Sustainability Report
Inquiring Minds:

Reading to Learn and Innovate in Mathematics and Science

(IQ-MS)

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Contents

Introduction

Inquiring Minds: Reading to Learn and Innovate in Mathematics and Science, (IQ-MS), a 3-year research study developed by South Carolina's Coalition for Mathematics and Science (SCCMS) at Clemson University in partnership with S^{2}TEM Centers SC, was established in 2012. This research and innovation program aimed to identify and implement reading, writing and communication strategies that make science and mathematics more accessible to middle grade (6th-8th) students. IQ-MS focused on a 'disciplinary literacy' (DL) initiative, in direct response to national and state student achievement data, expert advisement and interest expressed by instructional leaders in South Carolina school districts.

The IQ-MS Theory of Change (Figure 1) below, the foundation upon which the study was based, hypothesized the path of influence for the intervention. Two questions drove the research and evaluation, and a variety of measures were employed to assess the impact of IQ-MS on teacher attitudes, understanding and practice, and on student achievement. The general conclusion for the three years of the study, documented in BSCS evaluation reports in 2013, 2014 and 2015, was that the program was exerting a positive impact upon teacher attitudes and practice, as well as on student achievement, in middle school mathematics and science.
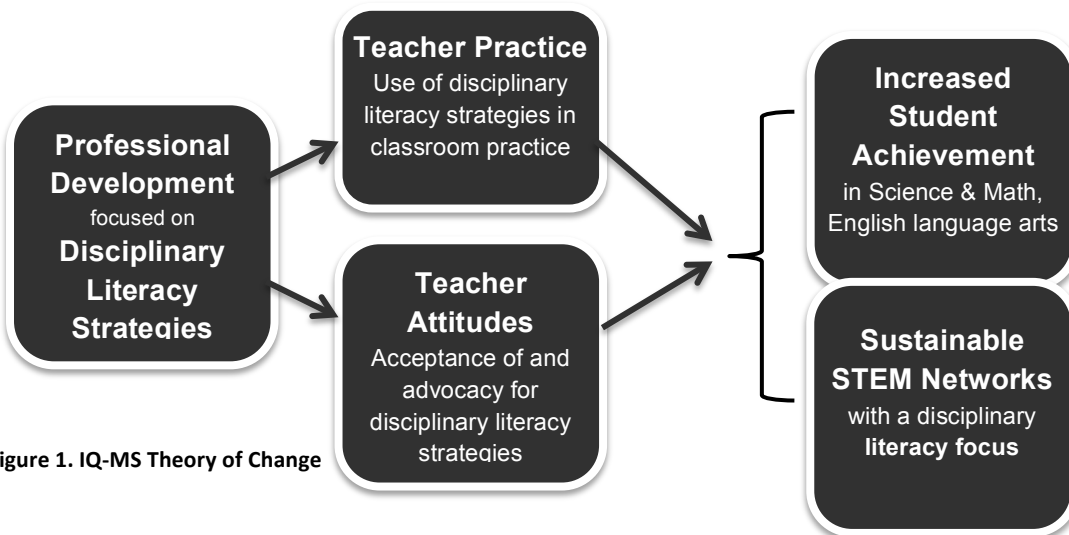

Figure 1. IQ-MS Theory of Change

Disciplinary Literacy, an advanced form of literacy, requires adolescent readers to have specific background knowledge about how to read purposefully, write in meaningful ways and engage in productive dialog in the disciplines - skills not often taught in English/Language Arts classes or the content area classes themselves. Disciplinary Literacy instruction engages learners with content in ways that mirror what scientists and mathematicians do to inquire and gain understanding in their disciplines. These abilities are essential to make sense of the complexities of science and mathematics. The intent of the project was thus to influence teachers to accept and practice disciplinary literacy strategies in their classrooms and then continue using these strategies following cessation of supported aspects of the program.

This report concludes the IQ-MS project study by investigating in more depth the final components of the Theory of Change, assessing sustainability of the STEM Networks with a disciplinary literacy focus aligned with data on student achievement in science, mathematics, and English language arts. First, we discuss the origins of IQ-MS, its evolution over three years

of research and evaluation, and then conclude with a discussion of sustainability and how IQ-MS measures up to the stated goals in the Theory of Change.

Background and Prior Data Collection

A total of twenty middle schools, ten treatment and ten control, in eighteen school districts of three South Carolina regions were included in the IQ-MS study. Professional development was delivered in two ways. First, a Summer Institute was convened each year through 2014, for all treatment school math and science teachers and administrators. Next, S²TEM Center staff IQ-MS Specialists supported treatment school mathematics and science teachers two days a week as instructional coaches for all three years of the program, concluding at the end of School Year 2014-2015. While on-site, specialists facilitated professional learning community (PLC) meetings around disciplinary literacy, modeled disciplinary literacy strategies in the classroom, co-taught lessons, and provided feedback and additional resources for incorporation of disciplinary literacy strategies into classrooms. Comparison schools were provided with three days of professional development on any topic of their choosing not related to disciplinary literacy. Their professional development took the form of on-site coaching or traditional workshop sessions.

An additional support for professional development that enriched the program for educators and ensured sustainability is the IQ-MS Virtual Library accessed at *http://www.s2temsc.org/disciplinary-literacy-virtual-library.html*. Developed over the course of the IQ-MS program through the S²TEM Centers SC, the open access resource library offers "promising practices, effective strategies, classroom lessons, and multimedia tools based on the Inquiring Minds: Reading to Learn and Innovate in Mathematics and Science (IQ-MS) research program."

The research aim of IQ-MS was to answer the following questions:

Question 1. *What effect does professional development focused on disciplinary literacy strategies have on the instructional practices of middle grade mathematics and science teachers?*

Question 2. *To what extent does the application of disciplinary literacy strategies in mathematics and science classrooms improve student achievement?*

Using a mixed-methods approach, the BSCS evaluation employed measures of teacher practice, teacher attitudes, and the South Carolina Palmetto Assessment of State Standards (PASS) student achievement to address the research questions. The summary report of 2015 presented comparative data and analysis that focused on the IQ-MS program's anticipated final stages of the IQ-MS:

1. To develop via iterative processes, a professional learning storyline for instructional improvement in mathematics and science through the application of disciplinary literacy strategies.
2. To develop a robust virtual library of vetted, disciplinary literacy resource materials for middle grade teachers.
3. To sustain and scale instructional innovation through regional networks of mentors and other champions for STEM education with a disciplinary literacy focus.

At the conclusion of the three-year IQ-MS research project, it was reported that

> *"evidence from multiple sources indicated that IQ-MS is a highly effective program positively impacting teacher practice and student learning in middle school mathematics and science classrooms."*

Triangulated data from the IQ-MS evaluation study revealed that most teachers participating in IQ-MS professional development strengthened their advocacy for and implementation of disciplinary literacy strategies. Through IQ-MS support of school-based Specialists, teachers demonstrated commitment to the tenets and instructional strategies of IQ-MS. Under the tutelage of the Specialists, many teachers developed their confidence and leadership skills as they extended their influence beyond school boundaries to share the IQ-MS program with educators in district, state and national venues. Finally, enriched by the comprehensive set of resources offered through the S²TEM Centers SC Virtual Library (*http://www.s2temsc.org/disciplinary-literacy-virtual-library.html*) IQ-MS was reported to be approaching the anticipated final innovation aim of "a functional community of support" for STEM education.

Data Sources and Methods

Foreshadowing Sustainability from Prior Data Collection
The 2015 evaluation report focused on the sustainability of Disciplinary Literacy strategy use in classrooms and the continuation of sustainable STEM networks through responses from participants to survey questions constructed by the IQ-MS leadership. The items targeted the sustainability of IQ-MS and the continuation of disciplinary literacy in schools through teachers' implementation, collaboration and outreach, specifically investigating continued **learning, sharing, and dissemination of program content and methods**.

Survey results for this section of the survey, reported in Tables 1-3 below, provided evidence for teachers' early commitment to continuing the program beyond the three years of the Specialists' on-site support. The majority of responses fell in the "strongly agree" and "agree" categories for every item, with the percentage of those in "strongly agree" increasing from Year 2 to Year 3. The only exception is for statement 6, "I regularly share my learning with others in the IQ-MS project through collaboration using Edmodo." Teacher interviews revealed that Edmodo was not commonly used for collaboration for several reasons including local technology issues, personal time constraints, or frustration with the inefficiency of the Edmodo program. In comparison, increases in agreement between years 2 and 3 for items 3 and 7 illustrate the rising popularity of the Virtual Library for learning and sharing, which, according to one interviewee, "exploded" over the final year. Responses to items 1 and 2 indicated strong agreement that video recording for collaborative discussions led by Specialists to facilitate implementation of DL strategies, a regular feature of the Specialists' on-site professional development program, was valued. Finally, the high number of responses in the 'strongly agree' and 'agree' categories attest to teachers' positive feelings about DL and their personal commitment to disseminate the IQ-MS work on disciplinary literacy.

Table 1. Frequency percentages for Sustainability items on Teacher Attitude Survey Years 2 and 3: Learning

		Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
Learning						
1. Analyzing video of my own teaching with my IQ-MS Specialist helps me implement Disciplinary Literacy strategies.	Year 3(n=26)	35.6	38.5	3.9	11.5	11.5
	Year 2(n=48)	16.3	40.8	22.5	20.4	0
2. Analyzing video of others' teaching with my colleagues and IQ-MS Specialist helps me implement Disciplinary Literacy strategies.	Year 3	30.8	38.5	15.4	7.7	7.7
	Year 2	16.3	49.0	22.5	12.2	0
3. I learn about successful practice with Disciplinary Literacy from others by viewing lessons in the IQ-MS Virtual Library.	Year 3	30.8	26.9	19.2	23.1	0
	Year 2	6.1	46.9	20.4	24.5	2.0
4. I regularly learn from others in the IQ-MS project through collaboration using Edmodo.	Year 3	11.5	26.9	19.2	34.6	7.7
	Year 2	10.4	35.4	10.4	37.5	6.3

Table 2. Frequency percentages for Sustainability items on Teacher Attitude Survey Years 2 and 3: Sharing

		Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
Sharing						
5. I share my learning about Disciplinary Literacy with others through Edmodo.	Year 3(n=26)	15.4	26.9	11.5	38.5	7.7
	Year 2(n=48)	8.3	33.3	18.8	33.3	6.3
6. I regularly share my learning with others in the IQ-MS project through collaboration using Edmodo.	Year 3	7.7	26.9	15.4	42.3	7.7
	Year 2	10.4	41.7	12.5	35.4	0
7. I share my successful practice with Disciplinary Literacy in my classroom by submitting video lessons for the IQ-MS Virtual Library.	Year 3	42.3	42.3	3.9	3.9	7.7
	Year 2	10.2	55.1	10.2	20.4	4.1
8. I share my learning about Disciplinary Literacy with others through school PLTs.	Year 3	38.5	46.2	3.9	11.5	0
	Year 2	2.1	8.3	12.5	58.3	18.8
9. I share my learning about Disciplinary Literacy with others in my district and region.	Year 3	34.6	50.0	0	15.4	0
	Year 2	4.3	17.0	4.3	57.4	17.0
10. I share my learning about Disciplinary Literacy with others at state and national conferences.	Year 3	26.9	30.8	7.7	30.8	3.9
	Year 2	10.6	44.7	14.9	21.3	8.5

Table 3. Frequency percentages for Sustainability items on Teacher Attitude Survey Years 2 and 3: Disseminating

		Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
Disseminating						
11. Disseminating the IQ-MS work on Disciplinary Literacy is important.	Year 3(n=26)	46.2	42.3	11.5	0	0
	Year 2(n=48)	24.5	53.1	22.4	0	0
12. My role in disseminating the IQ-MS work on Disciplinary Literacy is important.	Year 3	38.5	46.2	15.4	0	0
	Year 2	25.5	53.2	21.3	0	0

The Innovation - PD - Sustainability Link

As background, three previous evaluation reports of IQ-MS triangulated data from three measures of teacher attitudes and practice. First, the Levels of Use (LoU) Branching Interview Protocol (Loucks, Newlove & Hall, 1975; Hall, Dirksen & George, 2006) was conducted with a random sample of treatment school teachers at the conclusion of each school year. In addition, video tapes of classroom lessons were rated according to the Reformed Teacher Observation Protocol (RTOP) twice a year. Finally, the attitude survey mentioned above was administered annually to all IQ-MS educators.

Three factors gleaned from triangulation of the LoU interview, the RTOP observation and survey data were identified as critical factors for successful implementation of DL strategies:

A) The presence of on-site specialists through the duration of the 3-year project and the productive relationships built with the educators through on-going coaching and collaboration.

B) School administrators' management practices characterized by advocacy and actions that supported implementation of DL strategies in science and mathematics classrooms.

C) Local school contexts that included facilitating (or inhibiting) factors such as adoption of new curriculum standards, implementation of newly adopted curricula, presentation of competing or compatible professional development programs, and scheduled opportunities for educators to meet and collaborate.

Interestingly, the impact of these factors was evident from responses to the recent sustainability questions posed to the 17 teachers representing five IQ-MS treatment schools. The strength or weakness of these features appeared to impact implementation as well as account for differences in teachers' commitment to the use of DL strategies and their intent to continue in the future without direct support from IQ-MS personnel, i.e., sustainability of the DL strategies. Supporting this link of professional development to continued implementation of the innovation's instructional practices, Ragland (2015) identified elements of successful professional development which lead to sustainability. In her analysis of a program's sustained history teaching strategies over ten years, she points to professional development that established teachers' ability and willingness to accept theory-based change. Professional development that provides ongoing, long term, high quality experiences through sustained, discipline-specific interactions in collaborative communities was noted as essential for continued implementation of the practice. Finally, the "most important factor that led to sustained changes in teachers' core instructional practices was changing teachers' attitudes and beliefs about the efficacy of having a student centered classrooms were students are 'doing history' (Ragland, 2015, p. 634).

> *"Findings indicate that teachers' ability and willingness to continue a reform, to reflect on it, and to keep it a vital part of their classroom practices turns on a number of factors*

and conditions. Implementation is both assimilation and construction and must be anchored in general reform principles and concrete teaching contexts. The ongoing interaction of reform, learning, and context means that implementation is a process requiring ongoing invention." (Ragland, 2015, p. 616)

Thus, the key to sustainability of an educational innovation is an exemplary professional development program based on the effectiveness of the innovation. A study of a program's sustainability therefore must examine the interconnectedness of the professional development it provides with an eye to the many factors that contribute to or inhibit its continuation.

Investigating Sustainability
Building on these initial indications that sustainability of DL implementation was underway, the IQ-MS leadership and BSCS devised a process to more deeply study participants' intentions to continue with the intervention. Specialists constructed, administered, and recorded responses to a set of questions for a reflective conversational interview with IQ-MS teachers in their schools at the end of the 2015/2016 school year, the fourth year of IQ-MS. Nineteen teachers, 17 of whom agreed to meet later with the BSCS evaluator, were interviewed by specialists. The specialists then rated interviewees' 'buy-in' of IQ-MS principles and implementation on a scale of 1-5 from low to high based on responses to the interviews. Most teachers (14) were rated in the 'high' buy-in category (5). The others were distributed as: one 4, one 3, one 1.5, and two 1s (low buy-in). Next, the evaluator constructed an interview protocol to investigate participants'
1. views of their personal and professional growth,
2. perceived changes in their theories about learning,
3. self-assessments of their confidence in use of DL strategies, and
4. intent to continue implementing DL strategies.

The teachers were asked to respond to the questions and provide perceptions of the local school context. The follow-up interviews were conducted with 17 educators at 5 IQ-MS treatment schools during the week of 12-16 September.

In the following section, we frame the investigation of sustainability using Century, Cassata, Freeman, and Rudnick's (2012) multi-step procedure for measuring implementation, spread and sustainability of an educational innovation, a set of proposed categories, to be used as a "common conceptual organizer" to study features of sustained implementation of educational innovations. The major categories include a range of factors that impact "individual and organizational decisions to use, spread and sustain a program or practice in education." They are:
- Characteristics of the Innovation
- Characteristics of the Users
- Characteristics of the Organization
- Characteristics of the Environment
- Strategies

Findings

In this section, categories of the Century, Cassata et al., 2012 framework are linked to features of the IQ-MS innovation highlighted by illustrative comments from recent participant interviews. As the authors note, each category covers "a range of contexts and conditions that potentially influence implementation, spread and sustainability of innovations." At this point no judgement as to facilitating or inhibiting factors is made because many of the features occur simultaneously. However, the anecdotal references offer evidence of the impact of the features on implementation and sustainability of DL strategies.

Characteristics of the Innovation

In this category, an innovation is described in terms of complexity, specificity, adaptability, scope, empirical effectiveness and results demonstrability. Disciplinary Literacy instruction is intended to engage students in reading, writing and dialogue activities to develop their facility with mathematics and/or science content. This is accomplished through teachers' use of a variety of strategies that encourage students to reflect, share and construct understanding. The strategies vary in complexity, some being more labor intensive to teach and manage than others. The resulting flexibility allows teachers to adapt strategies to differing content, grade levels, learning types and classroom situations.

As noted earlier, Ragland's (2015) study of a 10-year sustained history teaching program stated that the most important factor that led to sustained changes in teachers' core instructional practices was changing teachers' attitudes and beliefs about the efficacy of having a student-centered classroom where students are "doing history" (p. 643).

In the final IQ-MS interviews, teachers expressed changes in their beliefs about teaching and learning as they developed expertise in managing the implementation of DL strategies. Illustrative comments detail the results of their changing to student-centered classrooms through the IQ-MS intervention:

> *"I used to be a traditional teacher but the strategies have opened my eyes. Kids need to be engaged. I saw the light! They are much more successful."*

> *"My classes are more student-driven which is more rewarding for me. After 28 years I stepped out of my comfort zone from a teacher-driven classroom. Students are more enthusiastic. I don't have as many administrative issues as when students were sitting but not getting it before. They were glazed over."*

> *"The strategies build on interacting and learning from each other. They find ways to demonstrate their learning and have heightened understanding."*

> *"Using strategies helps some kids be more successful than they might have been. They have to think to keep up like scientists to carry on."*

> *"The strategies opened doors for other students. They allow students to integrate curriculum, allow more options for students to solve problems."*

> *"Kids also learn life skills like collaboration and responsibility."*

> *"Learning in general has changed – no more lecturing, no more kids sitting in rows. There is a lot of self-paced work and collaboration. It is much more enjoyable."*

> *"I am more of a facilitator now. When the kids are brainstorming I step back to see where an idea is going. They have more well-rounded knowledge."*

Many of the interviewees noted that DL strategies were empirically effective because of changes in their students' standardized test scores. The increase in annual math or science scores was associated with their adoption of the more student-centered interactive strategies. Others were proud to report they had "the highest scores in the district." One teacher observed fluctuations in her classes' scores as she emphasized or de-emphasized the strategies over a three-year period.

Thus, the IQ-MS program appears to have changed or enhanced teachers' adoption of student-led classrooms that resulted in empirically or formally noted increases in students' depth of understanding of math and science concepts. As a set of adaptable tools the DL strategies provided teachers with flexibility to adjust interactive learning sessions for specificity, scope and complexity in mathematics and science classrooms.

Characteristics of Individual Users

This category encompasses attributes of users of the innovation including teachers, school leaders, and students. Perceptions, personal characteristics and demographics of school-based users are considered here. Leadership is also examined in terms of instructional leadership, personal support, innovation advocacy and innovativeness.

Of interest to this study is the variety of experience and diversity of backgrounds of the IQ-MS treatment school teachers (and their students) which seemed to have no impact on the positive outcome of the program. Some of the teachers were just beginning their careers when they came into IQ-MS. Others had one or two decades of classroom experience, and a few were transferring into math or science from other content areas. The new teachers were grateful for much needed local support while the experienced teachers displayed positive attitudes toward introduction of the new another instructional technique. The result was that all the teachers experienced personal and professional growth through their involvement in IQ-MS despite their initial doubts and feelings of being overwhelmed.

> *"I reexamined how I approached a lesson to enhance instruction, and my students improved yearly."*

> *"I am still a traditional teacher but I am more hands-on. It's not so much ME, it's more student directed."*

> *"I can reach children in a different way."*

> *"I learned new strategies to work with kids – it was 4 years well spent!"*

> *"It broadened my horizons."*

Teachers' interview responses also attested to intrinsic motivation to increase their repertoire of strategies. The IQ-MS organization provided multiple resources over the course of the program including a notebook of strategies for reading, writing and dialogue at the initial summer institute and additional reference books over the next three years. After seeing positive results from the strategies, many of the teachers continued to seek out additional interactive approaches to teaching as well as articles to introduce current events of interest in math and science classes. Some teachers return to the IQ-MS virtual library while others explore Google, Pinterest, or

other websites or request ideas from colleagues. The continual search for additional DL strategies points to sustainability.

This category also includes the instructional leadership, support, innovation, advocacy, and innovativeness. In the final IQ-MS evaluation report school leadership was noted as a strong influence in the success of IQ-MS. An administrator from every treatment school attended the Summer Institutes. Then, where local administrative support of the initiative was strong, the advocacy led to introduction of DL strategies in faculty meetings and professional development efforts, often by IQ-MS teachers themselves. Time was allocated for grade level meetings and content area team meetings in which teachers could share their experiences with DL strategies in their classrooms. In one school, what might be considered competing initiatives were combined to incorporate DL into a teacher development program across the curriculum. Finally, administrative support for IQ-MS teachers to present their expertise with DL at local, district and national conferences empowered educators and enhanced dissemination of literacy strategies. Thus, school leaders contributed to the strength and durability of the IQ-MS intervention. Teachers commented:

> *"(admin) offered grade level in-services during our planning periods."*

> *"(admin) gave us resources."*

Characteristics of the Organization
This category highlights the structure and people of the organization, including their ability to innovate, collaboration, communication, shared beliefs and values, resource allocation, and presence of opportunities for learning inside the organization. From the beginning, South Carolina's Coalition for Mathematics and Science (SCCMS) at Clemson University in partnership with S^2TEM Centers SC assembled a group of motivated educators to plan and execute the IQ-MS research project. The group members were well versed in educational research literature. Many had been involved in a previous iCoaching project and honed their skills in coaching and supporting teachers. Collaboration and cooperation characterized their planning. Out of this grew the IQ-MS implementation plan based on established qualities of effective professional development – on-going, hands-on, content specific support to ensure success of an innovation.

After the first Summer Institute in 2012, Specialists were assigned to the treatment schools, offering on-site support at least two days a week. As described in previous evaluation reports, the Specialists served as trusted mentors to encourage and support teachers. Their responsibilities included planning, observing, coaching, coordinating, mentoring, modeling, and training. Over the course of the IQ-MS program, Specialists intentionally inspired teachers' independence by steadily removing supports and encouraging their differentiated implementation of strategies, planning and development of lessons for the Virtual Library, and designing and conducting professional development sessions at local, district, state, and national conferences. Teachers expressed gratitude for the continuing support of the school-based Specialists and freely consulted with them in efforts to improve their competence in DL strategy implementation related to their students' mathematics and science achievement.

Specialist support was clearly the most important element of IQ-MS. In the final interviews, teachers were asked about the strongest elements in the school that positively influenced implementation of DL strategies. Most of the responses centered on the support of the Specialist.

"She was motivational and complimentary; she was singing my praises and could see I was trying."

"She was understanding, gave me the right amount of help."

"She was instrumental in smoothing out the right edges, she was always there, my go-to girl."

"She would remind me that I was using strategies, that they had become second nature."

"She found strategies to help me as a teacher to help kids grow."

"She was constantly patting me on the back, saying 'You've been doing it!'"

"She did observations for extra support, helped me plan with new strategies."

It is notable that the most effective Specialist support mentioned in the interviews came from those specialists whose presence was regular and with whom strong trusting relationships were constructed. In schools where there was a change in Specialists or where visits were not as regular, teachers did not express the same appreciation and incidentally were not rated as high in 'buy-in' as those at other schools. Instead, they suggested that the positive influences on their implementation of DL strategies was provided by colleagues.

Strategies
Components of this category include "actions taken by the organization that pertain to implementation and spread of the innovation" (Century, Cassata, Freeman, and Rudnick, 2012). As mentioned earlier, the IQ-MS intervention was carefully planned and constructed. The combination of introductory Summer Institutes and close on-site support ensured that the DL strategies were understood, implemented and developed into the teachers' routine over the course of the project. In addition, a scaffolded model was in place to slowly withdraw the Specialists' support and promote teachers' self-directed actions in locating, using, adapting, and sharing appropriate literacy strategies with colleagues. Dissemination was promoted through the development of a Virtual Library containing lesson plans, videos of participating teachers demonstrating DL strategies and additional reference material for all teachers. In at least one school, diffusion of the strategies was greatly enhanced by combining them with the TAP initiative. Thus, all teachers in the school began focusing on the strategies to increase effectiveness of instruction. Again, presentations at school, district, and state conferences increased visibility and contributed to dissemination.

Elements of the Environment
Included in this category are descriptions of the political environment, community beliefs and values, characteristics of the community, network structures and visibility. As mentioned above, we note that the presence or absence of outside directives, expectations, or restrictions can impact the success level of implementation of the initiative. The 2015 evaluation report stated, "teachers, Specialists, and administrators often noted that new curricula such as the Digits math program, changing state standards, the presence of the SC TAP (System for Student and Teacher Advancement) program, and introduction of new standardized testing have affected teachers' work by adding new requirements for performance." Thus, time was an issue for those who desire to seek, learn, and perfect the use of DL strategies in the classroom. Thoughtful teachers see congruencies between and among the 3 entities, but often DL strategies, Common Core standards, and the Digits curriculum are regarded as separate requirements that increase instructional burden on teachers. Additionally, depending on local context, the TAP/DL interface can either be an instructional impediment or an advantage for science and math educators. In

some cases, the stringent demands of TAP placed additional demands on teachers' time and may have negatively impacted opportunities for planning and implementing DL strategies. This year one teacher explained that a district-based rotational model for math classes impacted the use of DL strategies because parts of the rotation included independent, self-paced groups and collaborative groups had to practice strategies on their own while the teacher monitored all three groups. In contrast, another teacher from what she described as a "poor school district" succinctly stated, "We have no challenges to implementing DL strategies. We have more freedom because there were no mandated new programs."

Conclusion

As the focus of this report, a program's sustainability is closely linked to the innovation, the professional development provided to introduce and support it, along with the ensuing nature of the implementation itself. Using Century, Cassata, Freeman and Rudnick's (2012) framework to measuring implementation, spread and sustainability, we can formulate a picture of the factors that combine to influence success, and endurance, of the IQ-MS project. At each site, the elements of each factor combined in different ways to create a climate more or less likely to foster sustainability of DL strategies. However, based on the interview results, sustainability of IQ-MS is assured albeit at varying levels.

All seventeen teachers interviewed at the conclusion of the IQ-MS project expressed their intent to continue employing the strategies in their classrooms. Due to the characteristics of the innovation as adaptable and results oriented, and to the strength of the research-based, long term and supportive professional development model, teachers' levels of use had progressed from mechanical use to routine, refinement, integration and renewal over three years of the innovation. Disciplinary literacy strategies have become second nature for teaching and learning, and teachers noted the results in students' deeper understanding and retention of science and math concepts as well as their more positive views about learning.

When questioned about their personal goals for continued use of DL strategies, teachers' comments illustrate the ways in which DL has been personalized and applied to enhance their students' learning:

> "I will always use them. We have proven evidence in the test scores that kids are engaged."

> "I will continue to use them. There is no turning back."

> "I will continue with what I've done to this point. My goal is to have kids communicate about math because they benefit."

> "I am not gonna let anything drop. It is part of our planning. We can't throw out something that works – it can help any kid at all grade levels."

> "My goal is to have my classes be more student-driven so I will continue to use them. We need more reading, writing and talking. Read Rite Remember!"

> "My goal is to share DL strategies with others on my team. I will be an ambassador for the strategies."

> "I will go back to the binder and try some of the strategies again."

"I will do more independent research on strategies."

"We will be incorporating the strategies into the new initiative of Problem Based Learning in our school."

"The strategies are an integral part of my teaching – I have no problem utilizing them and I'm gonna continue."

"I will use them forever. They are useful for students in today's world."

In most schools, DL techniques have already spread from math and science to other content areas as teachers are exposed to them in local school professional development sessions, through grade level team planning, and through presentations at local, district and national conferences. The strong appeal and correlated results of instructional techniques that engage students in constructing their learning and incorporate current STEM knowledge and life skills cannot be denied.

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