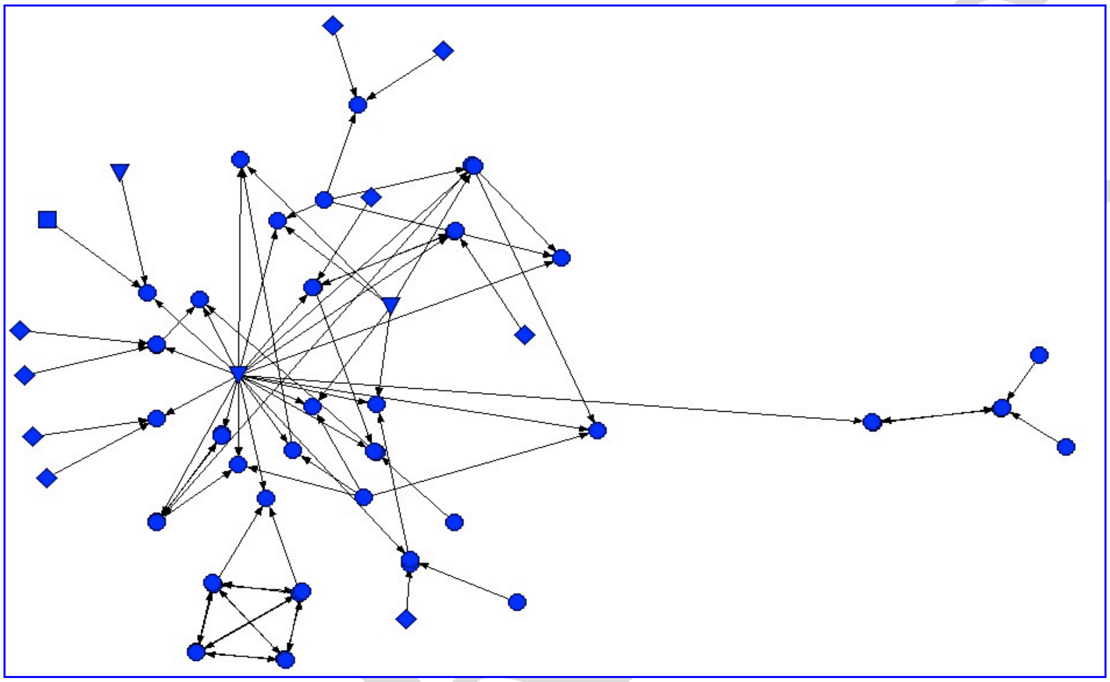


Figure 5. TRIM SNA Analysis for Project Teacher's Request for Assistance with Pedagogy at the End of Cycle 10, 2013

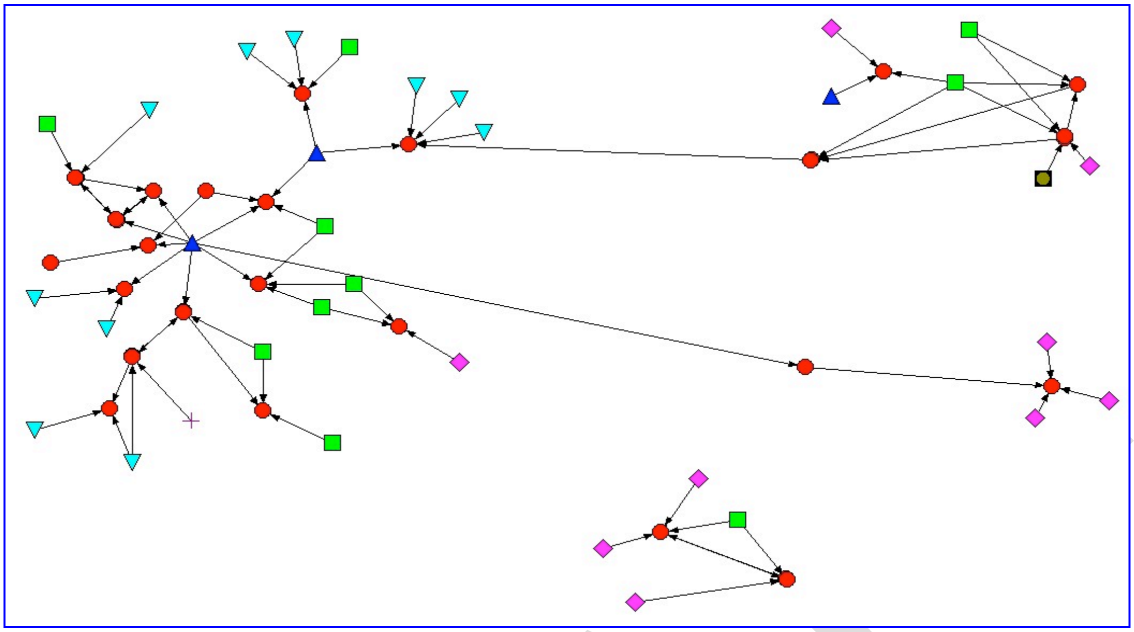
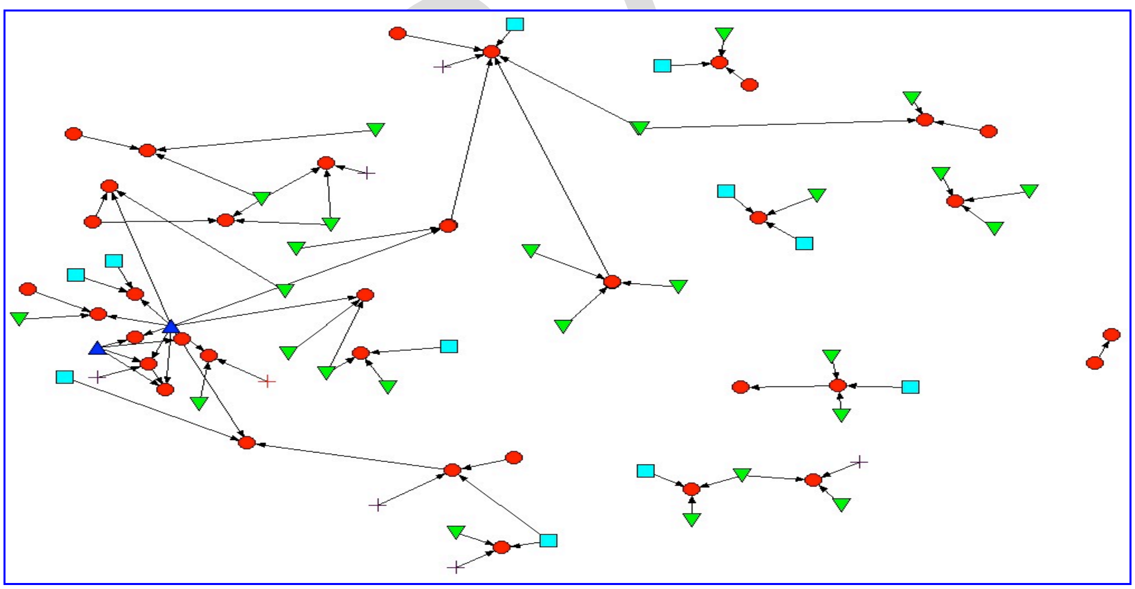


Figure 6. TRIM SNA Analysis for Project Teacher's Request for Assistance with Content at the End of Cycle 11, 2014



The evaluators appreciate the support and communication with project leadership and note the continued efforts on behalf of the leadership to raise the quality of both its technology programming and internal evaluation efforts.

M.A. HENRY CONSULTING, LLC

Early Elementary Environmental Education: A Field Based Approach (4E) Final External Evaluation Report Cycle 11 November 2014

Early Elementary Environmental Education: A Field Based Approach (4E) is an integrated mathematics and science project for teachers in grades K-4. It is located in south-central Missouri, headquartered at Missouri State University's main campus in Springfield and implemented largely at the university's West Plains campus. Four MSU staff were reported on the final report, supported by two graduate students who served in a logistical capacity. Evaluators had direct interactions with three of the faculty over the course of the cycle.

Partnering with the Rural Education Center and the Missouri Department of Conservation, the project offered in-depth environmental education resources to 36 teachers from 13 Missouri school districts, based on information used by the evaluators. The 4E project reported that participants attended an average of 80% of the possible 113.5 hours of professional development and follow-up activities. Implementation was conducted in a dedicated space that offered ample room for professional development activities, resources, and other needs.

Twenty-seven teachers completed both pre and post tests reflecting nine teachers who did not participate in the external evaluation. Losing one-fourth of the possible participants from the project evaluation requires that caution be taken in interpreting the project outcomes.

Internal Evaluation

Teachers

4E teachers were administered the DTAMS test to analyze content gains from pre to post and postpost tests. They showed no statistically significant gains at the $p<.05$ level either pre to post, post to postpost or pre to postpost administration (Table 1).

Table 1. DTAMS Results for Pre/Post/Post-Post Teacher Content Tests, Internal Evaluation, Cycle 11, 2014

		Mean	N	Mean Dif	SD	SEM	t	df	Sig. (2-tailed)
Pair 1	**Post %**	82.044	28	6.3492	17.8082	3.3654	1.887	27	0.070
	Pre %	75.694	28						
Pair 2	**Postpost %**	79.067	28	4.5794	17.3378	3.2765	0.787	27	0.438
	Pre %	76.488	28						
Pair 3	**PostPost %**	79.352	30	-3.9815	18.6650	3.4078	-1.168	29	0.252
	Post %	83.333	30						

The project administered additional tests and surveys on understanding the nature of science, the new environmental paradigm and attitude toward teaching science surveys. Results can be found in their internal report.

Student

Student scores by class were presented, along with copies of the individual tests. Several tests were administered by teachers at various grade levels. Similar tests and grades were combined for analysis. All grades showed statistically significant gains at the p=.000 level (Table 2).

Table 2. Internal Student Test Results for Pre/Post Content Tests by Grade and Test, Cycle 11, 2014

Subject	Grade	N	Pre %	Post %	Significance
Science (A)	K	32	52	96	0.000*
Science (B)	K	68	61	97	0.000*
Science	1/2	61	78	100	0.000*
Science	2	29	47	78	0.000*
Science (A)	3	48	56	82	0.000*
Science (B)	3	44	45	67	0.000*
Science	4	29	50	86	0.000*
Science	6	34	44	60	0.000*

*Statistically significant at the p=.000 level

Additional surveys were administered internally and are reported in their final project report.

External Evaluation

Teachers

Teachers were administered a pre/post content knowledge test early in the summer session and on the last day of the follow-up sessions in the spring of the academic year. The questions were released items from TIMMS, NAEP, PISA, and the Environmental Education group NAAEE. The test was submitted to two content experts to assure face, content, and construct validity. Chronbach's alpha for the pretest was .48 and posttest .63. These reliabilities are low for use in determining reliable results for individual people. They are lower than desired, but workable, for being confident of analysis results for the group.

Item analysis shows that teachers are still weak in reading charts and graphs and making and justifying decisions based on data. Teachers in the elementary groups were weaker overall in mathematics than the high school teachers, as would be expected.

Cycle 11 was the third year evaluators noticed weaknesses in reading graphic displays of information. With these types of displays in the popular media being more and more frequent, it would be helpful to both teachers and their students to emphasize this skill both in the science and mathematics-focused projects.

ITQG program teachers showed no statistically significant gain pre to post. 4E teachers had a pretest mean of 86% and posttest mean of 59%. Eight teachers who took the pretest did not take the posttest. Their pretest mean was 92%. The absence of one-fourth of the pretest takers with such a high pretest mean possibly contributed to the decline from pre to post test.

Teacher Pedagogy

Observations of two focus teachers across projects were conducted. Because of the low number of teachers per project and the possibility of identification of individual teachers, aggregate results across the entire program are reported in the Impact Report.

Partnership/Sustainability

At the end of the project, teachers were asked to name three people to whom they go for assistance in content and assistance in pedagogy. Results were analyzed through the use of UCINET Social Network Analysis (SNA) program. The resulting diagrams are helpful in determining networks within the project and assessing the strength of the support necessary for sustaining the project effort.

Each node in the analysis represents one unique person. The number of participants may not represent the full cohort of participants due to lack of response or opting out of the evaluation. The development of networks across Cycles 10 and 11 will be examined for the 4E project over its two years of funding.

Colors and symbols have changed across the cycles but project teachers are always circles, teachers outside of the project are down triangles, project leadership are blue triangles, and administrators are squares. Other shapes represent family, other science or math professionals, such as other university faculty, the web, and non-profit professionals. Note the size and comprehensiveness of the networks at the end of each of the cycles.

4E had been working with teachers in this grade level for one year prior to Cycle 11. Their networks had been established and Figure 1 illustrates this network. At the end of Cycle 10 a fairly strong network of project teachers had been established. Though several smaller groups can be seen only one teacher is not in touch with any other project teacher through a network. This teacher will be lacking any project support should the teacher need content assistance. In Cycle 11 the resulting network is even more fractured, with nine teachers having no direct contact with anyone else within the project, either another project teacher or project leader (Figure 2).

Figure 1. 4E SNA Analysis for Project Teacher's Request for Assistance with Content at the End of Cycle 10, 2013

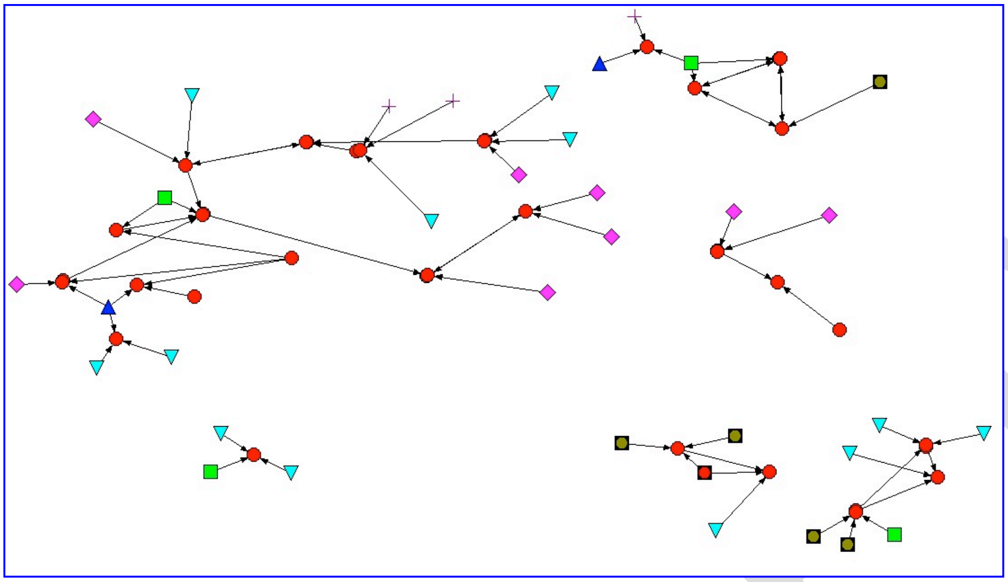
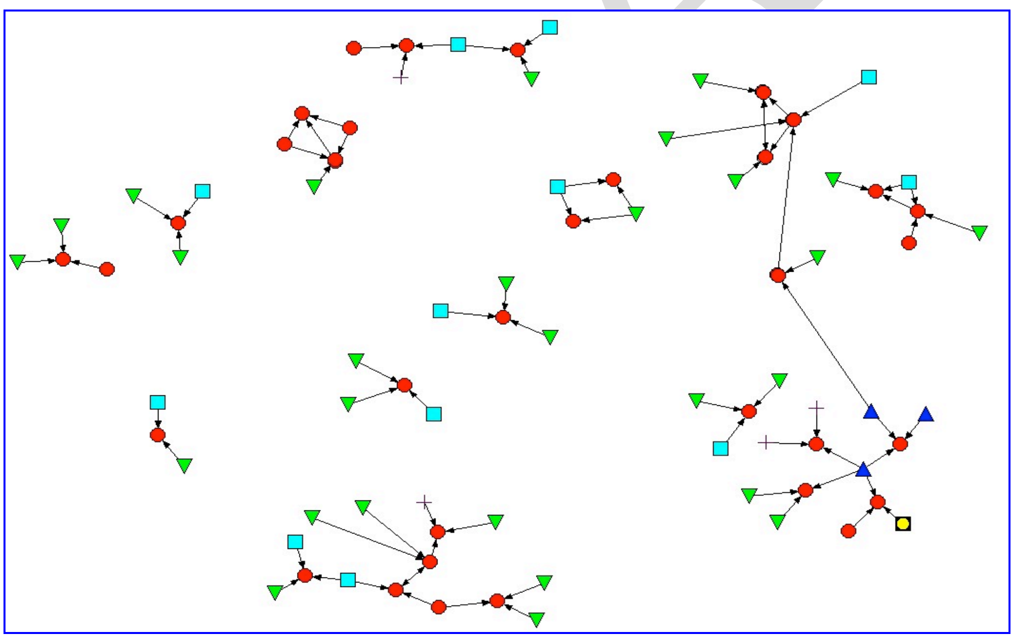


Figure 2. 4E SNA Analysis for Project Teacher's Request for Assistance with Content at the End of Cycle 11, 2014



When examining the SNAs for pedagogy assistance, the same pattern can be seen with a tighter network among the Cycle 10 teachers and a less-developed network in Cycle 11 (Figures 3 and 4). 4E serves several small school districts and this may be the pattern of smaller clusters observed in Cycle 11 (Figure 4). However, similar types of districts were observed in other projects and they have developed support networks through various methods among their participants. 4E could consider how they can provide the support to begin to have teachers talking with each other about content and pedagogy so as to maintain the work that has been begun in the project professional development.

Figure 3. 4E SNA Analysis for Project Teacher's Request for Assistance with Pedagogy at the End of Cycle 10, 2013

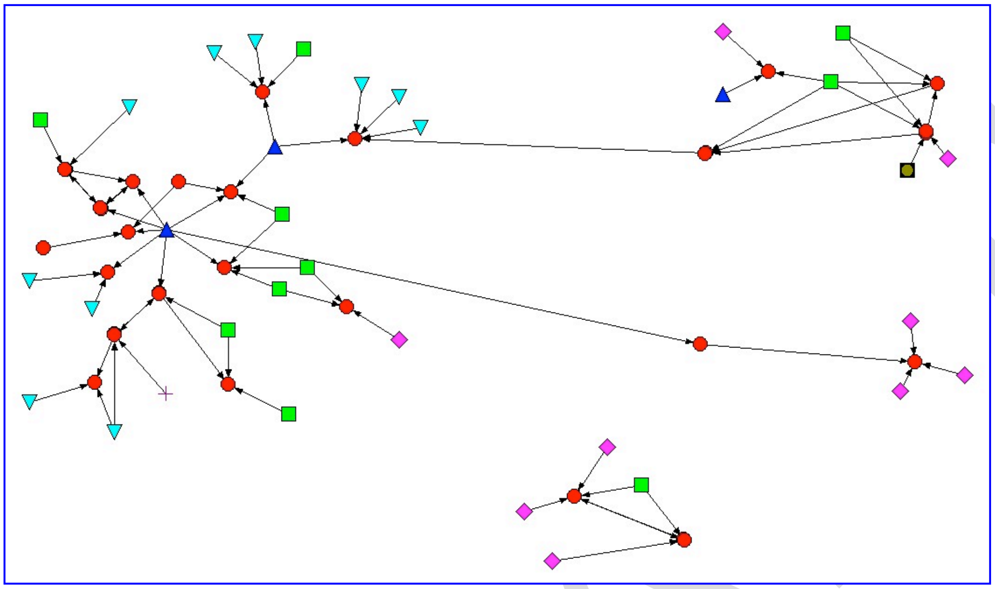
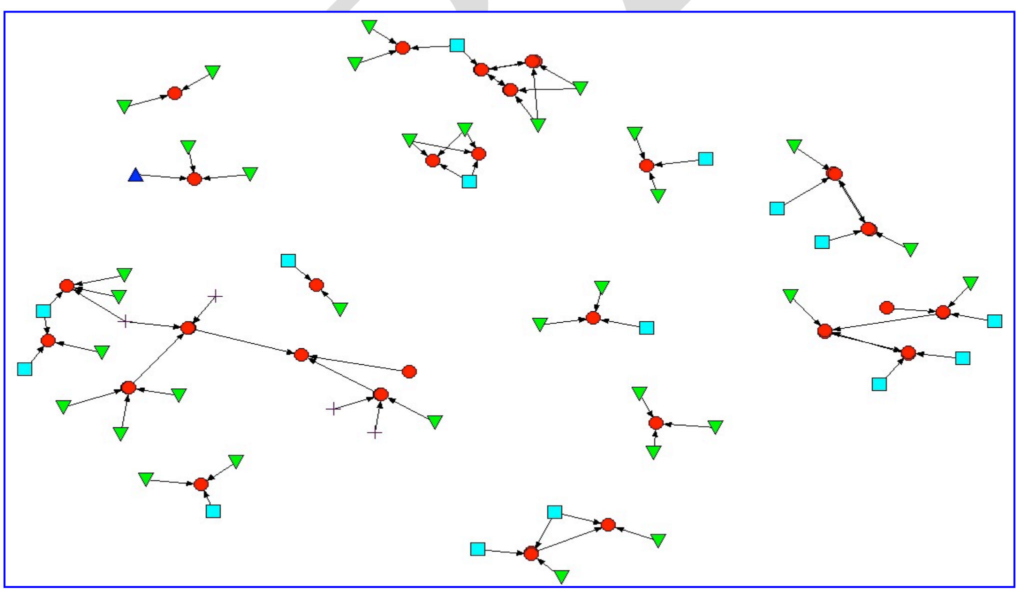


Figure 4. 4E SNA Analysis for Project Teacher's Request for Assistance with Pedagogy at the End of Cycle 11, 2014



The evaluators appreciate the support and communication with project leadership and note the continued efforts on behalf of the leadership to raise the quality of both its programming and internal evaluation efforts.