The Impact of a Teacher Leader Model of Professional Development for Common Core State Standards Implementation on Student Achievement

by

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On February 17, 2009, President Barack Obama signed into law the American Recovery and Reinvestment Act of 2009 (ARRA), designed to stimulate a suffering economy (ED, 2009). The ARRA laid the foundation for education reform by supporting innovative strategies that lead to long term positive effects (ED, 2009). A competitive Race to the Top (RTTT) grant process provided $4.35 billion through which states would be eligible based on applications that included specific conditions for reform (ED, 2009). States’ applications would be judged based on the following reform areas: (a) adopting standards and assessments that prepare students to succeed in college and the workplace and to compete in the global economy; (b) building data systems that measure student growth and success, inform teachers and principals about how they can improve instruction; (c) recruiting, developing, rewarding, and retaining effective teachers and principals, especially where they are needed most; and (d) a plan that would turn around our lowest achieving schools.

The key point in the RTTT is the criteria for application that included the adoption of Common Core State Standards and assessments. States would not be eligible for RTTT dollars if they did not include in their application a timeline for adoption and transition to Common Core State Standards in math, language arts, science, and social studies (ED, 2009). Secretary Duncan also commented on the need for states to take responsibility for implementing national standards without fear of federal over-reaching. “Education is a state and local issue. You pay 90 percent of the tab, and our job is to support leaders like you” (ED, 2009, p. 4). Duncan made his case for
the reason standards are necessary. “Today, our standards are too low and the results on international tests show it. Worse yet, we see the signals in the international economy as more and more engineers, doctors, and science and math Ph. Ds come from abroad” (ED, 2010, p. 5).

Phase I of the RTTT grant began in January 2010. Tennessee and Delaware were the only states awarded at that time. Winners of Phase II were announced in August of 2010. Ohio was awarded along with nine other states and the District of Columbia (ED, 2010). A total of 46 states applied for funds in phases I and II. All 46 states had to include adoption of Common Core State Standards in their applications in order to qualify for review (ED, 2010). The Ohio award initiated the process of the implementation of Common Core State Standards and assessments and the eventual implementation of the teacher-leader model as the professional development implementation model. A requirement of RTTT is every educator in Ohio was expected to be teaching to the State’s enhanced standards and have the necessary supports and resources to do so effectively. All Ohio educators will utilize multiple forms of assessments, including summative and formative, to monitor student progress and to personalize instruction. The combination of rigorous standards and high-quality assessments will inform instruction, professional development, and policy. By the end of the 2013-2014 school year, every teacher was expected to have accessed newly revised standards and associated curriculum online supports as well as participate in at least one standards awareness or professional development program (ODE, 2013).

**Teacher-Leader Model**

There are many methods of professional development that can be used to help schools implement a program or method of teaching. Educational professional development is defined as “a career-long process in which educators fine-tune their teaching to meet student needs”
Professional development can be accessed or delivered in many forms such as online courses, traditional direct graduate coursework or through local and regional entities. “What attracts teachers to professional development is their belief that it will expand their knowledge and skills, contribute to their growth, and enhance their effectiveness with students” (Guskey, 2002, p. 382). Professional development programs based on the assumption that change in attitudes and beliefs comes first are typically designed to gain acceptance, commitment, and enthusiasm from teachers and school administrators before the implementation of new practices or strategies (Guskey, 2002). In general, though, reviews of professional development research consistently point out the ineffectiveness of most professional development programs (Cohen, 1998).

The majority of professional development falls short because they do not take into account what motivates educators to engage in professional development and the process by which change typically occurs (Guskey, 2002).

The teacher-leader model of professional development is based on trained or experienced teachers “coaching” other teachers on a particular method or program designed to change student outcomes (Institute for Educational Leadership, 2001). There is substantial research that shows a positive effect when the teacher-leader model is used in many capacities. However, there is a paucity of research that demonstrates the effect of the train-the-trainer model of professional development on student achievement. Much of the existing research focuses on professional development as having a direct impact on collaboration, community, and professionalism are present in the culture of the educational process, while the impact of student achievement is only surmised (Hickey, 2005).

Historically, overall responsibility for the schools’ operation has fallen to a single
individual: the principal - a role that through much of the last century has been largely vested in managerial expertise (Alejano, Knapp, Marzoff, & Portin, 2006). Reformers believe that the teacher’s role in instructional leadership is important because of the greater demands on principals and that in order for true reform initiatives to take place, it must have the teacher as the leader in implementation (Institute of Educational Leadership, [IEL], 2001). According to the IEL, the rationale behind using teachers as more than “funneling information into schoolchildren” is that there is infinite potential for teachers to share their “hard earned knowledge and wisdom with players in education’s decision-making circles.

The concept that leadership makes a difference in schools is also a key component in determining whether the teacher-leader model might be an effective model for increasing student achievement. There is an abundance of research that shows a connection between instructional leadership and learning outcomes (Alejano et al., 2006). Similarly, there is an abundance of research that demonstrates that the most important variable in determining student success is the classroom teacher (Shelton, 2009).

There are many roles for teachers as leaders. How schools use their teachers and in what capacity vary greatly (Shelton, 2009). The need for teachers to assume different roles other than the traditional roles is related to the workload and responsibilities that have been placed on building principals (Alejano et al., 2006). The leadership roles and responsibilities of principals have evolved over the last three decades (Murphy, 2002). In the 1980s, the leadership roles began to transform because of the influence of A Nation at Risk.

In the 1990s, reform laws such as Goals 2000 shifted groundwork for principals to become more involved with outcomes in the classroom. In the 2000s, the principal’s role has taken on accountability for student performance (Alejano et al., 2006). The shift from a focus on
the individual titular leaders and individual behavior to a focus on the valued ends of the systems
that leaders lead has helped to redirect attention from “management” of schools to “leadership”
(Murphy, 2002). A new leadership agenda that includes guiding and improving the school
implies a new set of roles and responsibilities and the attendant authority to diagnose complex
modern challenges and doggedly focus the attention of the school and its community on the aim
of powerful and equitable learning opportunities (Alejano et al., 2006).

Research exists that demonstrates that school leaders affect students’ learning (Alejano et
al., 2006). The teacher-leader model was chosen for the current investigation because research
suggests that there is an impact of the teacher-leader on how students perform. Leaders’ effects
on learning appear to involve more than just student learning. In this broader conception,
leadership practice relates, in principle, to a broad learning improvement agenda in the school
around three learning tenets: (1) Student learning – framed in broad terms to include more than
achievement on single measures such as test scores; (2) Professional learning – including the
array of skills, knowledge, and values that teachers and administrators gain from practice itself,
formal attempts to develop their professional capacities while on the job, and from initial
preparation for their professional positions; and (3)System learning – conceived of as “insight
into the functioning of the system as a whole to develop and evaluate new policies, practices and
structures that enhance its performance.” (Knapp, 2003, p.11)

It is clear that initial preparation for school leadership can never teach aspiring leaders all
they need to know to assume the kind of school leadership roles envisioned in the concept of the
teacher-leader model for professional development (Davis et al., 2005). New practices and
strategies have been developed by school systems to redefine leadership roles, responsibilities,
and authority allocations (Alejano et al., 2006). One such practice involves developing new
models of leadership based on distributing leadership practices across the school organization (Alejano et al., 2006). Included among those leadership practices are the creation of instructional specialists or “coaching” roles, the formalizing of teacher-leadership roles focused on instructional improvement, the fostering of professional learning communities, and the redesigning and differentiating administrative roles.

The teacher-leader model for professional development utilized in the current investigation was developed out of these concepts. Rather than create wholly new instructional leadership positions, as in the coaching arrangements, this system seeks to designate teachers in formal roles of “teacher-leader” or “mentor” which places the teacher at the center of instructional improvement (York-Barr & Duke, 2004). An example of the model is Connecticut’s Beginning Educator Support and Training (BEST) program, which provides new teachers with an induction support team of veteran teachers (Murphy, 2002). Accomplished teachers attaining National Board Certification are also being used in some jurisdictions to support instructional practice of their colleagues (Berry, Johnson, & Montgomery, 2005).

**Current Investigation**

The train-the-trainer model is being used by some states to implement Common Core State Standards (Kavanaugh, 2012). In Tennessee and Ohio for example, the state selects exemplary educators to serve as core coaches who facilitate training sessions across the state (Kavanaugh, 2012). As stated earlier, there is a lack of research that directly links the achievement levels of students to specific common core professional development that utilizes teacher-leader model. There is also limited research that links student achievement to the train-the-trainer-model for any professional development. There is also little known about the other types of professional development and the methods used to deliver Common Core State
Standards in each of the states that have participated (Center, 2013). A preponderance of the existing research on the impact of a train-the-trainer type of professional development is related to some qualitative evidence that links an increase in school culture variables such as collaboration and professionalism. An example of this type of research has been conducted is a study in rural Texas. The district conducted surveys of both the teachers who conducted the professional development as well as those who were active participants. The results showed that peer-led professional development is strongly perceived by the presenters as increasing faculty togetherness or community (Hickey, 2005). As is the case in much of the current research, no additional investigation examined impact on student achievement to research increased student achievement in the district for those teachers that expressed an increase in professionalism and collaboration as a result of the professional development they received using the train-the-trainer model.

Pollnow (2012) conducted a study in Arizona, using a mixed method design, examining the use of the train-the-trainer professional development model, using the incorporation of student formative assessments in an effort to measure the impact. The training that was provided was collaborative, job-embedded, ongoing, and adaptable in order to meet the requirements of a School Improvement Grant. The research findings indicate that the professional development was perceived as effective by the trainers but not as effective by the teachers (Pollnow, 2102). The number of formative assessments did increase significantly more for those teachers who participated in the professional development as opposed to those who did not participate. However, as with other research, no specific analysis was conducted to measure student achievement as a result of the professional development. In the absence of research it can only be assumed that a more efficient use of variables such as the use of formative assessments,
increased learning goals, and teacher professionalism are all contributing variables to increased student achievement.

The current investigation will add to the paucity of existing research examining the impact of the teacher-leader model of professional development using measures of student achievement. As stated, there is no known research that has directly measured the effects of teacher-leaders on student achievement. This investigation will provide school leadership with a model of how to use available empirical evidence to help make informed decisions about programs that will affect the achievement, culture, and overall success of school. The current investigation can provide a model of how data can be used to show the worth and value of programs, as well as provide information for program improvement.

**METHODS**

**Participants**

The participants in the current investigation included fourth through eighth grade teachers from school districts in a Northeast Ohio, specifically the an area identified as the Mahoning Valley. The subject areas investigated included math and language arts. Teachers from four of the districts were considered to be members of the control group, in that they were not involved in receiving the professional development. Teachers from thirteen districts participated in at least one of the professional development offerings.

Districts that participated in the teacher-leader model were assigned values ranging from T1 through T13. The districts that did not participate were assigned values ranging from C1-C4. Descriptions of the districts used in this study are included in the table. Districts are classified by type, (rural, suburban or urban, treatment or control indicated with a “T” or “C”), enrollment (number of total students grades k-12), disadvantaged pupil population (the number of students
who qualify for free lunch), mobility (the percentage of students in the district for less than one year), and race (the percentage of non-Hispanic White students). This information is provided in Table 1.

Table 1. District Information

<table>
<thead>
<tr>
<th>District</th>
<th>Type</th>
<th>Enrollment</th>
<th>Disadvantaged</th>
<th>Mobility</th>
<th>Race</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>Suburban</td>
<td>5285</td>
<td>47%</td>
<td>6.7%</td>
<td>82%</td>
</tr>
<tr>
<td>T2</td>
<td>Urban</td>
<td>1211</td>
<td>82%</td>
<td>14.6%</td>
<td>40%</td>
</tr>
<tr>
<td>T3</td>
<td>Suburban</td>
<td>2804</td>
<td>14%</td>
<td>3.1%</td>
<td>93%</td>
</tr>
<tr>
<td>T4</td>
<td>Suburban/Rural</td>
<td>1036</td>
<td>37%</td>
<td>6.8%</td>
<td>94%</td>
</tr>
<tr>
<td>T5</td>
<td>Suburban/Rural</td>
<td>850</td>
<td>47%</td>
<td>6.1%</td>
<td>97%</td>
</tr>
<tr>
<td>T6</td>
<td>Suburban</td>
<td>607</td>
<td>43%</td>
<td>2.6%</td>
<td>91%</td>
</tr>
<tr>
<td>T7</td>
<td>Suburban</td>
<td>2163</td>
<td>1%</td>
<td>3.6%</td>
<td>95%</td>
</tr>
<tr>
<td>T8</td>
<td>Suburban/Rural</td>
<td>584</td>
<td>62%</td>
<td>12.8%</td>
<td>95%</td>
</tr>
<tr>
<td>T9</td>
<td>Suburban/Rural</td>
<td>1214</td>
<td>26%</td>
<td>4.4%</td>
<td>98%</td>
</tr>
<tr>
<td>T10</td>
<td>Suburban/Rural</td>
<td>1093</td>
<td>35%</td>
<td>5.6%</td>
<td>97%</td>
</tr>
<tr>
<td>T11</td>
<td>Suburban/Urban</td>
<td>1973</td>
<td>61%</td>
<td>8.4%</td>
<td>84%</td>
</tr>
<tr>
<td>T12</td>
<td>Suburban/Rural</td>
<td>2206</td>
<td>37%</td>
<td>7.0%</td>
<td>97%</td>
</tr>
<tr>
<td>T13</td>
<td>Rural</td>
<td>718</td>
<td>28%</td>
<td>5.4%</td>
<td>97%</td>
</tr>
<tr>
<td>C1</td>
<td>Rural</td>
<td>1953</td>
<td>41%</td>
<td>7.7%</td>
<td>97%</td>
</tr>
<tr>
<td>C2</td>
<td>Suburban</td>
<td>4530</td>
<td>42%</td>
<td>8.3%</td>
<td>77%</td>
</tr>
<tr>
<td>C3</td>
<td>Suburban/Urban</td>
<td>1735</td>
<td>59%</td>
<td>6.9%</td>
<td>84%</td>
</tr>
<tr>
<td>C4</td>
<td>Urban</td>
<td>5239</td>
<td>99%</td>
<td>21.1%</td>
<td>15%</td>
</tr>
</tbody>
</table>
Student data in those districts were derived from those fourth through eighth graders who had taken the Ohio Achievement Assessments in reading and math during the 2013 administration. Data collection was limited to these grades because these are the grade levels in Ohio which participate in the Ohio Achievement Assessments as well as receive Value-Added scores.

**Instrumentation**

The professional development was delivered to treatment group teachers by grade level bands/subject areas as follows: (1) 4-5 grade language arts/ teacher-leaders; (2) 4-5 math/teacher-leaders; (3) 6-8 language arts/ teacher-leaders; and (4) 6-8 math/teacher-leaders. The professional development began in December 2011 through January 2014. The assessments used for elementary student test scores were the Ohio Achievement Tests given in spring 2013. The scores used as measures of student achievement included: (1) 4th grade reading and math; (2) 5th grade reading and math; (3) 6th grade reading and math; (4) 7th grade reading and math; and (5) 8th grade reading and math. Traditionally, data from these assessments are collected and used to measure student achievement at that grade level and for that particular subject. Accountability measures for the school and district are also measured based on the results from these tests.

Value-added data is also part of the accountability measures currently used to measure the effectiveness of the classroom teacher and grade level as a whole. Value-added analysis is a statistical method that helps educators measure the impact schools and teachers have on a student’s academic progress rates from year to year. Each district receives a score for each grade based on a calculation that measures each student’s growth. Value-added scores are used in Ohio’s new teacher evaluation system and is an integral part of the accountability system in Ohio. The value-added scores that were used in this study were retrieved from each district’s
local report card. The report cards provide value-added ratings for each grade level.

Value-added psychometric information is relatively guarded information by the Ohio Department of Education. Investigation into possible models used in generating value-added numbers reveals that there are multiple models used (Wright, 2010). In general, all forms of the value-added models take one of two forms: the Multivariate Response Model (MRM) or the Univariate Response Models (URM). The MRM is a multivariate repeated measures ANOVA model. The URM is a traditional ANOVA model. The data provided can be used to predict scores on tests the students have yet to take (Wright, 2010). Currently, in Ohio, math and reading value-added scores are calculated using the MRM method which compares the average growth of students in the most recent year to the average growth of students in 2010, which is the state’s baseline year. The growth expectation is defined as maintaining placement in the distribution of normal core equivalency (NCE) scores from one year to the next (Meade, 2013). NCE is similar to a percentile rank in that scores are derived from scaled scores and ranked based upon performance and is an equal interval scale, different from a percentile rank (Meade, 2013).

Value-added scores used at each grade level are calculated by using a multi-year average composite of up to three years. The score is calculated by dividing the mean gain by the standard error at each grade level. A growth index is calculated by dividing the estimated gain by the associated standard error, and a letter grade is given to each grade level based upon the gain index (Meade, 2013). There is currently debate at the state level as to whether the information should be used to evaluate teachers or be used solely to predict student achievement and inform instructional practice.

**Procedures**

Identified teacher-leader candidates committed to three days of professional development
involving in-depth standards as well as strategies for working with colleagues on implementation of the standards. Additionally, these educators committed to developing a plan with building or district administration for implementation of the standards. The teacher-leaders received professional development opportunities, resources to assist with implementation, and the ability to participate as part of the Teacher-Leader Endorsement cohort. Instructional consultants from the local Educational Services Center (ESC) received training in Common Core State Standards for each subject area and by grade level from the ODE. The Ohio Standards for Professional Development were employed to deliver the professional development to the teacher-leaders.

There are six standards that are considered best practice:

1. Purposeful, structured, and continuous process that occurs over time;
2. Informed by multiple sources of data;
3. Collaborative;
4. Varied learning experiences that accommodate individual skills;
5. Evaluated by short term and long term impact on student achievement; and
6. Results in acquisition, enhancement, or refinement of skills and knowledge. (ODE, 2007)

Teacher-leaders were selected from each school district, from each grade level, and subject to participate in the ESC teacher-leader model of professional development for Common Core State Standards for math and language arts. The purpose of the model is to build capacity for implementation of the Common Core State Standards. The teachers chosen to participate in the leader portion of the professional development demonstrated skill in evidence-based principles of effective leadership and teacher learning; promoted the use of data-based decisions and evidence-based practice; facilitated a collaborative learning culture; participated in developing and supporting a shared vision and clear goals for their schools; and promoted and modeled
ongoing professional learning and improved practice within a learning community. Additional considerations included longevity, willingness to attend and participate in scheduled meetings, and willingness to communicate with ESC consultants. The control participants included those teachers and students from districts that did not participate in the professional development.

The instructional consultants worked in teams of two to provide the professional development which consisted of three separate days for Math and four separate days for Reading lasting from 8:30am to 3:00 pm each day. There was also a professional development opportunity for principals of all district buildings involved in the implementation process and suggestions for efficient and effective professional development to allow the teacher-leaders to train other staff.

The control group participants received professional development typically through limited group time that was spent doing gap analysis between the Ohio standards and the new Common Core State Standards. Control group schools indicated that this generally occurred during teacher planning periods. Districts in the treatment group used various methods for the teacher-leaders to train teachers in their respective districts. As stated earlier, principals engaged in discussions about effective methods used by the teacher-leaders. The consensus among principals and teacher-leaders was that the leaders were given release time on different occasions throughout the school year to train staff. Grade level and subject area meetings were held. Districts also held professional development waiver days, granted by the ODE, to allow leaders to train other staff. Teacher-leaders were also given the opportunity to provide 15 hours of professional development for Common Core State Standards outside of the school day. Although the delivery of the professional development by each teacher-leader took place in a variety of forms, this varied delivery potentially enhances the external validity of this investigation.
Data Collection and Organization

Data were collected from each district by accessing the statewide test site located on the webpage of the ODE. The data are public record and readily available; however, all district leaders were informed of the research and the methods for collection of data were approved. Usernames and passwords to access district data on the statewide test site were made available. Student level data were available for both reading and mathematics achievement across both the treatment and control groups. However, only grade level data were available for reading and mathematics value-added data across both the treatment and control groups.

RESULTS

Demographics

The data analysis process began by looking at aggregate values for the treatment and control group across the mathematics achievement scores. Scores were drawn from \( n = 4850 \) students attending the control group schools, and \( n = 8541 \) students from the treatment group schools. The aggregate mathematic scores are presented in Table 2.

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Student Achievement Mathematics Data by Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>Mean</td>
</tr>
<tr>
<td>Control</td>
<td>418.92</td>
</tr>
<tr>
<td>Treatment</td>
<td>429.71</td>
</tr>
</tbody>
</table>

As seen in Table 2, aggregate scores from the treatment group are higher than the aggregate
scores from the control group. A similar analysis for reading scores is presented in Table 3.

Table 3  *Student Achievement Reading Data by Group*

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>SD</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>418.92</td>
<td>28.70</td>
<td>-0.33</td>
<td>0.34</td>
</tr>
<tr>
<td>Treatment</td>
<td>428.13</td>
<td>24.95</td>
<td>-0.21</td>
<td>0.46</td>
</tr>
</tbody>
</table>

As seen in Table 3, aggregate scores from the treatment group are higher than the aggregate scores from the control group. Further examination of the scores examined the reading and math scores’ values by grade level, across the two groups. The mathematics aggregate data are presented in Table 4.

Table 4  *Student Math and Reading Achievement by Grade*

<table>
<thead>
<tr>
<th>Grade</th>
<th>Group</th>
<th>Math Mean</th>
<th>SD</th>
<th>Reading Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>4th</td>
<td>Control</td>
<td>426.10</td>
<td>34.20</td>
<td>426.67</td>
<td>24.61</td>
</tr>
<tr>
<td></td>
<td>Treatment</td>
<td>431.29</td>
<td>32.10</td>
<td>432.41</td>
<td>21.43</td>
</tr>
<tr>
<td>5th</td>
<td>Control</td>
<td>417.99</td>
<td>36.25</td>
<td>412.31</td>
<td>27.82</td>
</tr>
<tr>
<td></td>
<td>Treatment</td>
<td>421.98</td>
<td>34.69</td>
<td>418.90</td>
<td>25.36</td>
</tr>
<tr>
<td>6th</td>
<td>Control</td>
<td>422.25</td>
<td>41.46</td>
<td>419.52</td>
<td>28.68</td>
</tr>
<tr>
<td></td>
<td>Treatment</td>
<td>437.46</td>
<td>38.76</td>
<td>429.05</td>
<td>24.65</td>
</tr>
<tr>
<td>7th</td>
<td>Control</td>
<td>409.83</td>
<td>32.20</td>
<td>413.05</td>
<td>27.77</td>
</tr>
<tr>
<td></td>
<td>Treatment</td>
<td>427.82</td>
<td>31.24</td>
<td>425.26</td>
<td>23.90</td>
</tr>
<tr>
<td>8th</td>
<td>Control</td>
<td>417.80</td>
<td>33.49</td>
<td>422.46</td>
<td>31.25</td>
</tr>
<tr>
<td></td>
<td>Treatment</td>
<td>429.96</td>
<td>29.02</td>
<td>434.98</td>
<td>25.86</td>
</tr>
</tbody>
</table>
As seen in Table 4, treatment group scores in mathematics are higher than their control group counterparts when examining student level data by grade. Additionally, treatment group scores in reading are higher than their control group counterparts when examining student level data by grade. A graphical depiction of these results is provided in Figures 1 and 2.

*Figure 1. Graphical Image of Mean Mathematics Scores (vertical axis) Across Treatment and Control Groups by Grade Level (horizontal axis)*

*Figure 2. Graphical Image of Mean Reading Scores (vertical axis) Across Treatment and Control Groups by Grade Level (horizontal axis)*
Value-added Results

Value-added data are presented for the control group relative to the treatment group in Table 5.

Table 5. Overall Value-Added Score by Group

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>SD</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>-.73</td>
<td>5.75</td>
<td>.45</td>
<td>.51</td>
</tr>
<tr>
<td>Treatment</td>
<td>1.28</td>
<td>4.91</td>
<td>.47</td>
<td>-.72</td>
</tr>
</tbody>
</table>

As seen in Table 5, value-added scores are higher for the treatment group than the control group overall. Table 6 depicts reading value-added scores separated by grade level and group.

Table 6. Value-Added Aggregates for Math and Reading by grade level

<table>
<thead>
<tr>
<th>Grade</th>
<th>Group</th>
<th>Math Mean</th>
<th>Math SD</th>
<th>Reading Mean</th>
<th>Reading SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>4th</td>
<td>Control</td>
<td>.22</td>
<td>4.77</td>
<td>2.74</td>
<td>1.6</td>
</tr>
<tr>
<td></td>
<td>Treatment</td>
<td>-.76</td>
<td>4.06</td>
<td>.72</td>
<td>2.47</td>
</tr>
</tbody>
</table>
As seen in Table 6, reading value-added scores are fairly consistent among grade levels. The treatment group scores are higher for fifth through eighth grade. Math value-added scores by group reflect much the same as reading scores. The treatment group scores reveal higher mean scores in the fifth through eighth grades, with fourth grade being the exception. Likelihood analyses were conducted and provide evidence that the treatment scores are significantly higher than control group scores for the overall value-added data, \( p = .06 \), at \( \alpha = .10 \).

**Preliminary Analysis**

Zero-order correlations were analyzed across all potential dependent variables in order to assess the relationship between them. The dependent variables for the current investigation include reading value-added scores, mathematics value-added scores, reading achievement aggregate scores, and mathematics achievement aggregate scores. Independent variables include socio-economically disadvantaged, mobility rates, and race.

<table>
<thead>
<tr>
<th>Variables</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
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</thead>
<tbody>
<tr>
<td>5th Control</td>
<td>-3.38</td>
<td>7.73</td>
<td>-2.23</td>
<td>.94</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Treatment</td>
<td>.51</td>
<td>4.06</td>
<td>.24</td>
<td>1.40</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6th Control</td>
<td>-3.09</td>
<td>7.73</td>
<td>-1.55</td>
<td>5.03</td>
<td></td>
<td></td>
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<tr>
<td>Treatment</td>
<td>.23</td>
<td>7.04</td>
<td>.16</td>
<td>1.86</td>
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<td></td>
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<tr>
<td>7th Control</td>
<td>.43</td>
<td>.85</td>
<td>-2.28</td>
<td>3.2</td>
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<td></td>
<td></td>
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<tr>
<td>Treatment</td>
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<td>4.23</td>
<td>-1.79</td>
<td>2.58</td>
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<tr>
<td>8th Control</td>
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<td>8.70</td>
<td>.29</td>
<td>3.36</td>
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<tr>
<td>Treatment</td>
<td>2.57</td>
<td>5.40</td>
<td>.33</td>
<td>2.37</td>
<td></td>
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</tr>
</tbody>
</table>

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**Preliminary Analysis**

Zero-order correlations were analyzed across all potential dependent variables in order to assess the relationship between them. The dependent variables for the current investigation include reading value-added scores, mathematics value-added scores, reading achievement aggregate scores, and mathematics achievement aggregate scores. Independent variables include socio-economically disadvantaged, mobility rates, and race.

**Table 7  Zero-Order Correlations of Independent and Dependent Variables**
As indicated in Table 7, large significant correlation exists between aggregate math achievement scores and reading achievement scores, with moderate correlations presenting between the other potential dependent variables. The large significant correlation between the math and reading scores potentially creates a multicollinerity issue. Additionally, large significant correlations exist between disadvantage, mobility, and race. Notably, the correlations between the value-added dependent variables and the independent variables are predominantly small and negative, while correlations between the achievement scores and the independent variables are predominantly large, negative, and significant.

An independent samples $t$ test was used to examine group differences across math achievement and reading achievement with student level data. These analyses reveal significant differences across groups for both mathematic achievement, $t(9450.33) = -17.31, p < .001, CI_{95}[-12.035, -9.541]$, and reading achievement, $t(8943.18) = -18.76, p < .001, CI_{95}[-10.29, -8.29]$. These results suggest student achievement in the treatment group is significantly higher for both reading and math relative to control group achievement.

**DISCUSSION**

<table>
<thead>
<tr>
<th>Overall Value-Added</th>
<th>1</th>
<th>.275*</th>
<th>.370**</th>
<th>.204</th>
<th>.297**</th>
<th>-.018</th>
<th>-.365**</th>
<th>-.168</th>
<th>.204</th>
</tr>
</thead>
<tbody>
<tr>
<td>READ VA</td>
<td>2</td>
<td>1</td>
<td>.366**</td>
<td>.325**</td>
<td>.249*</td>
<td>-.143</td>
<td>-.105</td>
<td>-.102</td>
<td>.115</td>
</tr>
<tr>
<td>Math VA</td>
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<td>1</td>
<td>.178</td>
<td>.261*</td>
<td>.070</td>
<td>-.141</td>
<td>-.055</td>
<td>.065</td>
<td></td>
</tr>
<tr>
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<td>1</td>
<td>.823**</td>
<td>-.216</td>
<td>-.710**</td>
<td>-.707**</td>
<td>.632**</td>
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</tr>
<tr>
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<td>-.146</td>
<td>-.745**</td>
<td>-.713**</td>
<td>.649**</td>
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<tr>
<td>Enrollment</td>
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<td>.193</td>
<td>.315**</td>
<td>-.473**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disadvantage</td>
<td>7</td>
<td>1</td>
<td>.876**</td>
<td>-.790**</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mobility</td>
<td>8</td>
<td>1</td>
<td>-.853**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Race</td>
<td>9</td>
<td>1</td>
<td></td>
<td></td>
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</tbody>
</table>
Summary of Findings

As stated earlier, most of the research conducted regarding the teacher-leader model is related to qualitative evidence that links increased student achievement to improved culture created by peer-led professional development. One Arizona study used results from student formative assessments to measure impact. In this case, a mixed method design was used to measure quantitative and qualitative results. The research questions were similar to this research (Pollnow, 2012). In the Arizona study, the number of formative assessments increased for those teachers who participated in the teacher-leader professional development (Pollnow, 2012). There is no specific research on the correlation between formative assessments and increased achievement although it can be easily assumed that increased formative assessments would be beneficial in allowing teachers to provide more informed and individualized instruction resulting in higher achievement.

The current investigation examined student achievement and value-added scores in reading and math for grades four through eight in 17 districts throughout Mahoning, Columbiana, and Trumbull counties. Thirteen districts were used in the treatment group and the remaining four districts were included in the control group. The treatment group consisted of districts that participated in the professional development provided by the local ESC using the teacher-leader model of delivery. The control group included the districts that did not participate. The dependent variables of student achievement scores and value-added scores were the measures of the effects. The overall student sample size was n = 13,391, from n = 17 schools. Scores were drawn from those students in both reading and math. The results reveal that there is a significant increase in mean scores in reading and math among the treatment group compared to the mean scores of the control group. However, when math and reading scores are examined
by grade level, district, and group, results reveal that there are no significant pattern differences in scores for both reading and math across both groups.

Research does suggest that use of the teacher-leader model, which increases the positive achievement variables such as culture and self-efficacy, does impact student achievement (Pollnow, 2012). This is the first known study that specifically demonstrates the impact that professional development through the teacher-leader model is associated with higher achievement. The results of this investigation support Pollnow’s conclusions. In this investigation, a positive and significant correlation exists between math and reading achievement scores. Research exists that explains correlations between math and reading scores. Most research suggests a correlation exists (Larwin, 2010). There is research that suggests the correlations are not as significant as one might assume (Villa, 2008).

Value-added scores yield similar results to achievement scores. Overall value-added scores are higher for the treatment group compared to the control group. Results depicted by grade level show higher value-added scores in grades five through eight in reading and math for the treatment group. The fourth grade results are different in reading and math where the treatment scores are slightly lower than the control group. Possibilities for these results include, but are not limited to, the significance of the recent implementation of the third grade reading guarantee. Schools are now required to implement interventions at the third grade level for those students who are low achieving. If the control group scores are lower than the treatment group scores, this may reflect that more interventions were in place for that group resulting in higher value-added scores as evident with control group C4. The eighth grade math results are also higher for the control group. A possible explanation for this result is that two schools in the control group had abnormally high calculated value-added scores, significantly impacting the
average results. Unlike achievement scores, value-added math scores are not as highly correlated to reading value-added scores. The correlation of math to reading value-added scores in this investigation is moderate, positive, and significant.

There is considerable research regarding correlations between math and reading achievement and other independent variables that may have an effect on achievement (Konstantopoulos, 2013). Independent variables such as income, mobility, and race are highly correlated to achievement. This study also indicates that math and reading achievement scores are correlated to those same independent variables, however the effect is relatively large, negative, and significant. The same correlations do not exist for value-added scores and the independent variables. Those correlations are predominantly small and negative. Research has determined that correlations exist between reading achievement and math achievement (Larwin, 2010). Usually poor reading ability automatically undermines a student’s likelihood of success in math achievement. (Larwin, 2010). One suggestion for the correlation is that many of the math problems today are structured as word problems in which children must read a scenario and determine the proper procedure for solving, as opposed to a traditional numerical problem such as long division or multiplication tables. In the case of word problems, there are more reading skills that need to be utilized than mathematical skills, thus creating the correlation. Other research, such as the study conducted in Indiana, found a correlation between improved reading and math scores after teachers implemented a new system of interim assessments (Konstantopoulos, 2013). The study showed when increases in reading were shown after treatment, they usually occurred in math as well (Konstantopoulos, 2013).

Limitations

Many contributing variables influence the outcomes of achievement testing. To say that
one variable is the sole cause of an outcome is not defendable. Current research suggests that there are many variables that affect achievement (Lewis et al., 2010). For example, efficacy of the classroom teacher and teacher-leaders can positively affect achievement while poverty and mobility can negatively affect achievement. Macro level factors such as economic instability or political influences can also impact achievement. For this reason, directly linking achievement scores to any independent variable has its limitations. The goal of current investigation is to examine impact, if any, of an ongoing teacher-leader model of professional development that focuses specifically on Common Core State Standards. As such, this investigation simply utilized existing student data from school districts that participated in the intervention. Additionally, matching control group schools were incorporated. No manipulation of the data or selection of the participants occurred. Therefore, the results reflect the differences seen for those who received the intervention as opposed to those districts that did not participate. In this investigation, the independent variables that may have confounded results were relatively balanced across both the control and treatment groups.

Second, there are limitations to using test scores as a measurement of an indirect intervention, such as events that occur outside the classroom that might impact one aspect of the educational process. Additionally, while test scores are not the best measure of student achievement, currently, it is generally accepted for accountability and measurement (Bell, Wilson, Higgins, & McCoach, 2010). According to Thomas (2013), it is rare to connect student achievement to interventions that are not directly delivered to students. However, the current investigation was, in fact, able to demonstrate a link between an indirect intervention and differences in student achievement via test results.

Similarly, the impact of this professional development delivery system on student
achievement at this time may have been mitigated by the educational climate with favorable results. Over the past two years an educational reform initiative in Ohio known as the Ohio Teacher Evaluation System (OTES) was implemented and mandatorily included in each teacher’s evaluation. Because OTES uses student achievement as an indicator of effectiveness, it is in the teacher’s best interest to implement any strategy that would positively influence the achievement of students. Subsequently, teachers were more likely motivated to implement the Common Core State Standards, the focus of the intervention provided by the MCESC, in an effort to raise achievement.

Potential Contributions

The teacher-leader model is the most cost effective and the most efficient means, educationally, to deliver the professional development. There is limited research about the effect of the teacher-leader model directly related to student achievement. This investigation is the first of its kind. The contribution of this research will benefit educational entities that are in the decision making process as to which model of professional development would be most effective in relation to raising student achievement. Timely, ongoing, and effective professional development will be instrumental in implementing the standards (Center, 2013).

Based on the results of this investigation, the local ESC was effective in providing professional development for the school districts that participated. Also based on the results, there are opportunities for the ESC to improve the model and add components to provide a better investigation and evaluation such as a qualitative type of feedback from teachers who participated regarding the model and the implementation within the school districts. That type of information would allow for more in depth analysis of other independent variables that might
have an effect on the outcomes and would provide the evidence needed to most effectively
improve the ongoing professional development delivery.

The Race to the Top Initiative and the movement to implement new Common Core State
Standards has been in effect for three years. There is little known on a national level about the
aspects of professional development related to the CCSS, including which entities are
responsible for providing it, what kinds of professional development are being offered, how
many teachers and principals have received training to date, and what challenges states are
confronting as they try and meet this need (Center 2013). The Center on Education Policy (CEP)
at the George Washington University releases surveys to state superintendents and their deputies
regarding the professional development used in the implementation of the CCSS (Center, 2013).

The CEP conducted three surveys since 2010 when the CCSS were first introduced. The
findings of the surveys were as follows: More than half of the states surveyed, a majority of K-12
teachers of math and ELA, have participated in at least some CCSS related professional
development but fewer states report that a very large proportion of their educators have been
served; states, school districts, and other entities are providing CCSS-related professional
development services for teachers and school principals; states are providing various types of
professional development on the CCSS; and the majority of states reported major challenges in
providing CCSS-related professional development (Center, 2013). As seen by studies, many
states are facing challenges in the implementation of CCSS and as assessments are continually
introduced and more accountability is related to the outcomes, it is paramount that the services
delivered for professional development are of high quality (Center, 2013). Investigations such as
this will be helpful in ensuring entities of that quality.

Conclusion
Continual research and evaluation into the effects of programs on student achievement is paramount particularly in this era of persistent educational reform. Public scrutiny regarding education has increased rapidly over the years. Initiatives like NCLB, RTTT, and CCSS are meant to increase student achievement for all students to help our nation compete in an increasingly interconnected global society. The true measures of effectiveness are conducted using scientific research. Stakeholders in education need to be able to evaluate programs, initiatives, and the effectiveness of schools in general to be able to make good decisions that will positively affect student outcomes.

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http://www.edweek.org/ew/issues/no-child-left-behind/


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