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## **Summary Report on Action Research**

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A Summary of Findings on a Series of Action Research  
Projects Conducted by Goshen Community Schools

**Prepared by Marzano Research Laboratory**

for

Goshen Community Schools

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## Introduction

This report summarizes the findings of an analysis of a series of action research projects conducted by Goshen Community Schools at the elementary, middle, and high school levels. During the 2008-2009 school year, 40 teachers participated in independent action research studies regarding the extent to which a six step approach to direct vocabulary instruction enhanced the learning of students. (For additional information on the six step process see Marzano, 2004, pp. 91-103.)

Because students could not be randomly assigned to treatment and control groups, all independent action research studies employed a quasi-experimental design, referred to as a pretest-posttest non-equivalent groups design. The pretest scores were used as a covariate to partially control for differing levels of background knowledge and skill. Two teachers were excluded from analysis at the elementary school level due to discrepancies and/or anomalies in the data submitted for analysis. Additionally, one of the independent action research studies conducted at the middle school level was excluded from the aggregate analysis based on information provided by the teacher. The teacher's description indicated that the action research study focused on a series of general instructional strategies as opposed to the six step process. As such, 37 independent action research studies were considered for this summary report.

Participating teachers were asked to provide descriptions of their independent action research studies. Most of the teachers indicated that they utilized all of the steps in the six step approach to direct vocabulary instruction with their treatment groups while utilizing none of the steps with their control groups. Some of these teachers did indicate using step 1 (i.e., providing a description, explanation, or example of new terms) in their control groups. Additionally, some teachers indicated that they focused on one or more steps of the six step process. In some of these independent action research studies, the complete six step process was used in the treatment group while all but one of the steps was used in the control group. Based on descriptions provided, an assumption was made that some involved the use of only one or two of the steps in the treatment group while none of the steps were used in the control group.

## Findings Reported by School Level

Figure 1 shows a summary of the corrected meta-analytic findings for each action research project conducted at the elementary, middle, and high school levels (see Haystead, 2009a, 2009b, & 2009c). The column labeled "N" contains the number of studies included in the group, the column labeled " $\overline{ES}$ " contains the weighted mean effect size for the group of independent action research studies, the column labeled "95% CI" contains the 95 percent confidence interval for

the reported weighted mean effect size, and the column labeled “% Gain” contains the percentile gain (or loss) associated with the reported weighted mean effect size.

**Figure 1. Corrected Findings for School Level**

School Level	N	$\overline{ES}$	95% CI	% Gain
Elementary School	24	.65**	.28 to 1.03	24
Middle School	5	.89	-.24 to 2.01	31
High School	8	.45*	.13 to .77	17

\*  $p < .01$

\*\*  $p < .001$

Again, Figure 1 shows the reported corrected findings for the meta-analysis of the independent action research studies conducted at the elementary, middle, and high school levels. The weighted mean effect size is statistically significant for elementary school ( $p < .001$ ) and high school ( $p < .05$ ). The percentile gain was positive for all levels.

### Aggregate Findings

As mentioned in the report for middle school, information provided by the teachers indicated that the independent action research studies focused on one or more steps of the six step process (e.g., omitting a step, utilizing a specific step; see Haystead, 2009b). Additionally, information provided by two of the teachers in elementary school indicated a similar approach with respect to their independent action research studies (see Haystead, 2009a). As such, seven independent action research studies were excluded from the aggregate analysis regarding the overall effect of the use of the six step process on student achievement. Figure 2 displays the overall average effect size for the remaining studies.

**Figure 2. Overall Effects**

	N	$\overline{ES}$	95% CI	% Gain
Uncorrected	30	.59*	.33 to .86	22
Corrected	30	.68*	.38 to .98	25

\*  $p < .0001$

In Figure 2, the meta-analytic findings are reported two ways—one not corrected for attenuation due to lack of reliability in the dependent measure (i.e., teacher designed assessments of student academic achievement) and one corrected for attenuation. Technical Note 1 explains the method used to correct for attenuation and an interpretation of such corrections. Briefly though, when a dependent measure is not perfectly reliable it will tend to lower the strength of observed relationships between independent and dependent variables.

An independent variable is a factor which is assumed or hypothesized to have an effect on some outcome often referred to as the dependent variable. A dependent variable is an outcome believed to be influenced by one or more independent variables. For this analysis of the independent action research studies, the dependent variable is students' knowledge of academic content addressed during a unit of instruction and the independent variable of interest is the use of the six step process. It is always advisable to correct an observed effect size for attenuation (i.e., decrease in observed effect size) due to unreliability of the dependent measure (for a detailed discussion of attenuation see Hunter & Schmidt, 2004). In basic terms, every assessment is imprecise to some extent and this imprecision lowers the observed effect size. The corrected and uncorrected effect sizes are displayed for comparison. However, the discussion of findings is limited to the corrected results only.

When the results of the 30 independent action research studies are combined and corrected for attenuation, the overall percentile gain is 25 ( $\overline{ES} = .68$ ). This means that on the average, the six step approach to direct vocabulary instruction represents a gain of 25 percentile points over what would be expected if teachers did not use the six step approach (for a discussion of how effect sizes are combined and an overall significance level is computed see Lipsey & Wilson, 2001).

The third column, "95% CI" contains the 95 percent confidence interval for the effect size reported in the second column. Again, the effect size reported in Figure 2 is a weighted average of all the effect sizes from the 30 independent action research studies. As such, it is considered an estimate of the true effect size of the treatment (i.e., use of the six step process). The level of certainty with which this estimate accurately represents the true effect size is reported in the second column. The 95 percent confidence interval includes the range of effect sizes in which

one can be certain the true effect size falls. For example, consider the 95 percent confidence interval reported in the second row, .38 to .98. This indicates a 95 percent certainty that the true effect size for the analysis of the 30 independent action research studies is between the values of .38 and .98. When the confidence interval does not include .00, the weighted mean effect size is considered to be statistically significant ( $p < .05$ ). In other words,  $\overline{ES} = .00$  would not be considered a reasonable possibility. In fact, the  $p$ -value associated with the reported effect size is less than .0001 indicating it is highly significant in laymen's terms. (For a detailed discussion of the meaning of statistical significance see Harlow, Muliak, & Steiger, 1997.)

### Summary

The overall effects for the 30 independent action research studies considered for meta-analysis exhibited a statistically significant positive effect ( $p < .0001$ ). This level of significance is generally interpreted as an indication that the observed differences could have occurred less than one time in ten thousand if there is no true relationship between use of the six step approach to direct vocabulary instruction and student achievement. When corrected for attenuation, the percentile gain associated with the use of the six step process is 25 ( $\overline{ES} = .68$ ). A reasonable inference is that the overall effect of a 25 percentile point gain is probably not a function of random factors that are specific to the independent action research studies; rather, the 25 percentile point increase represents a real change in student learning.

## Technical Notes

Technical Note 1: In Figure 2, the meta-analytic findings are reported two ways—uncorrected and corrected. The corrected findings have been corrected for attenuation due to a lack of reliability in the dependent measure (i.e., teacher designed assessments of student academic achievement). Hunter and Schmidt detail the rationale and importance of correcting for 11 attenuation artifacts—one of which is random error associated with measurement of the dependent variable (2004, pp. 301-313). They explain:

. . . error of measurement in the dependent variable reduces the effect size estimate. If the reliability of measurement is low, the reduction can be quite sizable. Failure to correct for the attenuation due to error of measurement yields an erroneous effect size estimate. Furthermore, because the error is systematic, a bare-bones meta-analysis on uncorrected effect sizes will produce an incorrect estimate of the true effect size. The extent of the reduction in the mean effect size is determined by the mean level of reliability across the studies. Variation in reliability across studies causes variation in the observed effect size above and beyond that produced by sampling error. . . . A bare-bones meta-analysis will not correct for either the systematic reduction in the mean effect size or the systematic increase in the variance of effect sizes. Thus, even meta-analysis will produce correct values for the distribution of effect sizes only if there is a correction for the attenuation due to error of measurement. (p. 302)

For ease of discussion we consider correcting for attenuation due to unreliability in the dependent measure using the population correlation instead of the population standardized mean difference effect size. The reader should note that the example provided regarding correcting correlations is analogous to correcting a standardized mean difference. To illustrate correcting for attenuation due to unreliability in the dependent measure, assume that the population correlation between the use of the six step approach to direct vocabulary instruction and student academic achievement is .50. A given study attempts to estimate that correlation but employs a measure of the dependent variable (i.e., a teacher designed assessment of student academic achievement) that has a reliability of .81—considered a typical reliability for a test of general cognitive ability. According to attenuation theory, the correlation would be reduced by the square root of the reliability (i.e., the attenuation factor). In other words, the population correlation is multiplied by the attenuation factor ( $\sqrt{.81} = .90$ ), thus reducing the correlation by 10 percent. Therefore, the observed correlation will be .45 (.50 x .90) even if there is no attenuation due to the other ten artifacts listed by Hunter and Schmidt (2004, p. 35). When the measure of the dependent variable has a lower reliability, .36 for example, the correlation is reduced by 40 percent ( $\sqrt{.36} = .60$ ) to .30 (.50 x .60). In order to make a correction for

attenuation, the correlation is divided by the attenuation factor (i.e., the square root of the reliability).

For the purposes of this report, an estimate of reliability was used. Osborne (2003) found that the average reliability reported in psychology journals is .83. Lou and colleagues (1996) report a typical reliability of .85 for standardized achievement tests and a reliability of .75 for unstandardized achievement tests. Because the dependent measure in the independent action research studies involved teacher designed assessments of student academic achievement, .75 was used as the reliability to correct for attenuation using the following formula:

$$d_c = \frac{d_o}{a}$$

In the formula,  $d_c$  is the corrected effect size,  $d_o$  is the observed effect size, and  $a$  is the attenuation factor (the square root of the reliability). Using this formula, the reported effect size for each independent action research study (see Haystead, 2009a, 2009b, & 2009c) was corrected for attenuation to produce the corrected meta-analytic findings considered in this summary report.

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