APPENDIX B

FINDINGS ABOUT THE QUALITY OF CLASSROOM INSTRUCTION

THE QUALITY OF CLASSROOM INSTRUCTION

Introduction

ARSI deliberately promotes a vision of teaching and learning that is in line with the NCTM math standards and the NRC science standards. This vision involves rigorous content, multiple approaches, a high dose of inquiry, student-centered learning, a chance for teachers to interrogate student thinking, and a chance for students to communicate with each other. The question that arises, then, is to what extent has ARSI been able to identify, support and move instruction in this direction? That is, to what extent and in what ways has ARSI reached the classroom?

In considering these questions, we kept several things in mind. First, ARSI's primary focus is not on classrooms but on building the capacity of districts and the leadership within districts so that they can understand, initiate, and sustain reform themselves. Second, ARSI is a fairly "thin" initiative. That is, in comparison to a Local Systemic Change (LSC) initiative (which provides $3,000 and 100 hours of professional development for each teacher in a district) ARSI is quite a small investment. The funds it provides primarily make it possible for Teacher Partners to attend professional development sessions, to reflect on their own teaching, to learn more about science, math and technology reform and to share what they learn with their colleagues. In fact, by design, the Teacher Partner does not initially have a great deal of time and/or permission to work intensively with a significant number of teachers. Third, ARSI has only been a presence in Appalachian districts for three years or less. For all these reasons it seems reasonable that it may take some time before the influence of ARSI "trickles down" into many classrooms.

For our observations, we asked Teacher Partners to identify what we came to call "ARSI classrooms." These classrooms were defined as those where: 1) the teaching is beginning to reflect the national standards and the qualities of teaching and learning that ARSI is promoting; and 2) where the teacher has been "influenced" by ARSI (i.e., attended ARSI professional development offerings, spent time working one-on-one with the Teacher Partner, used the Teacher Partner as a resource in some way, etc). In the most general sense, an ARSI classroom is one where ARSI had created a supportive context within which the teacher has learned from and been influenced by ARSI.

A Description of the Protocol

In conducting the classroom observations that were a part of this study, researchers used an observation protocol developed by Horizon Research Institute, Inc. (HRI). The protocol was designed specifically for use in the NSF-funded Local Systemic Change (LSC) districts. It is important to note that the protocol is designed specifically to measure the extent to which classroom practice reflects the vision of math, science and technology instruction laid out in the national standards documents.[1] The protocol, in particular, emphasizes inquiry, standards-based content, and an equitable and student-centered classroom culture. Using this protocol, researchers note the number of students, the classroom's resources and the focus of the lesson, and then rate the lesson's design, its implementation and content and the overall culture of the classroom. Researchers also make summary judgments about the lesson's likelihood of contributing to student understanding of and interest in the discipline, and an overall rating is given.

The Horizon protocol gives high ratings only to those classrooms that are sound in the content they are teaching, that promote an inquiry-based approach, that value student thinking, that are inclusive and supportive of all students in the classroom, and that seek to make lessons relevant to today's culture and students' interests. (The rating scale ranges from 1 to 5 with 1 being the lowest and 5 being the highest.) Level 1 observations are characterized as "ineffective instruction" - exemplified either by a predominance of "passive learning" or "activity for activity's sake;" Level 2 lessons show "elements of effective instruction;" Level 3 classrooms are taught by teachers whose practice is showing the "beginning stages of effective instruction" (and can be distinguished by a "low," "solid" or "high" rating); Level 4 lessons are "accomplished;" and Level 5 instruction is "exemplary."

[1] National Council of Teachers of Mathematics (NCTM), Commission on Teaching Standards for School Mathematics: *Professional Standards for Teaching Mathematics* (1991). Reston, VA; and National Research Council (NRC): *National Science Education Standards* (1996). National Academy Press, Washington, DC.

From the HRI Protocol: Capsule Description of the Quality of the Lesson

Level 1: Ineffective Instruction
There is little or no evidence of student thinking or engagement with important ideas of science / mathematics. Instruction is *unlikely* to enhance students' understanding of the discipline or to develop their capacity to successfully "do" science / mathematics. Lesson was characterized by either:

- Passive Learning: Instruction is pedantic and uninspiring. Students are passive recipients of information from the teacher or textbook; material is presented in a way that is inaccessible to many students.

- Activity for Activity's Sake: Students are involved in hands-on activities or other individual or group work, but it appears to be activity for activity's sake. Lesson lacks a clear sense of purpose and / or a clear link to conceptual development.

Level 2: Elements of Effective Instruction
Instruction contains some elements of effective practice, but there are *substantial problems* in the design, implementation, content, and / or appropriateness for many students in the class. For example, the content may lack importance and / or appropriateness; instruction may not successfully address the difficulties that many students are experiencing; etc. Overall, the lesson is *quite limited* in its likelihood to enhance students' understanding of the discipline or to develop their capacity to successfully "do" science / mathematics.

Level 3: Beginning Stages of Effective Instruction
Instruction is purposeful and characterized by quite a few elements of effective practice. Students are, at times, engaged in meaningful work, but there are *some weaknesses* in the design, implementation, or content of instruction. For example, the teacher may short-circuit a planned exploration by telling students what they "should have found," instruction may not adequately address the needs of a number of students; or the classroom culture may limit the accessibility or effectiveness of the lesson. Overall, the lesson is *somewhat limited* in its likelihood to enhance students' understanding of the discipline or to develop their capacity to successfully "do" science / mathematics.

Level 4: Accomplished, Effective Instruction
Instruction is purposeful and engaging for most students. Students actively participate in meaningful work (e.g., investigations, teacher presentations, discussions with each other or the teacher, reading). The lesson is well designed and the teacher implements it well, but adaptation of content or pedagogy in response to student needs and interests is limited. Instruction is *quite likely* to enhance most students' understanding of the discipline and to develop their capacity to successfully "do" science / mathematics.

Level 5: Exemplary Instruction
Instruction is purposeful and all students are highly engaged most or all of the time in meaningful work (e.g., investigations, teacher presentations, discussions with each other or the teacher, reading). The lesson is well-designed and artfully implemented, with flexibility and responsiveness to student needs and interests. Instruction is *highly likely* to enhance most students' understanding of the discipline and to develop their capacity to successfully "do" science / mathematics.

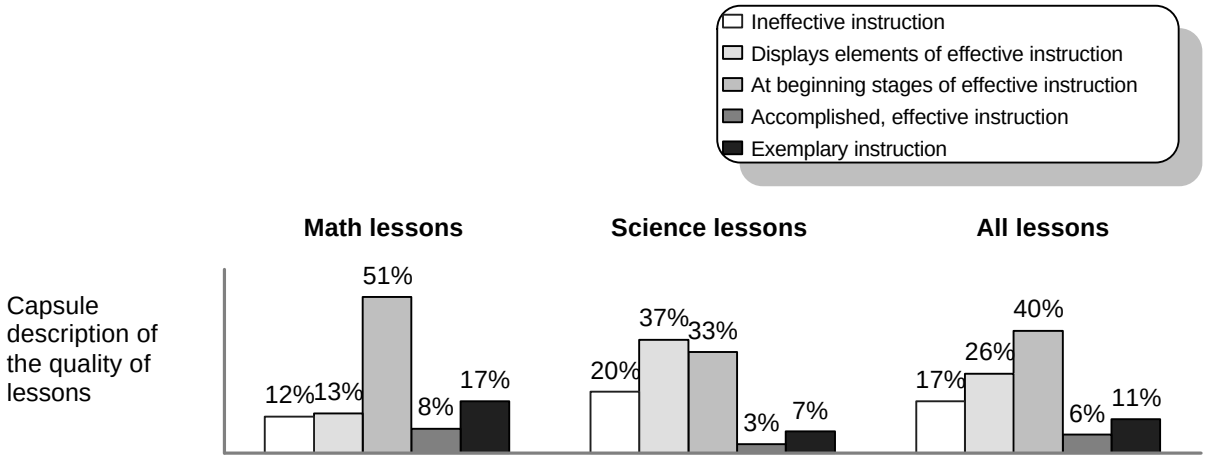
Findings About the Quality of Classroom Instruction

We observed 54 classroom lessons (30 science, 24 math) in six districts. In what follows, we present a summary of our data that will give the reader an overall picture of the quality of math and science teaching and learning in ARSI classrooms. We have included data and observations on the overall quality of the lesson; the design, implementation and content of lessons observed; and the culture of the classrooms observed. We also have included data summaries that illustrate the likely impact of ARSI lessons on students.

Overall, the most common lesson we saw (40%) was rated a 3 – at the beginning stages of effective instruction. These were classrooms where teachers were beginning to use cooperative learning, beginning to have student-centered instruction, and perhaps beginning to use a curriculum more in line with standards-based practices. Eleven percent of the teaching we saw displayed "exemplary instruction" (i.e., at the highest rating of 5). These teachers were doing wonderful lessons and were well supported by ARSI. It is also important to point out that 43% of the classrooms we visited were still below the beginning stages of effective instruction (rated with a 1 or a 2) and 17% of these lessons were very weak (rated with a 1).

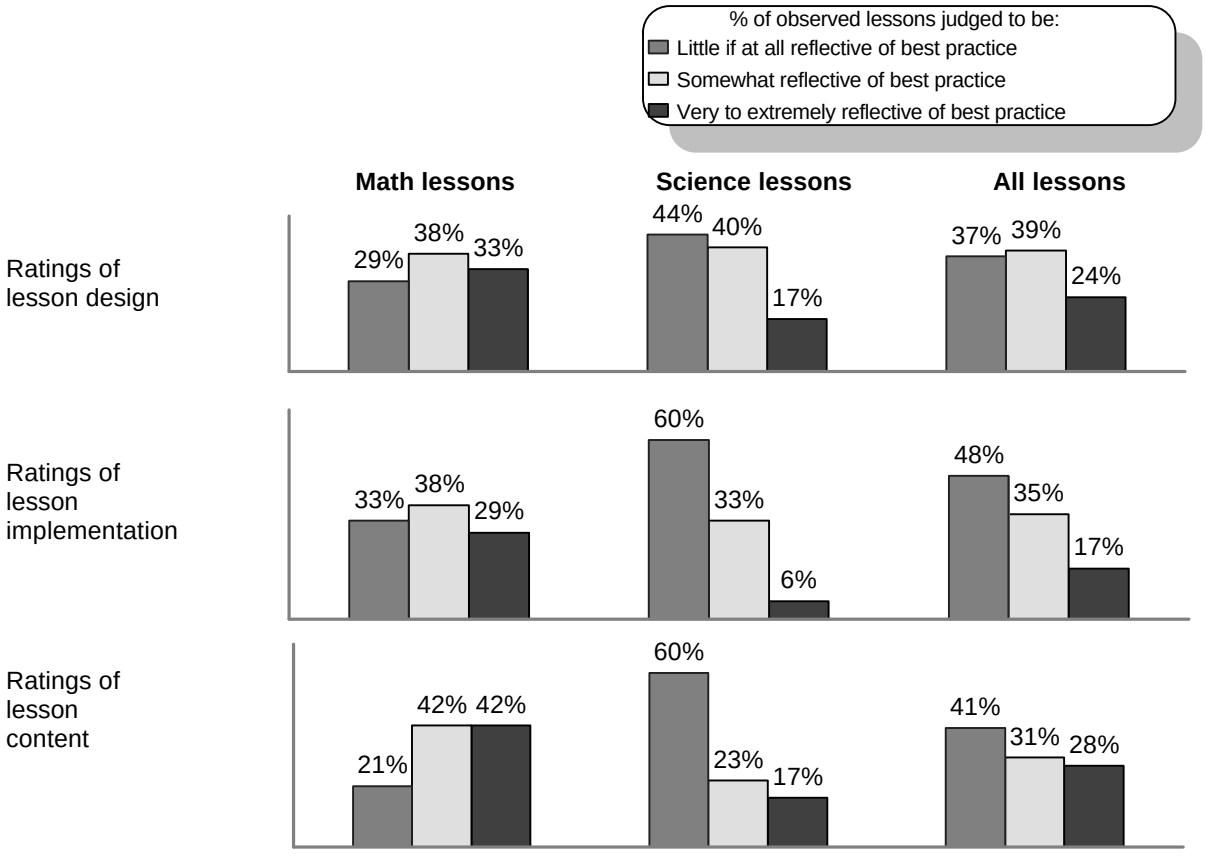
In general, our findings reveal that good instruction does not run deep or wide and that there is still plenty of work to be done on the classroom level. However, knowing that the districts we were in are faced with challenging circumstances, we were impressed that there were so many visible examples of good teaching and encouraged to know that these teachers are being recognized and supported by ARSI. Our findings show that there are good teachers who are beginning to use ideas that are supported by and come from ARSI in their classrooms.

FIGURE 1. CAPSULE RATINGS OF OVERALL LESSON QUALITY



A total of 54 lessons were observed (24 in math and 30 in science). Ratings are based on a five-point scale where "1" = "ineffective instruction," "3" = "beginning stages of effective instruction" and "5" = "exemplary instruction."

FIGURE 2. RATINGS OF THE DESIGN, IMPLEMENTATION AND CONTENT OF OBSERVED LESSONS



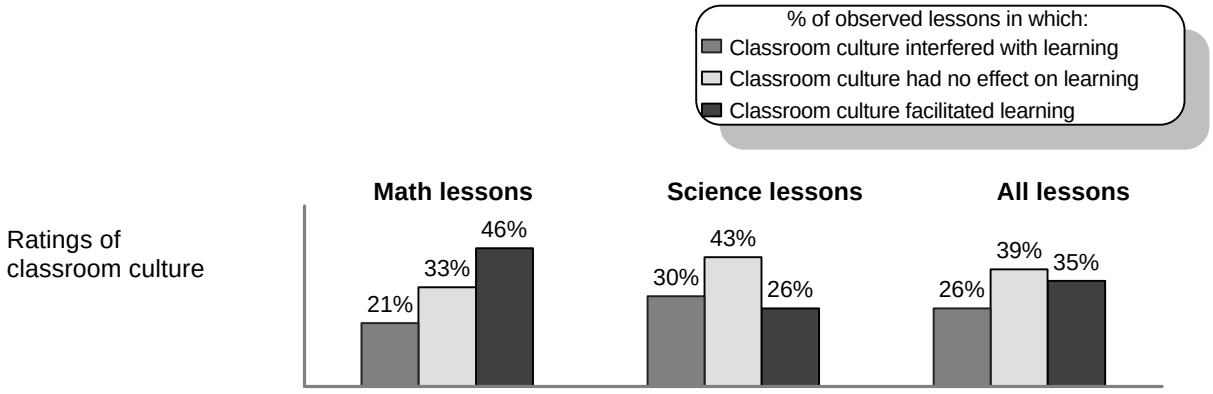
A total of 54 lessons were observed (24 in math and 30 in science). Ratings are based on a five point scale where "1" = "not at all reflective of best practice" and "5" = "extremely reflective of best practice."

Overall, in the classrooms we observed, lesson content came closer to reflecting best practice than either design and implementation.

Across almost all of the dimensions of the protocol, math lessons were farther along in reflecting best practices than the science lessons. We have several ideas as to why the math lessons we observed were rated more highly than the science. One is that mathematics lessons, in general, revolve around problem solving, so it is much easier, even with traditional teaching, to have lessons that lean more towards the classroom practice espoused in the national standards in mathematics than in science. Secondly, as we discussed earlier, there is a lack of

good curricula being used in these districts, particularly in science, so the lessons we observed were generally lessons teachers have invented with the support of some ARSI professional development experiences, as opposed to the effect of well-implemented, high-quality curriculum.

FIGURE 3. RATINGS OF THE EFFECT OF CLASSROOM CULTURE ON STUDENT LEARNING

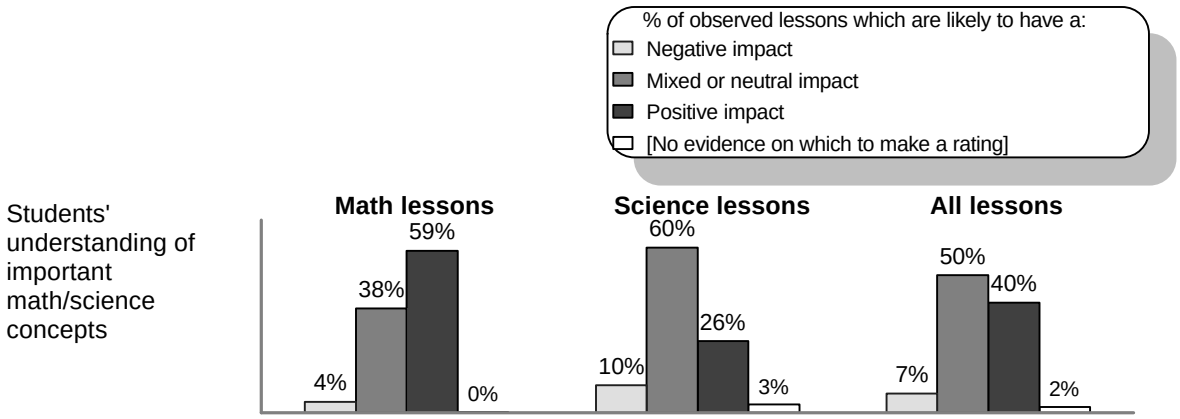


A total of 54 lessons were observed (24 in math and 30 in science). Ratings are based on a five-point scale where "1" = "not at all reflective of best practice" and "5" = "extremely reflective of best practice."

Disturbingly, one quarter of the lessons we observed were rated as having a classroom culture that interfered with learning. These were classes that suffered from teachers with inadequate training and/or a fundamental inability to relate to students well.

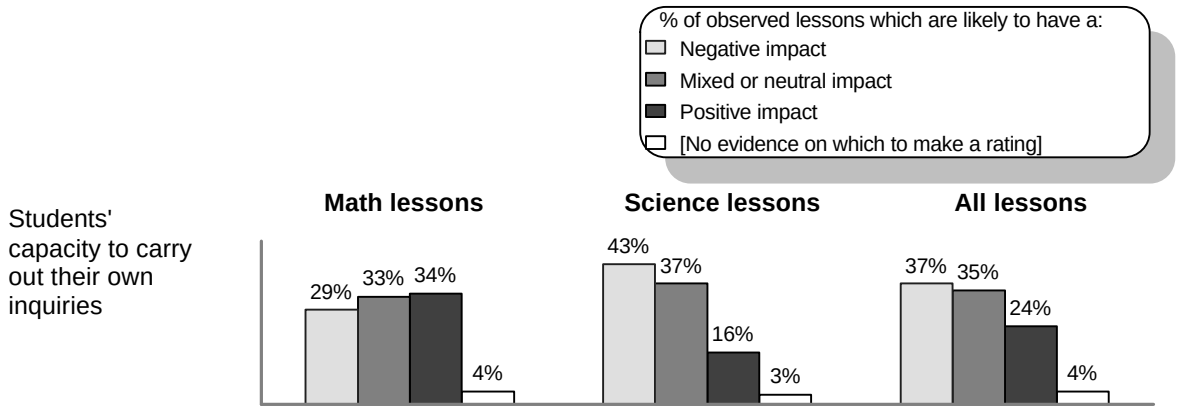
More positively, almost half of the math lessons we observed had a classroom culture that facilitated learning. The math lessons we observed were stronger than the science lessons along this dimension.

FIGURE 4. RATINGS OF THE EFFECT OF STUDENTS' UNDERSTANDING OF THE IMPORTANT CONCEPTS OF MATHEMATICS AND SCIENCE



Almost half of the lessons we observed were rated as having a positive impact on students' understanding of important math and science concepts. Again, the math lessons we observed were rated much more highly than the science lessons. However, few lessons we observed were viewed as having a negative impact on students' understanding of important concepts.

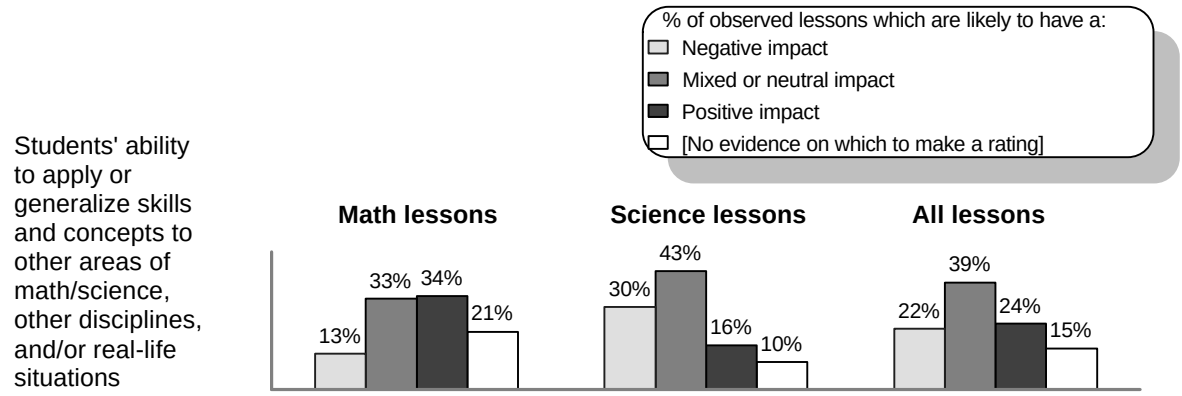
FIGURE 5. RATINGS OF THE EFFECT OF STUDENTS' CAPACITY TO CARRY OUT THEIR OWN INQUIRIES



While the language of inquiry-based instruction may be beginning to infiltrate the districts, the classroom practice is still more traditional in nature, even in those classrooms where ARSI feels it has had the greatest influence. In addition, forty-three percent of science lessons were viewed as having a negative impact on students' capacities to conduct their own inquiries. These were lessons that were either chaotic in nature, or involved teachers engaged didactically in imparting vocabulary and facts to students.

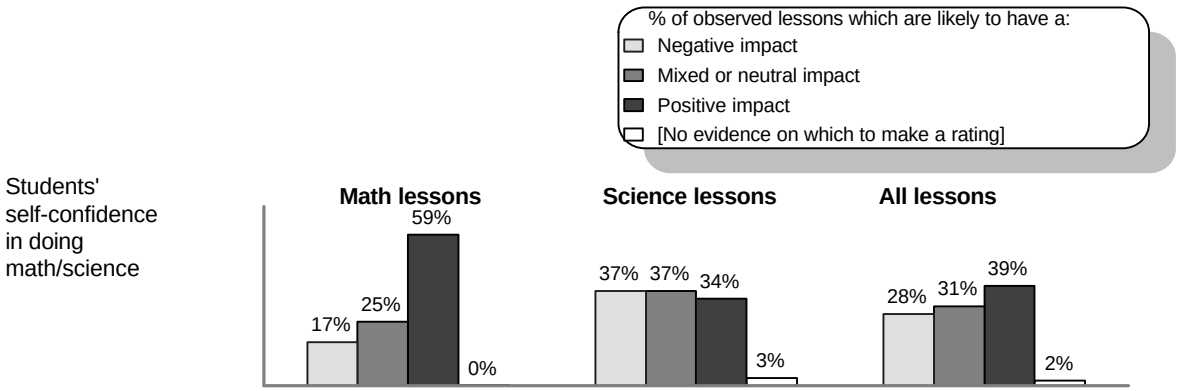
Overall, however, almost one quarter of all the lessons we observed were viewed as having a positive impact on students' abilities to carry out their own inquiries.

FIGURE 6. RATINGS OF THE EFFECT OF STUDENTS' ABILITY TO APPLY OR GENERALIZE SKILLS AND CONCEPTS TO OTHER AREAS OF MATH, SCIENCE, OTHER DISIPLINES, AND / OR REAL-LIFE SITUATIONS



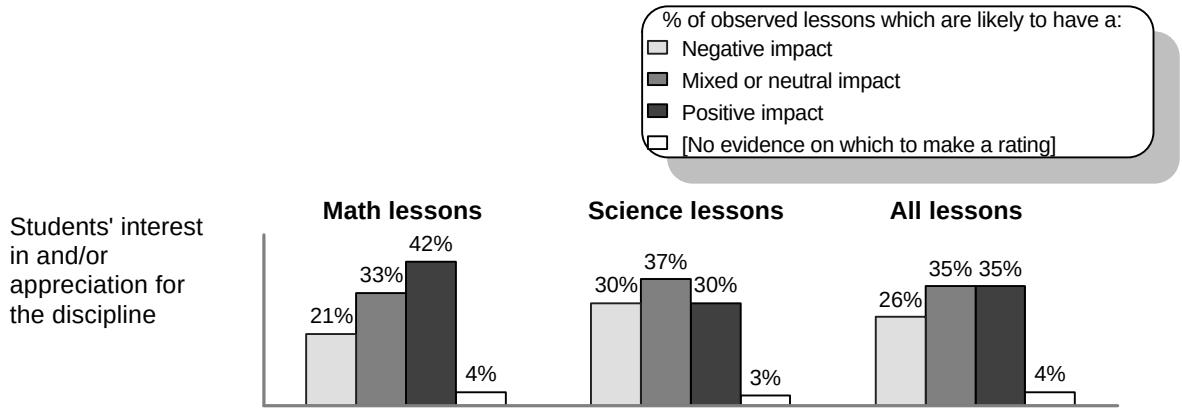
Almost one-quarter of the lessons we observed were rated as having a positive impact on students' abilities to generalize skills and concepts to other areas, disciplines and real-life situations. Notably, 34% of the math lessons were viewed as positive in this respect.

FIGURE 7. RATINGS OF STUDENTS' SELF-CONFIDENCE IN DOING MATH AND SCIENCE



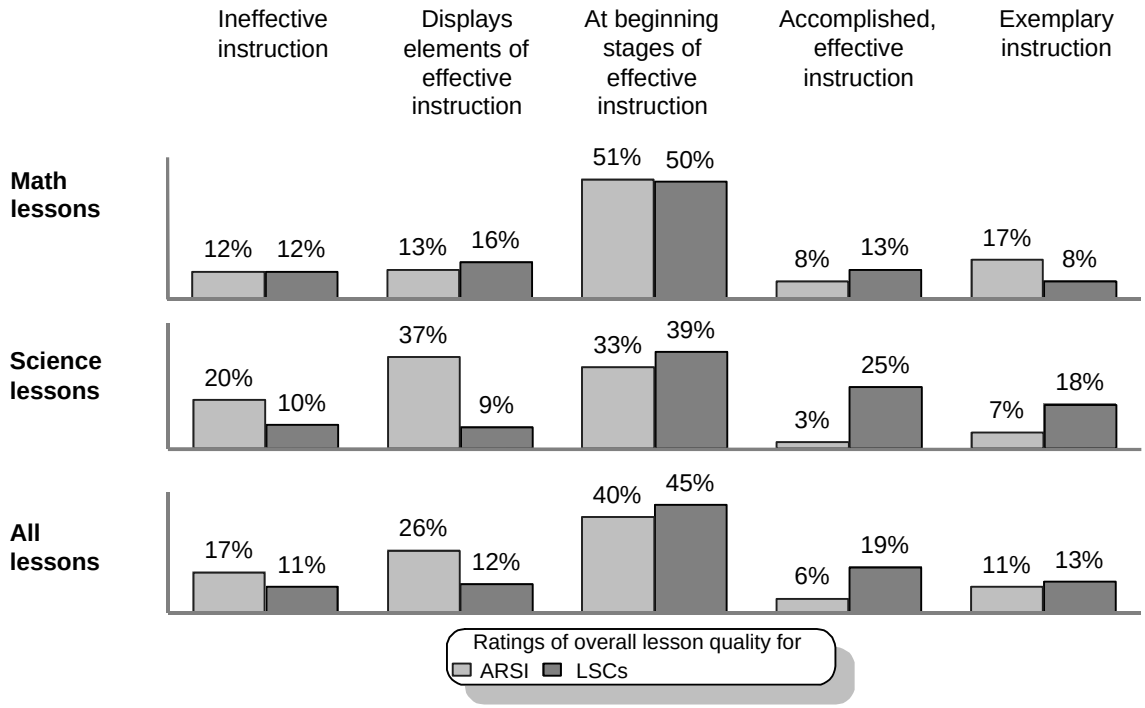
Nearly 40% of all the lessons we observed were rated as having a positive impact on students' self-confidence in doing math and science. Notably, 59% of the math lessons were viewed as having a positive impact, while almost equal percentages of the science lessons were viewed as negative, mixed and positive.

FIGURE 8. RATINGS OF STUDENT'S INTEREST IN AND / OR APPRECIATION FOR THE DISCIPLINE



About one-third of the lessons we observed were viewed as having a positive impact on students' interest in and appreciation for math and science. Again, a larger percentage of the mathematics lessons were rated as having a positive impact than the science lessons.

FIGURE 9. COMPARISON OF THE OVERALL QUALITY OF LESSONS FOR ARSI AND LSC DISTRICTS



A total of 204 LSC lessons presented by "non-lead" teachers were observed (102 K-8 science lessons, 52 elementary mathematics lessons, and middle and high school lessons. For science we only have K-8 data for comparison.) Ratings are based on a five-point scale where "1" = "ineffective instruction," 3 = "beginning stages of effective instruction" and "5" = "exemplary instruction."

To get a sense of how the ARSI classrooms were doing vis-à-vis other reform efforts we compared our observations to the national sample of classrooms that are observed as part of the evaluation of the LSC initiative. This is meant only to be a rough comparison and is intended merely to provide some comparative frame of reference for judging the quality of the ARSI classrooms.

Overall, the ARSI classrooms we observed are comparable to the ratings for LSC classrooms. Again, it is important to remember that the ARSI classrooms we were directed to were more “best case” classrooms, while the LSC classrooms were selected randomly. Thus, the best classrooms that ARSI guided us to were rated just slightly below the randomly selected classrooms in LSC districts. This is quite positive given the fact that the nature of the ARSI investment in these districts is quite different, and much less aimed at the classroom level, than the investments made in LSC districts.

Thus, ARSI, even though it has been aimed primarily at the professional development of lead teachers in these districts, has had a positive impact on the overall lesson quality and the nature of teaching and learning, in the "ARSI" classrooms. Also, these ratings indicate that we saw some teaching, either because of ARSI or supported by ARSI, that is beginning to be standards-based. Moreover, because ARSI directed us to these classrooms, these ratings indicate that ARSI leaders may well themselves be developing into more critical connoisseurs of standards-based teaching as well.