Summer 2004

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Can Professional Development Programs Help Close the Achievement Gap?

C. Jayne Brahler, William L. Bainbridge, and Margaret Stevens

This paper explores the question of whether it is possible to design professional development programs for teachers that can significantly improve student test results and reduce the achievement gap for students.

The Dayton (Ohio) Foundation and the Montgomery County (Ohio) Educational Service Center, sponsors of The Miami Valley Teacher/Leadership Academy, answer this question with a resounding yes. Recent results indicate that the academy’s two-year program, designed to provide professional development to help improve student test scores, not only succeeded in significantly improving the student proficiency mean score, but also considerably reduced the achievement gap for participating students.

This paper includes two parts. First, the authors discuss how to measure the achievement gap and assess its changes in individual classrooms. Second, they report the findings of an original research project relative to affecting the achievement gap.

The Miami Valley Teacher/Leadership Academy began to implement its program in September 2001 via a contract with the Center for Performance Assessment and 12 participating school systems. The program was designed by Dr. Douglas Reeves, a consultant and innovator in the field of educational assessment and accountability systems. His book Making Standards Work documents the MSW program, which has been used throughout the country as a guide for standards and performance assessment implementation. The MSW program meets the federal guidelines of high-quality professional development. It is scientifically research-based and focused on student achievement, and it follows a continuum from knowledge and skills to supported job-embedded practice and reflection.

The academy incorporated a research component into its overall design to assess whether student achievement would improve as a result of the professional development. A sampling of 12 teachers serving 291 students in grades 3, 4, 5, and 6 were studied. The research revealed two major findings: the gain in overall mean test score from pre- to post-test for students of teachers who attended all eight sessions was significantly higher than that of students of teachers who attended two to four sessions, and the achievement gap closed for the experimental group.

While the increase in proficiency test scores was expected, the close in achievement gap was a surprise. Thus, it merits closer scrutiny. How can individual teachers determine if they are making an impact on the achievement gap? Is it easily measured within the individual classroom? Is there a formula for closing the achievement gap? What types of activities are associated with closing the achievement gap?

The Achievement Gap

For the individual classroom teacher, the achievement gap resembles a huge, gaping crevasse that separates the mean proficiency test scores of lower- and
higher-achieving students. The goal is to narrow this
gap at the national, state, and district levels. Every
shred of progress toward narrowing the achievement
gap must begin in the individual classroom.

The preceding paragraph is built on a common
conceptual bottleneck concerning the achievement
gap. Reread this sentence: “For the individual class-
room teacher it resembles a huge, gaping crevasse
that separates the mean proficiency test scores of
lower- and higher-achieving students.” But the
phrase “achievement gap” does not refer only to
mean proficiency test scores. Mean proficiency test
scores are a measure of central tendency, not of de-
viations from the arithmetic mean of individual stu-
dent performances. Measures of central tendency do
not provide information about a disparity in student
achievement, yet the term “achievement gap” speaks
directly to remedying such a disparity.

An effective way to understand this concept is to
consider a classroom of students for whom the mean
test score is 75 percent. That may seem acceptable,
until further investigation reveals that few students
are performing near 75 percent. Instead, most stu-
dents fit into one of two categories: falling below 30
percent or performing above 90 percent. This repre-
sents a considerable achievement gap and also
means that student scores are greatly varied. Nar-
rrowing this variance equates to narrowing the
achievement gap. Everyone would like to raise mean
test scores, but it is equally important to decrease
the disparity between student performances.

That said, how many teachers deal regularly with
“variances” and are comfortable with assessing
changes in variance? Most people are familiar with
standard deviations (a statistic used as a measure of
the dispersion or variation in a distribution; the
squared deviation from the arithmetic mean), and
standard deviations are a measurement of variance.
The standard deviation can be used as the measure
of the variance in student scores within a classroom.
For the purpose of assessing changes in the achieve-
ment gap within classrooms, the variance at the be-
going of the year can be compared with the vari-
ance at the end of the year. When the changes in the
standard deviation are collected across several class-
rooms, one can gain information about the combined
effect of those classrooms on the achievement gap
(the disparity in student performances).

The distribution pattern of a set of scores can be
represented graphically and provides information
about two parameters: the mean and the standard
deviation. There are five basic distribution patterns:
symmetric, bimodal, skewed, flat, and outliers. Nor-
mal distributions are part of this family of distribu-
tions. They are symmetrical, with scores concen-
trated more in the middle than in the tails. Normal
distributions also are known as “bell curves.” They
suggest that the majority of student scores should
cluster around a middle score, with equal numbers
of scores falling above and below that midpoint.
The bell curve has been criticized because it sug-
gests that a “mid-level” performance should pre-
dominate in any group of students. In fact, for many
years teachers were encouraged to adjust student
scores to fit the bell curve so that the majority of
scores were in the mid-level range.

Standards-based assessment, in contrast to the
bell curve, sets a high-level criterion performance
as the goal for all students. The concept of wanting
all students to achieve high-level performance is both
similar to and different from the normal distribu-
tion, or bell curve. The majority of student scores
still are clustered tightly together around a mean
score, which equates to closing the achievement gap.
The mean student score, however, no longer must
be at a mid-point performance. Instead, it ideally will
be at a high level, which equates to most students
meeting that standard.

Let’s look at these concepts graphically. We will
focus on symmetrical, bimodal and skewed distribu-
tion patterns because they graphically represent:
1) no achievement gap, with mid-level mean perfor-

mance; 2) significant achievement gap, with bimo-
dal distribution; and 3) no achievement gap, with
high-level mean performance.

Anything that moves a test score distribution to-
ward normal distribution will decrease the standard
deviation, or variance, between student scores. Re-
ducing the variance between student scores is a tan-
gible example of closing an achievement gap.

Closing the Gap

In this section we provide an original example of
how a professional development activity, sponsored
by the Miami Valley Teacher Leadership Academy,
affected the achievement gap for children in grades
3, 4, 5 and 6 at participating schools.

The evaluation project covered several compo-
ents of the academy but focused primarily on MSW.
The study was funded by Dayton community busi-
nesses. Miami University’s Applied Research De-
partment collected data from July 2003 through July
2004, and faculty and staff from Miami University
and The University of Dayton completed all survey
and data analyses and interpretations.
The study's main finding was that the MSW professional development activity was successful in closing the achievement gap in all subject areas of the Ohio Proficiency Test (citizenship, math, reading, science, and writing). The study examined the achievement gaps of students taught by teachers who had participated in the MSW sessions compared with those of students taught by non-participating teachers. Two performance measures were selected to indicate the effect the program had on student performance and included the gain in proficiency scores from pre- to post-test and the change in test score distribution from pre- to post-test.

Twelve teachers who had no prior exposure to the MSW curricula were selected to participate in the study. All 12 teachers volunteered for the study and were provided the opportunity to participate in a total of eight MSW sessions over the course of 12 months. The sessions covered: Making Stan-
Figure 4. Test score gain is significantly different based on total number of MSW sessions completed.

![Graph showing test score gain based on number of MSW sessions attended]

Gain in student proficiency scores depending upon the total number of number of MSW sessions attended

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<th>Gain in scores</th>
<th>Total Number of MSW Sessions</th>
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2-4 sessions

8 sessions

Summary and Discussion

Figure 5 is a vertical box plot of the gain in student scores for students whose teachers attended zero, two, four, or eight MSW sessions. On the y-axis, each increment of one represents a shift up or down between the three categories of “below-proficient,” “proficient,” and “advanced proficient.” The x-axis groups the data according to number of sessions attended. Each one of the horizontal lines in the box plot represents an important number related to the data set. The top and bottom lines are drawn at the lowest and highest data values, representing the range. The three lines that form the box are drawn 25 percent, 50 percent, and 75 percent of the way through the data. These five numbers—the least, 25 percent, 50 percent, 75 percent, and the greatest—form the five-number summary and provide valuable information about the range and distribution of student scores.

This box plot represents the data collected in the current study and shows that for the teachers who attended eight sessions, the mean test score gain for 50 percent of their students was 0.05 (or half up from their baseline category to the next higher category) compared with a mean gain of zero for the students whose teachers were in the other groups.

Many factors, such as the number of years of teaching experience or the individual content area, can influence student test score performance. In this study, analysis of covariance (ANCOVA) tests were used in order to determine if there was a significant differ-
Figure 5

The professional development participation rate required to successfully implement eight sessions of MSW is a significant finding and validates the return on the academy’s investment. Additionally, per our previous discussion, this finding is especially significant when one considers the pattern of variance demonstrated by the test scores of the control and treatment students. The average test score standard deviation increased for the control group (+.13) but actually decreased for the experimental group (-.06). In other words, the disparity across student performances was lessened (the achievement gap was closed) for the students whose teachers had attended all eight MSW sessions. At the same time, the overall mean test scores increased, more so for the teachers who attended eight sessions compared with teachers who attended two or four sessions.

When the data from figures 4, 5, and 6 are combined, we have a graphical depiction of a distribution of students’ scores, with a mean score that has been raised following the teacher participation in eight MSW sessions. Individual student scores are clustered tightly about that mean. This type of distribution resembles the right-skewed distribution pattern previously discussed, which represents higher test score performances and a narrowed achievement gap. Recall that this distribution pattern graphically depicts an ideal standards-based distribution of student scores because of the high-level mean performance with no gap in student achievement. The standard deviation is smaller because there is less variance between student scores.

One purpose of this article was to share the method for assessing the achievement gap using the distribution of student test scores. The study utilized
this method, and its main objective was to determine if a specific professional development activity (in this case, MSW) was successful in closing the achievement gap for students in classrooms of teachers who participated significantly, compared with students of teachers who did not. Both performance measures (gain in proficiency test scores from pre- to post-test (Figures 4 and 5) and the change in test score distribution from pre- to post-test (Figure 6) indicate the program was successful in closing the achievement gap, but significant participation was required to have the greatest effect on test score improvement.

An explanation for why there was a decrease in the disparity between student test score performance for students whose teachers attended eight but not two to four MSW sessions would require further study, but it may be considered logical to assume that teachers who completed eight sessions benefited from high-quality, job-embedded professional development with content focused on student achievement and incorporating scientifically based research. The study shows that as teachers moved forward on the professional development continuum, student achievement improved, and disparity in student performance was significantly minimized.

**Conclusion**

While limited to a single study, these research findings indicate that high-quality professional development can help to close the achievement gap. A critical amount of professional development may be required, however, before effectiveness reaches a measurable level in terms of student achievement.

This study also shows that principals and teachers can and should monitor student progress not only by looking at mean scores, but also by studying variance to assess its effect on the achievement gap.

**Endnotes**

1. Data collection completed by Applied Research Center of Miami University.
2. Data analysis and interpretation completed by C. Jayne Brahler; University of Dayton.