Marzano Research Laboratory
Powered by Solution Tree

Report on Action Research

An Analysis of the Effects of a Six Step Approach to Direct Vocabulary Instruction on Student Achievement at the Middle School Level

Prepared by Marzano Research Laboratory

for

Goshen Community Schools

April, 2009
(04)

MARZANO RESEARCH LABORATORY
www.MarzanoResearch.com
Phone: 812-336-7700 ● Fax: 866-308-3135

Marzano Research Laboratory
Powered by Solution Tree

OUR MISSION
To provide the best research, the most useful actions, and the highest level of services to educators.

OUR VISION
To continuously develop tools that translate high quality educational research into practical applications educators can put to immediate use.

OUR GOAL
To be the place educators go for the latest information and data, synthesized into clear, concise resources that facilitate immediate action.

REPORT AUTHOR
Mark W. Haystead

BUSINESS DEVELOPMENT OFFICE
555 N Morton Street
Bloomington, IN 47404
Phone 888.849.0851
Fax 812.336.7790

RESEARCH CENTER
9000 E Nichols Ave Ste 210
Centennial, CO 80112
Phone 303.766.9199
Fax 303.694.1778

www.MarzanoResearch.com

Table of Contents

Executive Summary

This report describes the findings of an analysis of a series of action research projects conducted by Goshen Community Schools at the middle school level. During the 2008-2009 school year, six teachers at Goshen Middle School 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.

Information provided by participating teachers indicates 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). Therefore, the findings for each independent action research study apply only to the use or omission of the specific step or steps reported for that study.

Additionally, one of the studies 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, only five independent action research studies were analyzed using meta-analytic techniques.

The average effect size for the five studies was not statistically significant. When corrected for attenuation, the percentile gain associated with the use of the six step approach to direct vocabulary instruction is 31 ($\overline{ES} = .89$). Though not statistically significant, a reasonable inference is that the overall effect of a 31 percentile point gain is probably not a function of random factors that are specific to the independent action research studies; rather, the 31 percentile point increase represents a real change in student learning.

Introduction

This report describes the findings of an analysis of a series of action research projects conducted by Goshen Community Schools at the middle school level. During the 2008-2009 school year, six teachers at Goshen Middle School 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.)

Action Research Design

Participating teachers selected two groups of students both of which were being taught the same unit or set of related lessons. However, in one group (the "treatment" group) the six step process was used, whereas in the other group (the "control" group) only part of the six step process was used. Because students could not be randomly assigned to treatment and control groups, all studies employed a quasi-experimental design, referred to as a pretest-posttest non-equivalent groups design. These groups are considered to be non-equivalent, since it is unlikely that the two groups would be as similar as they would if assigned through random lottery.

A pretest and posttest was administered to students in both groups. The pretest scores were used to statistically "adjust" the posttest scores using a technique referred to as analysis of covariance (ANCOVA). In basic terms, the adjustment translates the posttest scores into those that would be expected if students in both groups started with the same scores on the pretest. In effect, it is a way of controlling for students' differences in what they know about a topic prior to the beginning of instruction on the topic (see Technical Note 1). ANCOVA is commonly used when random assignment is not possible. Although ANCOVA was used to statistically equate students in terms of prior academic knowledge, arguments about causal relationships are not as strong as they would be when group members are assigned through a random lottery.

Again, teachers were instructed to teach a short unit on a topic of their choice to two groups of students—one treatment and one control. Instructional activities in both groups were to be as similar as possible except for the fact that the entire six step process was used in one group only (i.e., the treatment group), and in the other group (i.e., the control group) parts of the six step process were used. Directions provided to teachers are reported in Appendix A.

Findings Reported by Teacher

Figure 1 presents the ANCOVA findings and associated effect size for each of the teachers involved in the independent action research studies. The columns labeled “Adjusted Mean” contain the posttest mean adjusted for differences in the pretest scores for the control and treatment groups respectively (number of students reported in parentheses). The column labeled “Sig.” contains the *p*-value for each study computed at a significance level of 5% ($\alpha = .05$). Basically, if the value in this column is less than .05, the effect size reported for the study can be considered statistically significant. In other words, a reasonable inference can be made that the reported effect size is probably not a function of random factors that are specific to each reported study; rather, the reported effect size represents a real change in student learning (for a detailed discussion of the meaning of statistical significance see Harlow, Muliak, & Steiger, 1997). The column labeled “ES” contains the calculated effect size for each study computed as Cohen’s δ. Effect size is the difference in the average score of the control group and the treatment group stated in standard deviation units. Thus, an effect size of 1.00 would indicate that the average score in the treatment group is one standard deviation higher than the average score in the control group. The column labeled “% Gain” contains the percentile gain (or loss) in achievement associated with the treatment (i.e., use of the six step process). (For a discussion of effect size and associated percentile gain see Technical Note 2.)

Figure 1: Findings for Individual Teachers

Teacher	Grade	Adjusted Mean (Control)	Adjusted Mean (Treatment)	Sig.	ES	% Gain
1[a]	7	82.71 (n=25)	90.33 (n=22)	.039	.64	24
2[b]	6	2.30 (n=30)	1.86 (n=30)	.000	1.52	44
3[c]	6-8	15.48 (n=12)	23.80 (n=9)	.000	2.87	50
4[d]	8	78.77 (n=29)	75.81 (n=17)	.450	-.24	-9
5[d]	7	74.68 (n=38)	61.44 (n=43)	.022	-.53	-20
6[e]	7	86.37 (n=31)	83.02 (n=22)	.298	-.30	-7

a. Utilized step 6 – interactive games (see Marzano, 2004, pp. 102-103).

b. Omitted step 5 – student discussion (see Marzano, 2004, pp. 101-102).
c. Utilized step 2 – student restatement using vocabulary notebook (see Marzano, 2004, pp. 94-96) and step 6 – interactive games (see Marzano, 2004, pp. 102-103).
d. Omitted step 6 – interactive games (see Marzano, 2004, pp. 102-103).
e. Utilized step 3 – nonlinguistic representations (see Marzano, 2004, pp. 96-97) and step 5 – student discussion (see Marzano, 2004, pp. 101-102).

Figure 1 presents the findings for six independent action research studies conducted at the middle school level. When considering the information displayed in the figure, it should be noted that the data for each study was checked for obvious coding errors, negative gains, and other potential outliers. Typically, when negative gains are excluded one has a better sense of the uniform effects of the treatment. In other words, assuming that students learn more about academic content during a unit of instruction, it would not make sense for a student to know less about the academic content at the end of the unit. “Learning theory and common sense tell us that a student might start a grading period with little or no knowledge regarding a topic but end the grading period with a great deal of knowledge” (Marzano, 2006, pp. 96-97). As such, students who scored higher on the pretest were excluded from analysis. It should be mentioned that information provided by participating teachers indicates 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 Figure 1 footnotes). Therefore, the findings for each independent action research study apply only to the use or omission of the specific step or steps reported for that study.

Of particular interest is the column entitled “% Gain.” Again, this column contains the percentile gain (or loss) in achievement associated with the treatment (i.e., use of the six step process). This value was determined by consulting a normal curve table for the area for each reported effect size. Effect size, again, is the difference between the treatment group and control group means expressed in standard deviation units (for a discussion of effect size see Lipsey & Wilson, 2001).

To understand the interpretation of an effect size consider the results reported in the first row of Figure 1. The adjusted mean for the control group was 82.71 (n = 25) and the adjusted mean for the treatment group was 90.33 (n = 22). The percentile gain for this study is 24 (ES = .64). This means that the average score in the treatment group is 24 percentile points **greater than** the average score in the control group.

It should be noted that for some of the studies the reported percentile gain is negative. This occurs when the adjusted mean for the treatment group is **less than** the adjusted mean for the control group. For example, the percentile “gain” reported in the fourth row of Figure 1 is negative 9 (-9, ES = -.24). This means that the average score in the control group is 9 percentile points greater than the average score in the treatment group.

Considered in isolation, two of the studies did not exhibit statistical significance ($p < .05$). Again, for an individual study to be considered statistically significant, the reported *p*-value should be .05 or lower (see Murphy & Myors, 2004). According to this criterion, four of the studies can be considered statistically significant. When the results of a set of studies are combined using meta-analytic techniques, the findings considered as a group might be statistically significant even though a number of the individual studies are not significant. In fact this is quite common in educational research where many individual studies might be deemed non-significant simply because they do not have enough subjects in the experimental and control groups. However, when these studies are combined using meta-analytic techniques the combined finding is often highly significant (for a detailed discussion see Hedges & Olkin, 1985). This is not the case with the present set of studies. One possible explanation is that there were simply not enough studies conducted. If more studies were conducted at the middle school level, the statistical significance of meta-analytic findings would most likely change.

Meta-analytic findings are typically reported in 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 3 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 complete 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. Throughout this report, corrected and uncorrected effect sizes are displayed for comparison. When this is the case, the discussion of findings is limited to the corrected results only.

Figure 2 shows the overall average effect size for five of the six independent action research studies considered for meta-analysis. Teacher 6 was excluded from 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. The column labeled "N" contains the number of studies included in the group, the column labeled "$\overline{ES}$" contains the weighted random effects 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 2. Overall Effects

	N	$\overline{ES}$	95% CI	% Gain
Uncorrected	5	.76	-.23 to 1.75	28
Corrected	5	.89	-.24 to 2.01	31

Recall from the discussion of Figure 1 that the independent action research studies focused on the use of the complete six step process as opposed to the incomplete process or specific steps within the process. When the results of the five independent action research studies are combined and corrected for attenuation, the overall percentile gain is 31 ($\overline{ES} = .89$). This means that on the average, the complete six step process represents a gain of 31 percentile points over what would be expected if teachers did not use the complete process. (For a discussion of how effect sizes are combined and an overall significance level is computed see Lipsey & Wilson, 2001.)

The second column, "95% CI" contains the 95 percent confidence interval for the effect size reported in the first column. Again, the effect size reported in Figure 2 is a weighted average of all the effect sizes from the six 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, -.24 to 2.01. This indicates a 95 percent certainty that the true effect size for the analysis of the five independent action research studies is between the values of -.24 and 2.01. 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. (For a detailed discussion of the meaning of statistical significance see Harlow, Muliak, & Steiger, 1997.)

Another way to examine the general effect of the use of the six step approach to direct vocabulary instruction in the classroom is to consider the distribution of effect sizes and percentile gain associated with the effect sizes. Figures 3 and 4 present the distribution of effect sizes and associated percentile gain respectively.

Figure 3. Distribution of Effect Sizes

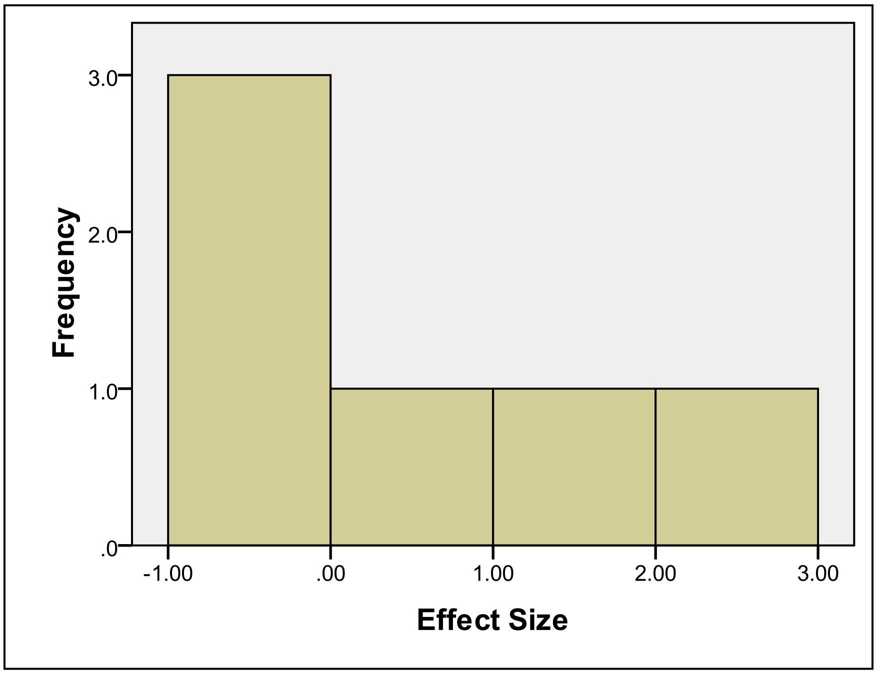

Figure 3 reports the distribution of "groups" of effect sizes across the six independent action research studies. Three studies exhibited a negative effect size (see first column), one study exhibited an effect size between .00 and 1.00 (see second column), one study exhibited an effect size between 1.00 and 2.00 (see third column), and one study exhibited an effect size greater than 2.00 (see last column). So, three out of six studies (or 50%) have a positive effect size.

Figure 4. Distribution of Percentile Gains

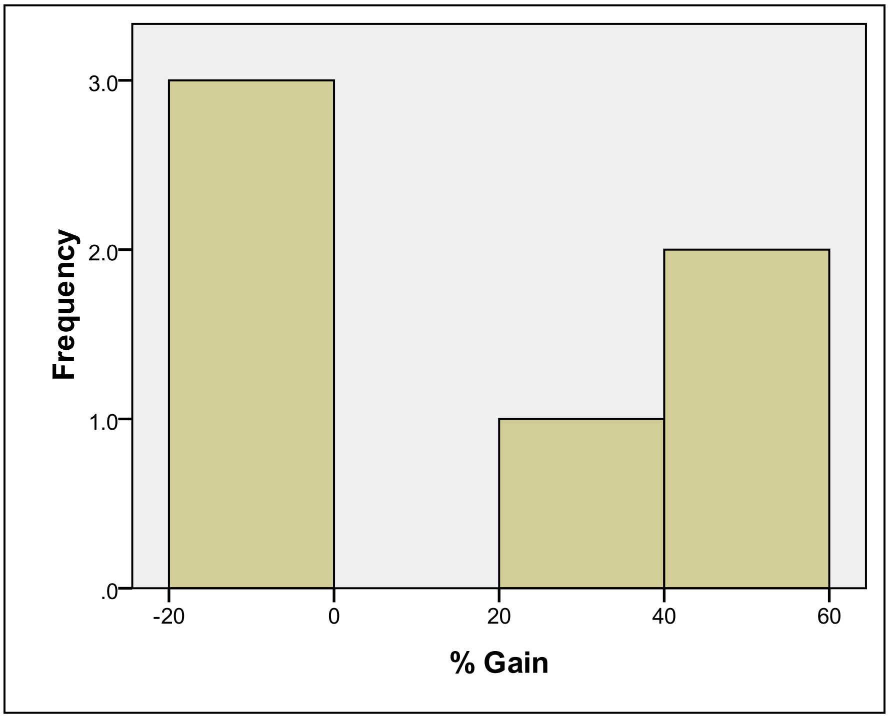

Figure 4 reports the distribution of "groups" of percentile gains associated with the reported effect sizes across the six independent action research studies. Three studies exhibited a negative percentile gain (see first column), one study exhibited a percentile gain between 20 and 40 (see second column), and two studies exhibited a percentile gain greater than 40 (see last column). Again, three out of six studies (or 50%) have a positive percentile gain.

Findings Reported by Variation of the Six Step Process

As mentioned previously, teachers reported focusing on one or more steps of the six step process in their independent action research studies (see Figure 1 footnotes). The results of each study were grouped and analyzed by the strategy that was utilized or omitted as part of the six step process. Figures 5 and 6 present these findings.

For most of the independent action research studies, submitted data was analyzed with the treatment group using the entire six step process and the control group omitting one or more of the steps. It should be noted that based on the information supplied by teacher 1 an assumption was made that only step 6 (i.e., interactive games) was utilized with the treatment group. Based on information supplied by teacher 3 an assumption was made that only step 2 (i.e., student restatement of terminology using vocabulary notebooks) and step 6 (i.e., interactive games) was utilized with the treatment group. Again, teacher 6 was excluded from the meta-analysis.

Figure 5. Strategy Effects (Uncorrected)

Strategy	N	$\overline{ES}$	95% CI	% Gain
Interactive Games	4	.55	-.49 to 1.58	21
Student Discussion	1	1.52	-.49 to 3.53	44
Vocabulary Notebook	1	2.87*	.59 to 5.16	50

Note: See discussion of Figure 2 for a description of column headings.
* $p < .05$

Figure 6. Strategy Effects (Corrected)

Strategy	N	$\overline{ES}$	95% CI	% Gain
Interactive Games	4	.64	-.51 to 1.79	24
Student Discussion	1	1.75	-.49 to 3.99	46
Vocabulary Notebook	1	3.32*	.79 to 5.86	50

Note: See discussion of Figure 2 for a description of column headings.
* $p < .05$

Figures 5 and 6 show the uncorrected and corrected effects for each target strategy utilized or omitted as part of the six step approach to direct vocabulary instruction. The effect size is statistically significant for using vocabulary notebooks as part of the second step of the six step process ($p < .05$). The percentile gain is positive for all three strategies.

Interpretation

There are a number of ways to interpret an effect size. Up to this point, this report has used the expected percentile gain. Another interpretation is the amount of overlap between the treatment and control groups. Consider again that an effect size of 1.00 can be interpreted as the average score in the treatment group being one standard deviation higher than the average score in the control group. Given that the associated percentile gain is 34 (ES = 1.00), the mean of the treated group is at the 84th percentile of the control group (50% + 34% = 84%). Stated differently, the score of the average person in the treated group exceeds the scores of 84 percent of the control group. Only 16 percent of the control group would be expected to have scores that exceed the score of the average person in the treated group. If the treatment and control groups both contained 29 students, the average student in the treatment group (i.e., the one ranked 15th in the group) would have scored about the same as the student ranked 5th in the control group. Figure 7 displays the overall results for the five independent action research studies considered for meta-analysis based on this interpretation.

Figure 7. Interpretation of Overall Effects.

	$\overline{ES}$	**Percentage of Control Group Scoring Lower than Treatment Mean**	**Rank of Average Student in Treatment Group (i.e., the Student Ranked 15th in the Treatment Group) in Control Group of 29**
Uncorrected	.76	78%	6
Corrected	.89	81%	5

Figure 7 depicts the percentage of control group students who have scored lower than the average student in the treatment group (see next to last column) along with the rank of the student in the control group who would be equivalent to the average student (i.e., the student ranked 15th) in the treatment group (see last column). When corrected for attenuation, the average student in the treatment group (i.e., the group that used the entire six step process) scored higher than 81 percent of the students in the control group (i.e., the group that only used part of the six step process) and would be ranked 5th in the control group as opposed to 15th in the treatment group.

Summary

The overall effects for the five independent action research studies considered for meta-analysis did not exhibit statistical significance. When corrected for attenuation, the percentile gain associated with the use of the complete six step process as opposed to parts of the process is 31 ($\overline{ES} = .89$). Though not statistically significant, a reasonable inference is that the overall effect of a 31 percentile point gain is probably not a function of random factors that are specific to the independent action research studies; rather, the 31 percentile point increase represents a real change in student learning.

Additionally, information provided by participating 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). The results of each study were grouped and analyzed by the strategy that was utilized or omitted as part of the six step process. The meta-analytic findings indicate that omitting a step in the process has a potentially detrimental effect on student achievement. When one or two steps of the six step process were used in one group (i.e., the treatment group) and not in the other group (i.e., the control group), the findings indicate that the use of those steps have a positive effect on student achievement.

Technical Notes

Technical Note 1: Conceptually, analysis of covariance (ANCOVA) can be thought of as using the covariate (i.e., pretest score) to predict students' performance on the posttest and then using the residual scores for each student as the dependent measure. To illustrate, consider an independent action research study for a topic within mathematics. Using ANCOVA, students' posttest scores were predicted using the scores received on the pretest. The difference between the predicted posttest scores and the observed posttest scores was then computed for each student that took both pretest and posttest. This difference is referred to as the residual score for each student. It represents the part of each student's posttest score that cannot be predicted from the pretest score for that student. Theoretically, use of residual scores based on pretest predictions is an attempt to equate all students on the dependent measure prior to execution of the intervention—in this case the use of the six step approach to direct vocabulary instruction. However, in actual practice this interpretation may not always be appropriate (see Berk 2004).

Technical Note 2: In Figure 1, the column labeled "ES" contains the calculated effect size for each study computed as Cohen's δ using the following formula:

$$d = \frac{r}{\sqrt{(1-r^2)(p(1-p))}}$$

where *p* is the proportion of the total population in one of the two groups (i.e., the treatment group). Partial eta squared (η_p^2) as calculated by SPSS was used to determine partial eta (η_p) as an estimate for *r* (the effect size correlation) by taking its square root. This formula is used to compute the effect size from an effect size correlation (e.g., the point-biserial correlation coefficient) when the treatment and control group populations are not equal (i.e., treatment N $\neq$ control N) (see Lipsey & Wilson, 2001, pp. 62-63). Again, partial eta (η_p) was used as an estimate for the point-biserial coefficient in the formula.

The generic term *effect size* applies to a variety of indices (e.g., *r, R*, and *PV*) that can be used to demonstrate the effect of an independent variable (e.g., use of the six step process) on a dependent variable (e.g., student academic achievement). As used in this report, effect size means the standardized mean difference effect size. This index, first popularized by Glass (1976) and Cohen (1977), is the difference between treatment and control means divided by an estimate of the population standard deviation.

$$\textit{standardized mean difference effect size} = \frac{\textit{mean of treatment group} - \textit{mean of control group}}{\textit{estimate of population standard deviation}}$$

Consider the following illustration of the use of effect size. Assume that the achievement mean of a group of students in a class that used the six step approach to direct vocabulary instruction is 90 on a standardized test and the mean of a group of students in a class that did not use the six step approach to direct vocabulary instruction is 80. Assuming the population standard deviation is 10, the effect size would be as follows:

$$ES = \frac{90 - 80}{10} = 1.0$$

This effect size leads to the following interpretation: The mean of the treatment group is 1.0 standard deviation larger than the mean of the control group. One could infer from this that use of the six step approach to direct vocabulary instruction raises achievement test scores by one standard deviation. Therefore, the effect size expresses the differences between means in standardized or "Z score" form, which gives rise to another index frequently used in research regarding education—percentile gain.

Percentile gain is the expected gain (or loss) associated with the effect size expressed in percentile points of the average student in the treatment group compared to the average student in the control group. By way of illustration, consider the same example. An effect size of 1.0 can be interpreted as the average score in the treatment group being about 34 percentile points greater than the average score in the control group. Again, the effect size translates the difference between group means into Z score form. Distribution theory dictates that a Z score of 1.0 is at the 84.13 percentile point of the standard normal distribution. To determine the percentile gain, the effect size is transformed into percentile points above or below the 50th percentile point on the unit normal distribution.

Technical Note 3: The meta-analytic findings in this report are typically reported in 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, each effect size reported in Figure 1 was corrected for attenuation to produce the corrected meta-analytic findings considered in this report.

Appendix A: Instructions for Action Research

Thank you for agreeing to participate in an action research study regarding the effectiveness and utility of instructional strategies in your classroom. To be involved in a study you must be willing to do a few things. First you should select a specific unit of instruction, or set of related lessons on a single topic (hereinafter referred to as unit) and design a pretest and posttest for that unit. It is best if the unit is relatively short in nature. For example, if you teach mathematics, you might select a two week unit on linear equations. At the beginning of the unit, you would administer a pretest on linear equations. Then at the end of the unit you would administer a posttest. This test could be identical to the pretest, or it could be different. The important point is that you have a pretest and a posttest score for each student on the topic of linear equations. Ideally the pretest and posttest are comprehensive in nature. During this unit of instruction you would make sure you use your target instructional strategy whenever and in ways you believe it to be applicable.

Second, you must deliver the same unit to another group of students. This, of course, means that you are teaching the same unit to two different groups of students. Ideally you would teach the unit to the two groups during the same period of time. You would administer the same pretest and posttest to this other group of students; however, you would NOT use your target instructional strategy with this second group.

If you are an elementary school teacher and do not have two different classes of students then you would teach two different units within the same subject area to the same students. For example, you might select the subject area of writing. First you would teach a two week unit of instruction on writing essays that focus on logical progression of ideas with good transition sentences. You would begin the unit with a pretest composition that is scored using a rubric specifically designed to measure students' logical progression of ideas and use of good transition sentences. At the end of the unit you would assign another composition, this one used as a posttest. Again you would score the composition using the same rubric. During this unit of instruction, you would make sure you use your target instructional strategy whenever and in ways you believe it to be applicable. Then, you would teach a two week unit of instruction on writing essays with a clear purpose for a specific audience. As before, you would begin the unit with a pretest composition that is scored using a rubric specifically designed to measure students' presentation of a clear purpose for a specific audience. At the end of the unit you would assign another composition, this one used as a posttest. Again you would score the composition using the same rubric. During this unit of instruction you would NOT use your target instructional strategy.

Pretest and posttest scores for each student would be recorded on the forms below, along with general demographic information for each student. Please note there is no space for including student names or other means of identifying each student. This has been done intentionally to comply with student privacy requirements. This is an anonymous action research study; do NOT include any student names, id numbers, or other student identifiers on the data sheets you submit to the project leader in your school or district. Finally both pretest and posttest scores should be translated to a percentage format. For example, if your pretest involves 20 points and a particular student receives a score of 15, then translate the 15 into a percentage of 75% (i.e. 15/20 = .75 x 100 = 75%) and record that as the pretest score for the student. If your posttest involves 80 points and that same student receives a score of 75, then translate the 75 into a percentage of 94% (75/80 = .94 x 100 = 94%) and record that as the student's posttest score. The same procedure would be employed if you used a rubric. For example, if a student received a 2 on a 4 point rubric on the pretest, this score would be translated to a percentage of 50% (2/4 = .50 x 100) and this would be recorded as the student's pretest score. The same translation would be done on the student's rubric score for the posttest.

It is imperative that you keep track of each student's pretest scores and posttest scores and make sure they match when your data sheet (below) is filled out. If posttest scores are not aligned with the pretest scores for particular students then the data cannot be used.

When you have completed the study please fill out the forms below and submit them to the project leader in your school or district. Note: if your school or district has obtained an approved electronic version of these forms, completing the electronic version is preferred.

The first data form asks you to provide general information about your school. It also asks you to provide a personal ID Number as opposed to your name. This is because the results of the action research projects will be reported in an anonymous fashion. Only you will know which results apply to your students. This is important, as supplying your name removes the anonymity from the action research project. Please do NOT use your name, or any part of your name, as your personal ID Number. Alternatively, your project leader can randomly assign an alpha-numeric identifier based on the school or district name and a number. For example, district1, district2, school1, school2, etc. Longer names could also be shortened to initials. For example, DPS1, DPS2, etc.

The second and third forms ask you to provide demographic information about your students along with their pretest and posttest scores. The second form is for students in the group that used the target instructional strategy. The third form is for students in the group that did NOT use the target instructional strategy. Please use the ethnicity codes listed at the bottom of each form when filling out the demographic information for your students.

The final form is a brief survey regarding your general experience as a teacher and your use of the target instructional strategy.

In addition to these requirements, you might be asked to be videotaped during a single lesson (out of the unit of instruction, or set of related lessons) of your choosing that utilizes the target instructional strategy. The video camera should be set up in such a way as to capture you and your students interacting with the technology, perhaps off to one side of the classroom. It would be helpful, if someone could periodically pan the classroom, to capture as much of the class as possible. In order to address student privacy concerns, please refrain from addressing students by name during the videotaped lesson.

Thank you again for considering involvement in an action research project.

Study Information

School ____________________________

Personal ID Number ______________________________

Grade level taught___________________________

Topic (and general subject area) addressed during the unit where the target instructional strategy was used_________________________________

Number of days the unit lasted___________

Topic (and general subject area) addressed during the unit where the target instructional strategy was NOT used_________________________________

Number of days the unit lasted___________

Were both classes comprised of different students? (Y/N) _______

General description of what you did:

Target Instructional Strategy Class:

Non-Target Instructional Strategy Class

Scores for Students in the Group that **Used** the Target Instructional Strategy

Student	Gender	Ethnicity	Free/Reduced Lunch (Y/N)	English Language Learner (Y/N)	Special Education (Y/N)	Pretest Score	Posttest Score
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							

Ethnicity Code: A – Asian, AA – African American, C – White/Caucasian, H – Hispanic, N – Native American, O - Other

Scores for Students in the Group that **Did Not Use** the Target Instructional Strategy

Student	Gender	Ethnicity	Free/Reduced Lunch (Y/N)	English Language Learner (Y/N)	Special Education (Y/N)	Pretest Score	Posttest Score
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							

Ethnicity Code: A – Asian, AA – African American, C – White/Caucasian, H – Hispanic, N – Native American, O - Other

Teacher Survey

How long have you been teaching? ___________

How long have you used your target instructional strategy in your classroom? _____________

How confident are you in your ability to use your target instructional strategy in your classroom?

Not at all				Completely
1	2	3	4	5

References

Berk, R. A. (2004). *Regression analysis: A constructive critique.* Thousand Oaks, CA: SAGE Publications.

Cohen, J. (1977). *Statistical power for the behavioral sciences* (Rev. ed.). New York: Academic Press.

Glass, G. V. (1976). Primary, secondary, and meta-analyses of research. *Educational Researcher, 5,* 3-8.

Harlow, L.L., Muliak, A. A., & Steiger, J. H. (Eds.). (1997). *What if there were no significance tests?* Mahwah, NJ: Erlbaum.

Hedges, L. V., & Olkin, I. (1985). *Statistical methods for meta-analysis.* Orlando, FL: Academic Press, Inc.

Hunter, J. E., & Schmidt, F. L. (2004). *Methods of meta-analysis: Correcting error and bias in research findings* (2nd ed.). Thousand Oaks, CA: SAGE Publications.

Lipsey, M. W., & Wilson, D. B. (2001). *Practical meta-analysis.* Thousand Oaks, CA: SAGE Publications.

Lou, Y., Abrami, P. C., Spence, J. C., Poulsen, C., Chambers, B., & d'Apollonia, S. (1996). Within-class grouping: A meta-analysis. *Review of Educational Research, 66* (4), 423-458.

Marzano, R. J. (2004). *Building background knowledge for academic achievement.* Alexandria, VA: Association for Supervision and Curriculum Development.

Marzano, R. J. (2006). *Classroom assessment and grading that work.* Alexandria, VA: Association for Supervision and Curriculum Development.

Murphy, K. R., & Myors, B. (2004). *Statistical power analysis: A simple and general model for traditional and modern hypothesis tests* (2nd ed.). Mahwah, NJ: Erlbaum.

Osborne, J. W. (2003). Effect sizes and disattenuation of correlation and regression coefficients: Lessons from educational psychology. *Practical Assessment, Research and Evaluation, 8* (11). Retrieved March 20, 2009, from http://PAREonline.net/getvn.asp?v=8&n=11.