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# Developing Teacher Leaders in Math and Science: Content Coaches Mentoring Teacher Leaders

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**Introduction**

The AMSTI (Alabama Math Science Technology Initiative)-USA Fellows program, a collaboration between a university College of Education and Arts & Sciences, State Department of Education, and local school district, was created to develop *Teacher Leaders in AMSTI Mathematics and Science*. The specific focus of this research was to examine the mentoring provided to the Teacher Leaders Fellows, and to determine if the professional development provided to the teacher leaders helped them develop mentoring skills to mentor and coach the AMSTI teachers with whom they worked. At the completion of their Fellowship, these AMSTI-USA Fellows returned to become teacher leaders at their home schools, charged with mentoring and coaching teachers in the AMSTI curriculum.

The objectives of this research was to evaluate the effectiveness of:

(1) mentoring the newly identified teacher leader Fellows into the role of teacher leader; and,

(2) developing the mentoring and coaching skills in both the affective components and content aspects of the selected AMSTI Teacher Leader Fellows.

**Perspective**

*Role of the Instructional Coach*

In the last five years, the role of the instructional coach has become more prevalent in p-12 public schools (Steiner & Kowal, 2007). During this time period, instructional coaching has developed into a highly recognized, systematic practice (Gibson, 2005). Traditional professional development workshops have been scrutinized as many show little correlation with improving student achievement and changing teacher practices. Theories suggest that learners need the opportunity to collaborate with peers and apply new strategies with the guidance of an expert (Lockwood, McCombs, and Marsh 2010). The purpose of the instructional coach is to create a learning atmosphere for teachers effective in promoting change. The coaches serve as catalysts to improve instructional practices and, ultimately, student learning (Steiner & Kowal, 2007).

Administrators and teachers alike are contented to have a non-evaluative person who offers help and support in their schools (Makibbin and Sprague, 1997). Though not a standard model or definition for an instructional coach, most spend a significant amount of time working with teachers by modeling lessons, making specific observations of individual teaching practices, and providing supportive feedback. In essence, they use their expertise and knowledge to empower teachers. (Gallucci, DeVoogt Van Lare, Yoon, & Boatright, 2010). As instructional coaching is also becoming more prevalent in secondary schools, many lead organizations for secondary schools such as the

International Reading Association, National Council of Teachers of English, Mathematics, Science, and Social Studies have developed standards for middle and high school coaches (International Reading Association, 2006). These standards are in the areas of: skillful collaborators, job-embedded coaches, skillful evaluators of literacy needs, and skillful instructional strategists in the content areas.

Due to the relatively new opportunities for coaching to occur beyond the realm of literacy, it is imperative for professional development for coaches to be a systematic part of the role.  In some districts, this is a built in part of the instructional coaches pathway (Steiner & Kowal, 2007). However, often times, instructional coaches find themselves in isolated roles, with few strategic opportunities designed to support them (Burkins & Ritchie, 2007). Many feel the need for additional training in their role as an instructional coach (Makibbin & Sprague, 1997). It then becomes the responsibility of the coach to seek out their own means of professional development, or neglect their own professional learning altogether.

Expert teachers cannot be expected to take on the role of an instructional coach independently. Relying on pedagogical expertise and classroom experience are not enough to fulfill this dynamic role; it is likely that coaches will experience challenges that require professional development to move forward (Gibson, 2005). Instructional coaches should be viewed as learners. It is essential that they be given the opportunity to participate in professional learning and collaborate with other instructional coaches; this type of support system is essential for growth (Gallucci & et al., 2010).

A Coach-to-Coach model was one way researchers sought to implement job-embedded (Joyce & Showers, 2002) professional learning for coaches (Burkins & Ritchie, 2007). Layer one begins with the instructional coach being identified as highly effective classroom teachers. Though this is necessary, it is not a sufficient as a coach also must know and understand the subject matter of coaching adults. In layer two, the instructional coach must gain ownership of educational change, adult education, learning styles, professional learning communities, relationship building, and communication among other things. Finally, and in addition to the previous two layers, an instructional coach must be able to offer support and be supported by other coaches. In using the key players of a guest coach, home coach, and classroom teacher, the model was found promising for literacy coaches who are seeking to promote their own professional development.

Though some studies appear inconclusive (Reeves, 2007), another study about the implementation of instructional coaches in a high school in Oregon shows that scores in reading have improved in the two years since the implementing the instructional coach model (Barton, 2006). Moreover, researchers indicate that coaching can affect student learning on a larger scale; such as building school leadership, and enhancing school climate (Lockwood, Sloan, & Marsh 2010). In addition, teachers were more likely to make changes in the classroom while being coached, and teachers continued to implement these practices after the coaching ended. Similarly, another study on literacy coaches revealed that teachers altered their teaching philosophy by creating student- centered curriculum. The teachers valued the help they received from their coach and felt good about the changes they made in their classroom. As a result, their students became better readers (Stephens & Vanderburg, 2010).

*A Word on Mentoring*

New coaches are expected to assume the same job responsibilities as skilled coaches who have years of experience, with little assistance or guidance during their first year of coaching. Novice

instructional coaches must address the challenges of a new school culture, cope with the emotional ups and downs associated with a new work experience, meet high expectations of the school and the community, and master all the new knowledge that must be acquired about policies and practices of the school district, while transitioning from working with students to working with adults.

Though little research exists on providing quality mentoring for new instructional coaches, it can be postulated that some of the research on new teacher mentoring can be transferred to mentoring new coaches. Therefore, a quality-mentoring program, with quality mentors, can help new coaches face these *daily* challenges in a manner that promotes success. Well-planned mentoring programs must be included as part of the *daily life* of a new coach. It must be founded on common goals, and build in time for observation, conferencing, and reflection (Bell & Thomas, 2007; Normore, & Loughry, 2006). A recent study by Giebelhaus and Bowman (2002) suggested that mentor teachers (coaches) who receive specific training before working as advisors to novice teachers may have greater success in impacting their growth, development, and success when compared to mentors who received no formal training. Also, several reports have indicated that highly qualified mentors may be associated with an increase in student achievement, improved student behavior, and greater teacher enthusiasm (White & Mason, 2003).

As much of the research centers around instructional coaching in the areas of literacy, it became apparent that coaches were needed in the areas of math and science as well. However, it was essential to the design of the AMSTI Fellows program, that coaching and mentoring of these new coaches be central to the development of these Specialists.

**The Program**

The main design feature of the program was to mentor and train high performing elementary AMSTI teachers for one year as AMSTI Specialists in the math and science curriculum, then insert them back into their home school as Teacher Leaders. This design feature of the program is supported by research on professional development as it recognizes the positive effect and the essential role of teachers leading teachers (Stein, Smith & Silver, 1999).

Through the mentoring of experienced AMSTI Specialist and USA trained mentors, the experience was designed to allow the Teacher Leader Fellows the opportunity to gain insight into the comprehensive, interconnectedness of K-5 education and how education is intended to function. The knowledge gained purportedly would be invaluable to the AMSTI-USA Fellows' service to other schools during their Fellowship in preparation for their transitioning back into their schools as teachers and Teacher Leaders.

In order to achieve the goal of systematically improving mathematics and science education in Alabama, teachers must continue to receive support and mentoring so as to enable them to strengthen their skills and knowledge and positively reinforce previous training. Research on systemic reform (Butler-Kahle, 1999; NSF, 1996; Porter et al., 2002; Wells, et al., 1995) indicates that the school is a basic unit of change within a district and in relation to the broader context of statewide improvement. Teachers at a school (crucial mass estimates 80%) must believe that the proposed changes are beneficial for students and they must believe that they are prepared and capable to implement those changes (Putnam & Borko, 2000).

In transforming schools, there is a direct correlation to the support and mentorship that teachers' receive during the academic year. However, mentors must receive the professional development in mentoring they need to be successful, and if in a new role of mentor, they themselves need to be involved in the mentoring process for true implementation of a full cycle mentoring program.

**Method**

This research involved examining three aspects: 1) the day to day mentoring that the Teacher Leaders received in their new positions, 2) the mentoring and coaching professional development program the Teacher Leaders completed to equip them to mentor the teachers they coached, 3) and the mentoring and professional development in the content areas of math and science received by the Teacher Leaders.

*Mentoring of the Teacher Leaders*

There were multiple components to the mentoring of the Teacher Leader Fellows. First, they were partnered with experienced AMSTI Specialists on a daily basis for the first 9 weeks of the program. They shadowed the Specialists for the first four weeks of the fall semester; then moved toward team-based practices the next five weeks. The experienced Specialists answered questions, explained processes, and engaged in general mentoring of the role of a Teacher Leader with the new fellow(s) in both the affective components of being in a new position and in the content of AMSTI.

The remainder of the academic year, each Teacher Leader Fellow was assigned to three AMSTI schools. Their assigned mentor was available to them via phone conversations and email on a daily basis. In addition, every Friday for half of the day, the Fellows met individually with their mentors and with the 14 AMSTI specialists and the AMSTI project director to discuss triumphs and challenges that occurred during the week. They also used Fridays to engage in professional development in coaching and mentoring.

*Mentoring and Coaching Professional Development Received by the Teacher Leader Fellows*

On a daily basis, the Fellows were primarily engaged in mentoring, demonstration lessons, and working with professional learning teams in AMSTI schools. In order to be effective in the role of a mentor and coach, the Teacher Leader Fellows engaged in Friday seminars focusing on key elements of their daily activities. University Faculty, experienced AMSTI Specialists, and outside consultants conducted these seminars. Topics of the seminars included:

- Mentoring: Relationship building

- Mentoring: Dispositions of Teacher Leaders

- Mentoring: Dispositions of teachers

- The coaching cycle and its relationship to mentoring

- Data driven coaching

- Mentoring and coaching the resistant teacher

- Mentoring and coaching in science

- Mentoring and coaching in math

- Mentoring and coaching through professional learning teams

- Attending Ed Trust: A leading national authority on effective strategies for increasing student achievement in high need hard to staff schools.

**Data sources**

**Qualitative Data**

*Mentoring of the Teacher Leader Fellows*

The mentoring provided to the Fellows was evaluated through a content analysis of the mentoring activities reported by the Fellows through weekly journals.

In addition, focus groups with the principal investigators were held quarterly to obtain feedback from the Fellows regarding the level of mentoring and support they were receiving. A narrative analysis was conducted to identify those mentoring elements of the program that were effective and to determine common areas of concern.

*Mentoring and Coaching Professional Development*

The Teacher Leader Fellows reported their perceived usefulness of the mentoring professional development sessions, specifically related to implementation in mentoring and coaching, through a survey containing both rating scales and open-ended questions.

At the end of the year the teachers and administrators at the target schools were asked to evaluate the success of the interactions that the Fellows had with them. The teachers completed a 10 question survey with a likert type scale, with an additional opportunity for a free response. The administrators met with the principal investigators in a focus group session.

*Evaluation of AMSTI Implementation and Student Performance*

To determine if the overall impact of providing additional Teacher Leader Fellows in AMSTI schools to coach and mentor AMSTI teachers was beneficial, the level of implementation and student achievement scores in mathematics and science were examined.

**Results**

*Journals and Focus Groups of Fellows*

After conducting a constant comparative analysis, patterns of emphasis emerged in the Fellows journals and in the focus groups. One such theme was the positive mentoring the Fellows felt from the university partners. Another theme was the difficulty the Fellows felt in being part of the culture of the existing AMSTI specialist when they were in whole group settings, countered by the positive mentoring experiences reported when they were working individually with their mentor AMSTI Specialist.

Another central theme was the challenges the Fellows faced when trying to mentor and coach the

AMSTI curriculum in their assigned schools. They frequently reported on the impact of the school principal, and relied on the daily mentoring of their assigned Mentor Specialist.

*Survey of Fellows*

A survey of the Fellows containing both ratings scales and open-ended questions that asked them about the training they received and their activities in the schools. Overall they were satisfied with the training they received, and all of the Fellows indicated that they had improved their knowledge of inquiry-based learning and instruction. A theme that was apparent throughout their replies was that they really felt much more confident in their mentoring and coaching skills.

In reflecting back on ways to improve the program the Fellows indicated that a few of the mentoring and coaching professional development activities that had late in the year would be helpful if they had dealt with them earlier in the year. Overall, the Fellows were positive about their training and enthusiastic about their roles in mentoring and coaching teachers as AMSTI specialists.

*Survey of Teachers*

An indicator of the success of the AMSTI Fellows is teachers' satisfaction with the work that the Fellows did with them.  We asked the teachers to provide us with data on two sets of questions.  The first set that is displayed in Table 1 deals with mentoring and coaching support provided by the Fellows.  The second set that are displayed in Table 2, reflect the agreement of the teachers concerning positive outcomes associated with the AMSTI Fellows' work. (n = 51)

As can be seen in the tables below, the teachers were generally satisfied to very satisfied with the performance of AMSTI Fellows in mentoring and coaching them with AMSTI kits, lessons, content knowledge, student assessment, teaching strategies, and formative evaluation.  They also agreed that:

- the AMSTI fellow helped them to teach AMSTI better,

- their students learned more from AMSTI,

- they were more confident in their abilities to teach with AMSTI,

- they better understood AMSTI,

- and having an AMSTI specialist is helpful.

Table 1
*Mean Level of Satisfaction with performance of AMSTI Fellows (Scale ranges from 1—very unsatisfied to 4—very satisfied).*

|  | Mean | SD |
|---|---|---|
| Helped me prepare AMSTI science Kits for use in class | 3.34 | 0.97 |
| Co-taught AMSTI lessons with me | 3.43 | 0.88 |
| Provided me with professional development on inquiry based instruction | 3.35 | 0.86 |
| Helped me to learn how to better assess students' thinking in science and math | 3.28 | 0.93 |
| Helped me to learn additional content knowledge related to AMSTI | 3.28 | 0.96 |
| Helped me prepare AMSTI lesson plans | 3.47 | 0.90 |
| Helped me to develop strategies for successfully teaching the AMSTI curriculum | 3.28 | 0.93 |
| Evaluated how I taught AMSTI lessons | 3.32 | 0.91 |

Table 2

*Mean Agreement with Statements about Positive Outcomes from AMSTI Fellows Work (1 = strongly disagree and 5 means strongly agree).*

|  | Mean | SD |
|---|---|---|
| The AMSTI fellow has helped me to teach the AMSTI curriculum better this year | 4.00 | 1.06 |
| My students learned more from AMSTI this year than my students the previous year did | 3.86 | 1.11 |
| I am more confident in my ability to teach AMSTI after working with the AMSTI fellow | 4.00 | 1.10 |
| After working with the AMSTI Fellow, I am better able to understand the AMSTI curriculum. | 3.96 | 1.11 |
| Having an AMSTI Fellow or Specialist in a school is helpful for teachers who want to better grasp the AMSTI curriculum | 4.24 | 1.11 |

*Focus Group of Principals*

Data from principal focus group reveals they view the AMSTI Fellows as a positive addition to the mentoring and coaching needed related to the implementation of AMSTI. They felt the Fellows were receiving training that adequately prepared them to function as a mentor and coach, and that they

demonstrated the dispositions and knowledge to perform the job.

## Significance and Conclusions

In this study, instructional coaching was implemented in effort to improve instructional practice and, ultimately, student learning, in the areas of math and science. Research makes it clear that improving teachers' classroom practices has great potential to improve student learning, and coaching has been increasingly used as a professional development strategy to improve instructional practices. As schools and districts invest a great deal of time and money in professional development for teachers through instructional coaching, also comes the responsibility of designing coaching programs that provide the professional development and daily mentoring needed for the instructional coach as well.

It is imperative that quality mentoring and induction for teachers be placed at the center of our nation's reform efforts, not only for new teachers, but also for teachers who are charged with implementing new programs or who have been put in new positions (NEA, 2000). Educators should be provided with comprehensive mentoring that emphasizes methods of best practice for teaching, including the areas of math and science. Providing teachers with intensive mentoring by teacher leaders who are competent in mentoring and in content will likely produce successful new teachers who will remain committed to new instructional initiatives. Providing consistent, quality education and instruction on a long-term basis will ultimately lead to greater student achievement.

Ellen Logue states, "A mentor helps teachers make sense of the realities that they face in teaching, learn their significance, and use what they have learned to improve their teaching skills" (National Foundation for the Improvement of Education, 2001). The goal of mentoring is to help ensure that teachers have access to the accumulated instructional knowledge and expertise of their mentor in ways that ultimately contribute to student success. Therefore, mentoring is a means to share the art and craft of teaching. In this program, the Teacher Leader Fellows were in a unique position, both as a mentee in a new position, and as a mentor in as a Teacher Leader. Thus, one could argue the critical aspect of mentoring even more far reaching.

The literature and this study confirms that coaches should be experienced teachers who have demonstrated success in the classroom, have a thorough understanding of the subject they are coaching and the curriculum they are using, and must possess strong interpersonal skills and competencies. This study indicates that instructional coaching has great potential to influence teacher practice and, ultimately, student performance, as well as the professional growth of the coaches themselves. As more schools and districts implement coaching programs, it is important carefully select, train, and mentor new coaches and provide for the evaluation of evidence on programs. In addition, more research is necessary in each of these areas, including:

- areas of expertise that instructional coaches should possess in order to meet reform goals.

- the professional development that is best suited for instructional coaches.

- appropriate methods for effective performance evaluations.

- the correlation between instructional coaching and student achievement.

Research confirms that careful selection of instructional coaches play an important role in the

achievement of teachers and students. Strong pedagogical knowledge coupled with interpersonal skills are the primary traits found among good instructional coaches. Like with all professionals, ongoing professional development is needed to hone their existing skills and improve their coaching strategies. Further, educational leaders and coaches would benefit from evaluations of students and teachers to assess the overall effectiveness of each program. This assessment could be used as a guide to identify the strategies that are working and change those that are not. Considering these essential components, a successful instructional coaching program can be achieved by addressing the needs of the school and investing in the programs that in the end, directly impact students.

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