Preliminary Report

Evaluation Study of the Effects of Promethean ActivClassroom on Student Achievement

Prepared by Marzano Research Laboratory

for

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Executive Summary

This evaluation study examined the effects of Promethean ActivClassroom on student achievement. During the 2008-2009 school year, 79 teachers from 50 schools throughout the country participated in independent studies to determine the effect Promethean ActivClassroom has on students' achievement in their classrooms.

The evaluation study involved 1,716 students in the treatment group and 1,622 students in the control group. In the treatment group, teachers used Promethean ActivClassroom to augment their instructional practices. In the control group, teachers used strategies and materials to facilitate instruction without the use of Promethean ActivClassroom. The specifics of Promethean ActivClassroom can be found at Promethean's website (see http://www.prometheanworld.com).

Because students could not be randomly assigned to treatment and control groups, this study employed a quasi-experimental design, referred to as a pretest-posttest non-equivalent groups design. The pretest scores were used as a covariate to statistically equate the students and partially control for differing levels of background knowledge and skill. Some teachers participated in more than one independent study. As such, 85 independent treatment/control studies were considered for analysis.

The evaluation study attempted to answer the following questions through a meta-analysis of the independent treatment/control studies:

Evaluation Question 1: What effect does Promethean ActivClassroom have on students' achievement regarding the subject matter content taught by their teachers?
Evaluation Question 2: Does the effect of Promethean ActivClassroom differ between school levels?
Evaluation Question 3: Does the effect of Promethean ActivClassroom differ between grade levels?
Evaluation Question 4: Does the effect of Promethean ActivClassroom differ between academic content areas?
Evaluation Question 5: Does the effect of Promethean ActivClassroom differ based on length of teaching experience?
Evaluation Question 6: Does the effect of Promethean ActivClassroom differ based on how long the teacher has used the technology?
Evaluation Question 7: Does the effect of Promethean ActivClassroom differ based on the percentage of instructional time the technology is used in the classroom?
Evaluation Question 8: Does the effect of Promethean ActivClassroom differ based on teachers' confidence in their use of the technology?

The average effect size for all 85 independent treatment/control studies was statistically significant ($p < .0001$). When corrected for attenuation, the percentile gain associated with the use of Promethean ActivClassroom is 17 percent ($\overline{ES} = .44$). A reasonable inference is that the

overall effect of a 17 percentile point gain is probably not a function of random factors that are specific to the independent treatment/control studies; rather, the 17 percentile point increase represents a real change in student learning.

The meta-analytic findings suggest relatively large percentile gains in student achievement under the following conditions:

- a teacher has 10 years or more of teaching experience
- a teacher has used the technology for two years or more
- a teacher uses the technology between 75 and 80 percent of the time in his or her classroom
- a teacher has high confidence in his or her ability to use the technology

Additionally, lower than anticipated effects at the seventh grade level warrant further investigation.

Introduction

This report describes the preliminary findings for the evaluation study of the effects of Promethean ActivClassroom (hereinafter referred to as Promethean technology) on student achievement conducted by Marzano Research Laboratory (MRL). During the 2008-2009 school year, 79 teachers from 50 schools throughout the country participated in independent studies regarding the effect of Promethean technology on student achievement. A more thorough analysis of data collected is being conducted and will be followed by more detailed reports.

Design of the Evaluation Study

At a very basic level, the evaluation study as reported here asks the following question:

Evaluation Question 1: What effect does Promethean technology have on students' achievement regarding the subject matter content taught by their teachers?

Specifically, the evaluation study employs one primary independent variable: whether teachers use Promethean technology to augment their current instructional practices (referred to as the *treatment* group) or do not use Promethean technology to augment their current instructional practices (referred to as the *control* group).

Additionally, the evaluation study seeks to answer the following questions through a meta-analysis of the independent treatment/control studies:

Evaluation Question 2: Does the effect of Promethean technology differ between school levels?
Evaluation Question 3: Does the effect of Promethean technology differ between grade levels?
Evaluation Question 4: Does the effect of Promethean technology differ between academic content areas?
Evaluation Question 5: Does the effect of Promethean technology differ based on length of teaching experience?
Evaluation Question 6: Does the effect of Promethean technology differ based on how long the teacher has used the technology?
Evaluation Question 7: Does the effect of Promethean technology differ based on the percentage of instructional time the technology is used in the classroom?
Evaluation Question 8: Does the effect of Promethean technology differ based on teachers' confidence in their use of the technology?

The findings of the independent treatment/control studies were analyzed with meta-analytic techniques (explained below) using seven types of moderator variables reflected in evaluation questions 2 through 8: students' school level (elementary school, middle school, high school); students' grade level (K-12); academic content area; length of teaching experience (reported in years); length of time Promethean technology has been used by the teacher (reported in months);

percentage of classroom time Promethean technology is used; and teachers' reported confidence level in the use of the technology.

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. A moderator variable is a qualitative or quantitative factor that affects the direction and/or strength of the relation between the dependent and independent variables. For this evaluation study, the dependent variable is students' knowledge of academic content addressed during a unit of instruction. Again, the primary independent variable of interest is the use of Promethean technology to augment current instructional practices in the classroom. Secondary independent variables of interest are treated as moderators.

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. The pretest scores were used as a covariate to statistically equate the students and partially control for differing levels of background knowledge and skill. Analysis of covariance (ANCOVA) is commonly used when random assignment is not possible (see Technical Note 1).

One unique feature of this evaluation study is that (in general) each teacher served as his or her own control. At the secondary level, 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 Promethean technology was used in one group only (i.e., the treatment group). At the elementary grades—particularly the lower elementary grades—it is common that an individual teacher has one group of students for the entire year. Consequently, these teachers do not have the opportunity to teach the same unit to two groups of students. In such situations teachers were instructed to teach two separate units to the same group of students. The first unit was to be considered the treatment group in that the Promethean technology was used. The second unit was to be considered the control group in that the Promethean technology was not used. Teachers were asked to ensure that the subject matter of each unit was as closely related as possible. Directions provided to teachers are reported in Appendix A.

The Use of Meta-Analysis

As mentioned above, meta-analytic techniques (see Hedges & Olkin, 1985; Lipsey & Wilson, 2001) were used to aggregate the findings from the independent treatment/control studies using the statistical package Comprehensive Meta-Analysis (Version 2). In general, meta-analytic techniques are used when the results of independent studies on a common topic are combined. For example, assume 85 studies were conducted in various sites on the effects of a specific instructional technique on student achievement. The studies were different in terms of the subject areas that were addressed. Consequently, different assessments of student achievement were used to reflect the different subject areas. This is the classic scenario requiring the use of meta-

analytic techniques—independent studies on a common topic (i.e., a common instructional technique) but with different dependent measures.

To combine studies that used different dependent measures, the results of each study are translated into an effect size. While there are many types of effect sizes, the one used in this study is the standardized mean difference. In very general terms, a standardized mean difference is the difference between the mean of the treatment group minus the mean of the control group divided by some estimate of the population standard deviation. Thus an effect size of 1.0 can be interpreted in the following way: the average score in the treatment group is one standard deviation higher than the average score in the control group. Consulting a table for the unit normal distribution (i.e., the normal distribution) one sees that the average score in the treatment group would be expected to be at the 84th percentile of the control group. From a slightly different perspective, one could say that a student at the 50th percentile in a class where the instructional technique was not being used would be predicted to increase his achievement to the 84th percentile if the instructional technique were introduced everything else being equal (e.g., random assignment, no moderator variables affecting the outcome).

The present evaluation study is analogous to this situation. A common intervention was used in all treatment classes (i.e., use of Promethean technology), but the independent studies employed different subject areas requiring different dependent measures. One note of caution must be made here. As mentioned previously, all the independent treatment/control studies involved in the evaluation study employed intact groups (i.e., students were not randomly assigned to treatment/control conditions). Although ANCOVA was used to statistically equate students in terms of prior achievement, without randomization arguments about causal relationships are severely weakened.

One aspect of this evaluation study is that findings are typically reported in two ways—one not corrected for attenuation due to lack of reliability in the dependent measure (i.e., **uncorrected**) and one corrected for attenuation (i.e., **corrected**). Technical Note 2 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. Consequently 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 (see Hunter & Schmidt, 2004). Throughout this report, corrected and uncorrected effect sizes are typically reported. When this is the case, however, the discussion of findings is limited to the corrected results only.

The Sample

As the following figures (1a through 1e) illustrate, 50 sites participated in the independent treatment/control studies from 29 cities in 19 states. The sites are grouped by their location in one of five geographic regions—Midwest, Northeast, Southeast, Southwest, and West. The figures (1a through 1e) also show the number of teachers involved in the independent studies at each site, as well as their designation as public or private.

Figure 1a. Participating Sites – Midwest Region

Site	City	State	School Type	# of Teachers
1	Westfield	IN	Public	1
2	Westfield	IN	Public	2
3	Westfield	IN	Public	1
4	New Buffalo	MI	Public	1
5	Orchard Lake	MI	Public	2
6	Minneapolis	MN	Private	1
7	St. Louis	MO	Public	5
8	Avon Lake	OH	Public	1
9	Garfield Heights	OH	Private	1
10	Rapid City	SD	Public	1
11	Rapid City	SD	Public	1
12	Rapid City	SD	Public	1
13	Kenosha	WI	Public	1
14	Kenosha	WI	Public	1
15	Kenosha	WI	Public	3
16	Kenosha	WI	Public	1
17	Kenosha	WI	Public	1
18	Kenosha	WI	Public	1
			Total	26

Figure 1b. Participating Sites – Northeast Region

Site	City	State	School Type	# of Teachers
19	Groton	CT	Public	1
20	Waterford	CT	Public	2
21	Waterford	CT	Public	1
22	Sudbury	MA	Public	2
23	Germantown	MD	Public	1
24	Berkeley Heights	NJ	Public	1
25	Horseheads	NY	Public	2
26	New York	NY	Public	2
			Total	12

Figure 1c. Participating Sites – Southeast Region

Site	City	State	School Type	# of Teachers
27	Nokomis	FL	Public	1
28	North Port	FL	Public	2
29	North Port	FL	Public	6
30	Sarasota	FL	Public	1
31	Sarasota	FL	Public	1
32	Venice	FL	Public	1
			Total	12

Figure 1d. Participating Sites – Southwest Region

Site	City	State	School Type	# of Teachers
33	Paradise Valley	AZ	Public	6
34	Tulsa	OK	Public	3
35	Dallas	TX	Public	1
36	Houston	TX	Public	1
37	Houston	TX	Public	1
38	Houston	TX	Public	1
39	Houston	TX	Public	1
40	Houston	TX	Public	1
41	Houston	TX	Public	1
			Total	16

Figure 1e. Participating Sites – West Region

Site	City	State	School Type	# of Teachers
42	La Puente	CA	Public	1
43	Riverside	CA	Public	2
44	Riverside	CA	Public	1
45	Riverside	CA	Public	1
46	San Francisco	CA	Public	2
47	San Francisco	CA	Public	1
48	Bellingham	WA	Public	1
49	Bellingham	WA	Public	2
50	Etna	WY	Public	2
			Total	13

Figures 1a through 1e indicate that 48 public schools and 2 private schools participated in the evaluation study. In the Midwest region, 24 teachers participated at 16 public schools and 2

teachers participated at 2 private schools; in the Northeast region, 12 teachers participated at 8 public schools; in the Southeast region, 12 teachers participated at 6 public schools; in the Southwest region, 16 teachers participated at 9 public schools; and in the West region, 13 teachers participated at 9 public schools.

Figure 2 displays the number of participating sites by school level along with the number of students in treatment and control groups.

Figure 2. Number of Participating Sites by School Level

School Level	# of Sites	Control N	Treatment N	Total N
Elementary School	21	688	735	1,423
Middle School	21	631	656	1,287
High School	8	303	325	628
Total	**50**	**1,622**	**1,716**	**3,338**

In all, this evaluation study involved 3,338 students. Of those students, 1,423 were at 21 sites that teach students at the elementary school level, 1,287 were at 21 sites that teach students at the middle school level, and 628 were at 8 sites that teach students at the high school level.

For comparison purposes, teachers were asked to report the grade level(s) taught (see Appendix A). Some teachers reported teaching more than one grade. As such, those independent treatment/control studies were excluded from grade level analysis. Figure 3 depicts the number the number of treatment and control students for each grade level.

Figure 3. Number of Students by Grade Level

Grade Level	Control N	Treatment N	Total N
K	8	6	14
1	78	79	157
2	76	78	154
3	80	88	168
4	31	31	62
5	282	303	585
6	337	334	671
7	214	249	463
8	134	140	274
9	98	109	207
10	--	--	--
11	--	--	--
12	9	9	18
Total	**1,347**	**1,426**	**2,773**

The previous two figures (Figure 2 and Figure 3) indicate that 565 students were excluded from the grade level analysis; 275 from the control group and 290 from the treatment group. With several teachers reporting that they taught more than one grade in the high school level, the findings from the grade level analysis should be considered carefully. Again, only independent treatment/control studies which identified a single grade level were considered for the grade level analysis. Therefore, those studies with students in more than one grade were excluded from consideration.

Demographics

To determine what type of community in which each participating school is located, MRL used data from the National Center for Education Statistics (NCES), a federal entity located within the U.S. Department of Education's Institute of Education Sciences. "The National Center for Education Statistics fulfills a Congressional mandate to collect, collate, analyze, and report complete statistics on the condition of American education; conduct and publish reports; and review and report on education activities internationally" (U.S. Department of Education. Institute of Education Sciences, National Center for Education Statistics [NCES], n.d. -a).

MRL used the U.S. Department of Education's NCES website to search their online databases for each of the 50 participating schools involved in the evaluation study. Specifically, a search was conducted for the 48 public schools using the NCES Common Core of Data (CCD) "Search for Public Schools" webpage (http://nces.ed.gov/ccd/schoolsearch/). The CCD is a database containing annual statistical information for all public elementary and secondary schools and school districts in the United States. (For additional information on CCD, see NCES, n.d. -f.) CCD public school data is currently available from the NCES website for the 2006-2007 school year.

A search was then conducted for the two private schools that participated in the study using the NCES Private School Universe Survey (PSS) "Search for Private Schools" webpage (http://nces.ed.gov/surveys/pss/privateschoolsearch/). The PSS is a single survey completed by administrative personnel in private schools every two years producing data similar to CCD. (For more information on PSS, see NCES, n.d. -c.) PSS private school data is currently available from the NCES website for the 2007-2008 school year.

In their databases, NCES uses locale codes to describe a school's location. The codes currently in use were derived from a classification system developed in the 1980's to describe a school's location as ranging from "large city" to "rural." The locale code system was redesigned in 2005 and 2006 in partnership with the U.S. Census Bureau. The new codes are based on the school's physical location (represented by an address) and its proximity to an urbanized area, which is defined as a densely settled core with densely settled surrounding areas. The new system classifies territories into four major types: city, suburb, town, and rural. Cities and suburban areas have three subcategories based on gradations of size—large, midsize, and small. Towns and rural areas have three subcategories based on their distance from an urbanized area—fringe, distant, and remote. (For further information on the NCES urban-centric locale code system, see

NCES, n.d. -b.) Figure 4 shows the locale codes, categories, and definitions currently used by NCES.

Figure 4. NCES Locale Codes & Definitions

NCES Locale Code & Category	Definitions Used by NCES
11 – City, Large	Territory inside an urbanized area and inside a principal city with population of 250,000 or more.
12 – City, Midsize	Territory inside an urbanized area and inside a principal city with population less than 250,000 and greater than or equal to 100,000.
13 – City, Small	Territory inside an urbanized area and inside a principal city with population less than 100,000.
21 – Suburb, Large	Territory outside a principal city and inside an urbanized area with population of 250,000 or more.
22 – Suburb, Midsize	Territory outside a principal city and inside an urbanized area with population less than 250,000 and greater than or equal to 100,000.
23 – Suburb, Small	Territory outside a principal city and inside an urbanized area with population less than 100,000.
31 – Town, Fringe	Territory inside an urban cluster that is less than or equal to 10 miles from an urbanized area.
32 – Town, Distant	Territory inside an urban cluster that is more than 10 miles and less than or equal to 35 miles from an urbanized area.
33 – Town, Remote	Territory inside an urban cluster that is more than 35 miles from an urbanized area.
41 – Rural, Fringe	Census-defined rural territory that is less than or equal to 5 miles from an urbanized area, as well as rural territory that is less than or equal to 2.5 miles from an urban cluster.
42 – Rural, Distant	Census-defined rural territory that is more than 5 miles but less than or equal to 25 miles from an urbanized area, as well as rural territory that is more than 2.5 miles but less than or equal to 10 miles from an urban cluster.
43 – Rural, Remote	Census-defined rural territory that is more than 25 miles from an urbanized area and is also more than 10 miles from an urban cluster.

Source*:* From NCES (n.d. -b).

MRL also used the U.S. Census Bureau's American FactFinder website (http://factfinder.census.gov/) to search for population statistics from the 2000 U.S. Census. Figure 5 shows the city population statistics for each site, along with the NCES locale code and category assigned to that site. Again, the locale codes are assigned based on the proximity of a site's address to an urbanized area.

Figure 5. Locale Codes for Participating Sites & Population Statistics

Site	Locale Code & Category	City	State	Population
1	21 – Suburb, Large	Westfield	IN	9,293
2	21 – Suburb, Large	Westfield	IN	9,293

Site	Locale Code & Category	City	State	Population
3	21 – Suburb, Large	Westfield	IN	9,293
4	31 – Town, Fringe	New Buffalo	MI	2,468
5	21 – Suburb, Large	Orchard Lake	MI	2,215
6	11 – City, Large	Minneapolis	MN	382,618
7	21 – Suburb, Large	St. Louis	MO	348,189
8	21 – Suburb, Large	Avon Lake	OH	18,145
9	21 – Suburb, Large	Garfield Heights	OH	30,734
10	13 – City, Small	Rapid City	SD	59,607
11	13 – City, Small	Rapid City	SD	59,607
12	13 – City, Small	Rapid City	SD	59,607
13	22 – Suburb, Midsize	Kenosha	WI	90,352
14	22 – Suburb, Midsize	Kenosha	WI	90,352
15	22 – Suburb, Midsize	Kenosha	WI	90,352
16	22 – Suburb, Midsize	Kenosha	WI	90,352
17	22 – Suburb, Midsize	Kenosha	WI	90,352
18	22 – Suburb, Midsize	Kenosha	WI	90,352
19	22 – Suburb, Midsize	Groton	CT	39,907
20	22 – Suburb, Midsize	Waterford	CT	19,152
21	41 – Rural, Fringe	Waterford	CT	19,152
22	21 – Suburb, Large	Sudbury	MA	16,841
23	21 – Suburb, Large	Germantown	MD	55,419
24	21 – Suburb, Large	Berkeley Heights	NJ	13,407
25	23 – Suburb, Small	Horseheads	NY	19,561
26	11 – City, Large	New York	NY	8,008,278
27	41 – Rural, Fringe	Nokomis	FL	3,334
28	41 – Rural, Fringe	North Port	FL	22,797
29	41 – Rural, Fringe	North Port	FL	22,797
30	21 – Suburb, Large	Sarasota	FL	52,715
31	21 – Suburb, Large	Sarasota	FL	52,715
32	41 – Rural, Fringe	Venice	FL	17,764
33	21 – Suburb, Large	Paradise Valley	AZ	13,664
34	11 – City, Large	Tulsa	OK	393,049
35	21 – Suburb, Large	Dallas	TX	1,188,580
36	21 – Suburb, Large	Houston	TX	1,953,631
37	21 – Suburb, Large	Houston	TX	1,953,631
38	11 – City, Large	Houston	TX	1,953,631
39	11 – City, Large	Houston	TX	1,953,631
40	11 – City, Large	Houston	TX	1,953,631
41	11 – City, Large	Houston	TX	1,953,631
42	21 – Suburb, Large	La Puente	CA	41,063

Site	Locale Code & Category	City	State	Population
43	11 – City, Large	Riverside	CA	255,166
44	11 – City, Large	Riverside	CA	255,166
45	11 – City, Large	Riverside	CA	255,166
46	11 – City, Large	San Francisco	CA	776,733
47	11 – City, Large	San Francisco	CA	776,733
48	13 – City, Small	Bellingham	WA	67,171
49	13 – City, Small	Bellingham	WA	67,171
50	43 – Rural, Remote	Etna	WY	123

Sources: From NCES (n.d. -d, n.d. -e) & U.S. Census Bureau (n.d.)

Figure 6 lists the number of treatment and control students in the evaluation study for each of the 12 NCES urban-centric locale codes. As this figure shows, there are 910 students from 17 sites located in cities, there are 1,875 students from 26 sites located in suburban areas, there are 27 students from 1 site located in a town, and there are 562 students from 6 sites located in rural areas.

Figure 6. Number of Students, by Site & Study Locale Category

Locale Code & Category	Control N	Treatment N	Total N	# of Sites
11 – City, Large	321	387	708	12
12 – City, Midsize	--	--	--	--
13 – City, Small	99	103	202	5
Total	**420**	**490**	**910**	**17**
21 – Suburb, Large	628	665	1,293	17
22 – Suburb, Midsize	258	247	505	8
23 – Suburb, Small	40	37	77	1
Total	**926**	**949**	**1,875**	**26**
31 – Town, Fringe	10	17	27	1
32 – Town, Distant	--	--	--	--
33 – Town, Remote	--	--	--	--
Total	**10**	**17**	**27**	**1**
41 – Rural, Fringe	235	229	464	5
42 – Rural, Distant	--	--	--	--
43 – Rural, Remote	31	31	62	1
Total	**266**	**260**	**562**	**6**
Overall Total	**1,622**	**1,716**	**3,338**	**50**

Data Analysis and Findings

As mentioned previously, in this study one dependent variable was considered: students' knowledge of academic content addressed during a unit of instruction. The primary independent variable of interest was the treatment/control condition—whether students were exposed to

Promethean technology or not. Also of interest are the differences in potential effect of Promethean technology with respect to seven types of moderator variables: school level, grade level, academic content area, length of teaching experience, how long Promethean technology has been used by the teacher, percentage of instructional time Promethean technology is used in the classroom, and teachers' perceived confidence in their use of Promethean technology in the classroom.

The specifics of the Promethean technologies available in the classroom can be found at Promethean's website (see http://www.prometheanworld.com). The control condition in this study was not a specific program or instructional strategy. Rather the control condition represented the aggregate strategies and materials used by the teachers to facilitate instruction without the use of the Promethean technology. Surveys submitted by the teachers indicated that they were quite diverse in the approaches they used.

Data from each independent treatment/control study was analyzed using the general linear model as employed by the statistical software package, SPSS (v17.0). One independent variable (treatment/control condition) was analyzed as a fixed effect. (See Technical Note 3 for a discussion of fixed effects.) The dependent variable was the posttest scores submitted for each independent treatment/control study with the pretest scores being used as the covariate. Stated differently, a fixed effects analysis of covariance (ANCOVA) was executed for the dependent measure.

The statistical software package, Comprehensive Meta-Analysis [CMA] (v2.0) was used to aggregate the findings from the independent treatment/control studies using the computed effect size for the treatment (i.e., use of Promethean technology).

Again, the following questions were considered in the evaluation study:

Evaluation Question 1: What effect does Promethean technology have on students' achievement regarding the subject matter content taught by their teachers?
Evaluation Question 2: Does the effect of Promethean technology differ between school levels?
Evaluation Question 3: Does the effect of Promethean technology differ between grade levels?
Evaluation Question 4: Does the effect of Promethean technology differ between academic content areas?
Evaluation Question 5: Does the effect of Promethean technology differ based on length of teaching experience?
Evaluation Question 6: Does the effect of Promethean technology differ based on how long the teacher has used the technology?
Evaluation Question 7: Does the effect of Promethean technology differ based on the percentage of instructional time the technology is used in the classroom?
Evaluation Question 8: Does the effect of Promethean technology differ based on teachers' confidence in their use of the technology?

Findings for each question are discussed separately.

Evaluation Question 1: What effect does Promethean technology have on students' achievement regarding the subject matter content taught by their teachers?

Figure 7 presents the ANCOVA findings and associated effect size for each of the teachers involved in independent treatment/control studies at their site. 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. The column labeled "ES" contains the calculated effect size for each study computed as Cohen's δ. The column labeled "% Gain" contains the percentile gain (or loss) in achievement associated with the treatment (i.e., use of Promethean technology). (For a discussion of effect size and associated percentile gain see Technical Note 4.)

Figure 7. Findings for Independent Treatment/Control Studies

Site	Teacher	Grade	Adjusted Mean (Control)	Adjusted Mean (Treatment)	Sig.	ES	% Gain
1	1	10-12	82.71 (n=30)	84.70 (n=25)	.45	.21	8
2	2	6	54.80 (n=21)	66.47 (n=26)	.00	1.22	39
2	3	6	85.18 (n=22)	87.75 (n=20)	.06	.62	23
3	4	8	79.12 (n=28)	79.87 (n=27)	.83	.06	2
4	5	7	89.20 (n=10)	87.83 (n=17)	.76	-.13	-5
5	6	3	71.93 (n=13)	81.60 (n=15)	.03	.95	33
5	7	5	70.29 (n=18)	72.23 (n=16)	.74	.12	5
6	8	5	16.09 (n=19)	17.17 (n=20)	.16	.48	18
7	9	5	87.33 (n=17)	94.56 (n=17)	.08	.65	24
7	10	2	68.63 (n=15)	78.92 (n=17)	.04	.82	29
7	11	2	70.73 (n=14)	82.85 (n=15)	<.01	1.18	38

Site	Teacher	Grade	Adjusted Mean (Control)	Adjusted Mean (Treatment)	Sig.	ES	% Gain
7	12	1	66.67 (n=18)	77.77 (n=18)	.11	.56	21
7	13a	2	66.13 (n=11)	76.13 (n=12)	.40	.38	15
7	13b	1	56.13 (n=10)	60.87 (n=10)	.72	.17	7
8	14	8	84.14 (n=27)	82.89 (n=25)	.54	-.18	-7
9	15	8	83.71 (n=21)	87.69 (n=25)	.07	.57	22
10	16	3	71.13 (n=20)	78.97 (n=22)	.04	.69	25
11	17	2	77.86 (n=17)	79.76 (n=15)	.69	.15	6
12	18	7	80.13 (n=25)	87.57 (n=26)	.13	.45	17
13	19	6	72.68 (n=23)	82.27 (n=23)	.12	.48	18
14	20	6	94.69 (n=28)	87.60 (n=18)	.01	-.83	-29
15	21	6	70.25 (n=23)	84.05 (n=25)	.00	.90	32
15	22	6	82.25 (n=23)	84.51 (n=16)	.65	.16	6
15	23	6	66.90 (n=27)	80.07 (n=27)	.02	.66	25
16	24a	6	80.39 (n=22)	77.48 (n=24)	.52	-.20	-8
16	24b	6	79.86 (n=21)	80.91 (n=23)	.80	.08	3
17	25	6	48.65 (n=16)	72.06 (n=26)	.00	1.32	41

Site	Teacher	Grade	Adjusted Mean (Control)	Adjusted Mean (Treatment)	Sig.	ES	% Gain
18	26	6	66.75 (n=24)	64.99 (n=20)	.69	-.13	-5
19	27	1	89.07 (n=18)	96.92 (n=15)	.23	.44	17
20	28	8	83.26 (n=18)	87.29 (n=22)	.40	.28	11
20	29	6	86.31 (n=15)	83.54 (n=8)	.47	-.34	-13
21	30	--	81.37 (n=16)	92.63 (n=16)	.00	1.34	41
22	31	5	88.59 (n=18)	91.75 (n=18)	.52	.22	9
22	32	5	85.59 (n=18)	89.73 (n=17)	.05	.72	26
23	33	6	84.59 (n=25)	79.41 (n=25)	.28	-.32	-13
24	34[a]	5	92.47 (n=19)	94.31 (n=36)	.18	.39	15
25	35	5	81.01 (n=22)	86.04 (n=22)	.13	.49	19
25	36	5	78.95 (n=18)	79.66 (n=15)	.84	.08	3
26	37	3	82.94 (n=16)	84.79 (n=19)	.57	.20	8
26	38	1	87.02 (n=15)	90.21 (n=18)	.47	.27	11
27	39	6	86.31 (n=20)	86.54 (n=22)	.93	.03	1
28	40	7	70.79 (n=19)	82.63 (n=16)	.07	.66	25
28	41	--	69.68 (n=21)	76.88 (n=20)	.02	.82	29

Site	Teacher	Grade	Adjusted Mean (Control)	Adjusted Mean (Treatment)	Sig.	ES	% Gain
29	42	12	80.34 (n=9)	82.44 (n=9)	.80	.13	5
29	43a	9	79.28 (n=27)	82.58 (n=23)	.53	.19	8
29	43b	9	61.20 (n=11)	69.70 (n=11)	.45	.36	14
29	43c	9	48.11 (n=26)	62.76 (n=25)	<.01	.83	30
29	44	9-12	84.68 (n=29)	95.52 (n=29)	.00	1.23	39
29	45	9	91.40 (n=7)	95.82 (n=10)	.29	.60	23
29	46	11-12	93.69 (n=26)	96.46 (n=26)	<.05	.57	22
29	47	10-12	69.72 (n=20)	72.98 (n=18)	.41	.28	11
30	48	9-12	14.00 (n=13)	16.00 (n=27)	<.01	1.00	34
31	49	7	80.68 (n=23)	79.88 (n=22)	.85	-.06	-2
32	50	6	26.67 (n=4)	44.33 (n=4)	.12	1.66	45
33	51	3	78.48 (n=23)	87.17 (n=23)	.00	1.03	35
33	52	5	81.30 (n=29)	77.34 (n=30)	.16	-.38	-15
33	53	5	56.97 (n=30)	68.58 (n=31)	.00	.90	32
33	54	5	73.81 (n=31)	86.79 (n=29)	.00	.78	28
33	55	5	78.52 (n=29)	81.67 (n=31)	.40	.23	9

Site	Teacher	Grade	Adjusted Mean (Control)	Adjusted Mean (Treatment)	Sig.	ES	% Gain
33	56	3-6	10.12 (n=9)	11.90 (n=11)	.10	.85	30
34	57	9-12	84.85 (n=9)	78.47 (n=5)	.40	-.55	-21
34	58	9	76.43 (n=6)	79.18 (n=19)	.37	.45	17
34	59	--	47.33 (n=9)	51.23 (n=13)	.61	.24	9
35	60	1	83.38 (n=17)	90.69 (n=18)	.00	1.43	42
36	61	7	93.63 (n=29)	82.09 (n=33)	.00	-.83	-30
37	62	2	93.58 (n=19)	93.26 (n=19)	.89	-.05	-2
38	63	5	58.52 (n=14)	68.84 (n=21)	.00	1.20	38
39	64	10-12	78.88 (n=25)	86.60 (n=27)	.04	.61	23
40	65	10-11	85.20 (n=15)	80.34 (n=18)	.10	-.62	-23
41	66	11-12	75.91 (n=20)	89.30 (n=19)	.00	1.54	44
42	67	8	93.11 (n=31)	87.06 (n=27)	.07	-.50	-19
43	68	7	80.75 (n=22)	77.28 (n=30)	.37	-.26	-10
43	69a[b]	7	53.14 (n=20)	54.85 (n=25)	.79	.08	3
43	69b[b]	7	49.57 (n=14)	54.50 (n=24)	.49	.25	10
43	69c[b]	7	77.27 (n=22)	68.27 (n=26)	.10	-.50	-19

Site	Teacher	Grade	Adjusted Mean (Control)	Adjusted Mean (Treatment)	Sig.	ES	% Gain
44	70	6	70.44 (n=23)	85.48 (n=27)	.00	1.33	41
45	71	7	69.01 (n=30)	75.82 (n=30)	.06	.50	19
46	72	8	61.78 (n=9)	69.93 (n=14)	<.05	.96	33
46	73	7-8	55.39 (n=12)	56.84 (n=11)	.74	.15	6
47	74	9	77.67 (n=21)	81.75 (n=21)	.33	.32	13
48	75	3	93.12 (n=8)	84.61 (n=9)	.48	-.39	-15
49	76	4-5	90.03 (n=21)	89.87 (n=25)	.96	-.02	-1
49	77	K	93.48 (n=8)	94.89 (n=6)	.82	.14	6
50	78[c]	4	87.47 (n=12)	86.72 (n=17)	.55	-.24	-9
50	79[c]	4	86.10 (n=19)	86.79 (n=14)	.76	.11	4

a. No pretest given. Data analyzed using analysis of variance (ANOVA).
b. This teacher administered two pretests, two posttests, and a written test to the same group of students. Data for this teacher reported as follows: 69a – posttest "a" with pretest "a" as covariate; 69b – posttest "b" with pretest "b" as covariate; 69c – written test with pretest "a" as covariate.
c. Notes on scoring sheets indicate treatment and control classes are taught by different teachers.

Figure 7 presents the findings for all 85 independent treatment/control studies. It should be noted that teacher 34 did not administer a pretest. As such, an analysis of variance (ANOVA) was employed with the posttest scores used as the dependent variable. It is also worth noting that teacher 69 administered two pretests, two posttests, and a written test to both treatment and control groups. The test scores for this teacher were analyzed as three separate studies (see Figure 7 footnote for grouping). Additionally, the studies reported for teachers 78 and 79 involved different teachers for each control group. The data was analyzed under an assumption that the control groups were given the same tests as the treatment groups.

When considering the information displayed in Figure 7, it should be noted that the data for each independent treatment/control 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 that a student would know less about the academic content at the end of the unit. As such, students who scored higher on the pretest were excluded from analysis. The student counts reflected in Figures 2, 3, 6, and 7 represent the number of students whose test scores were considered for analysis in this evaluation study (i.e., students who took both pretest and posttest that did not score higher on the pretest).

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 Promethean technology). 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 7. The adjusted mean for the control group was 82.71 (n = 30); the adjusted mean for the treatment group was 84.70 (n = 25). The percentile gain for this study is 8 (ES = .21). This means that the average score in the treatment group is 8 percentile points **greater than** the average score in the control group. It should be noted that in some cases 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 fifth row is negative 5 (-5, ES = -.13). This means that the average score in the control group is 5 percentile points greater than the average score in the treatment group.

The typical convention in social science research and evaluation is to consider any contrast with a probability less than .05 as "statistically significant" at the .05 level (see Murphy & Myors, 2004). Using this convention, Figure 7 indicates that the comparison between treatment and control groups was statistically significant ($p <$. 05) for 25 independent treatment/control studies. Of those 25 studies, 16 are statistically significant at the .01 level ($p < .01$).

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. Such is the case with the present set of studies. Figure 8 shows the overall average effect size for the evaluation study using a random effects model (see Technical Note 5). (Throughout the report, average effect sizes computed using a random effects model will be referred to simply as "overall random effects.") 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 treatment/control studies, the column labeled "95% CI" contains the 95 percent confidence interval for the reported weighted mean effect size, the column labeled "% Gain" contains the percentile gain (or loss) associated with the reported weighted mean effect size, and the column labeled "Fail-Safe N" contains the number of missing studies that would be required to reduce the weighted mean effect size to .00 (i.e., no difference between treatment and control groups) using Orwin's formula (for a discussion of sampling bias and the fail-safe N, see Lipsey & Wilson, 2001, pp. 165-166).

Figure 8. Overall Random Effects

	N	$\overline{ES}$	95% CI	% Gain	Fail-Safe N
Uncorrected	85	.37*	.25 to .48	14	3,060
Corrected	85	.44*	.30 to .58	17	3,655

* $p < .0001$

When the results of the 85 independent treatment/control studies are combined and corrected for attenuation, the overall percentile gain is 17 ($\overline{ES} = .44$). (For a detailed discussion of attenuation, see Hunter & Schmidt, 2004.) This means that on the average, the use of Promethean technology in the evaluation study represents a gain of 17 percentile points over what would be expected if teachers did not use Promethean technology (for a discussion of how effect sizes are combined and an overall significance level is computed see Lipsey & Wilson, 2001).

Consider the fail-safe N reported in the second row, 3,655. This means that over 3,500 additional independent treatment/control studies with an effect size of .00 would be needed to reduce the weighted mean effect size to .00 (i.e., no difference between groups).

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 8 is a weighted average of all the effect sizes from the 85 independent treatment/control studies. As such, it is considered an estimate of the true effect size of the treatment (i.e., use of Promethean technology). 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, .30 to .58. This indicates a 95 percent certainty that the true effect size for the evaluation study is between the values of .30 and .58. 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.)

Another way to examine the general effect of the use of Promethean technology in the classroom is to consider the distribution of effect sizes and percentile gain associated with the effect sizes. Figures 9a and 9b present the distribution of effect sizes and associated percentile gain respectively.

Figure 9a. Distribution of Effect Sizes

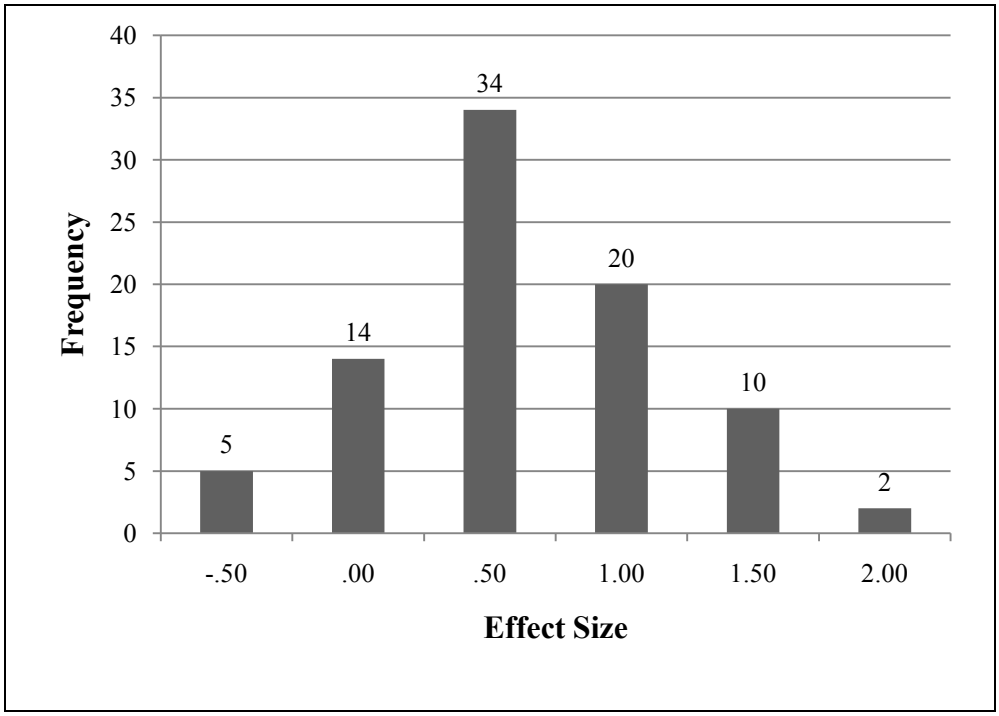


Figure 9a reports the distribution of "groups" of effect sizes across the 85 independent treatment/control studies (rounded to the nearest .50). 5 studies exhibited an effect size of -.50 (see first column), 14 studies exhibited an effect size of .00 (see second column), 34 studies exhibited an effect size of .50 (see third column), and so on. 66 out of 85 studies (or 78%) have a positive effect size.

Figure 9b. Distribution of Percentile Gains

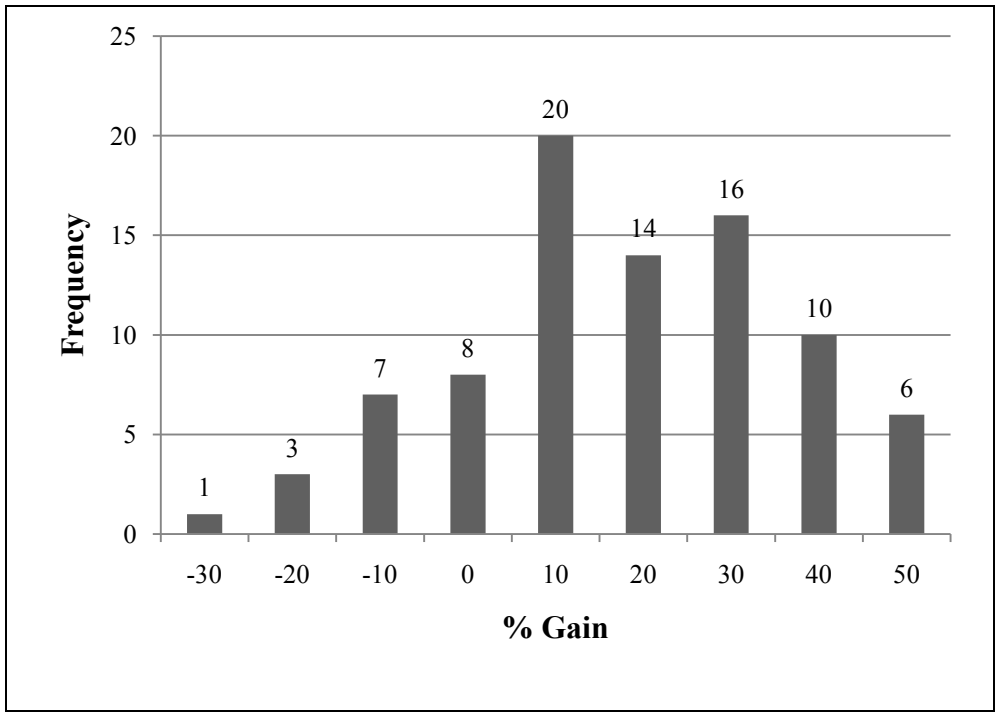


Figure 9b reports the distribution of "groups" of percentile gains associated with the reported effect sizes across the 85 independent treatment/control studies (rounded to the nearest 10). 11 studies exhibited a negative gain (see first through third columns), 8 studies exhibited no gain (see fourth column), 20 studies exhibited a 10 percent gain (see fifth column), 14 studies exhibited a 20 percent gain (see sixth column), and so on. 66 out of the 85 studies (or 78%) exhibited a positive percentile gain.

The following sections present the meta-analytic findings for each question involving a moderator variable. The findings will be reported in the same manner as for the overall random effects.

Evaluation Question 2: Does the effect of Promethean technology differ between school levels?

In order to answer this question, a meta-analysis was employed using the school level for each independent treatment/control study as a moderator variable. The meta-analytic findings are reported in Figures 10a and 10b.

Figure 10a. Random Effects for School Level (Uncorrected)

School Level	N	$\overline{ES}$	95% CI	% Gain
Elementary School (Grades K-5)	39	.52**	.37 to .67	20
Middle School (Grades 6-8)	29	.12	-.07 to .31	5
High School (Grades 9-12)	17	.47*	.22 to .72	18

Note: See discussion of Figure 8 for a description of column headings.
* $p < .001$
** $p < .0001$

Figure 10b. Random Effects for School Level (Corrected)

School Level	N	$\overline{ES}$	95% CI	% Gain
Elementary School (Grades K-5)	39	.62**	.43 to .80	23
Middle School (Grades 6-8)	29	.15	-.08 to .38	6
High School (Grades 9-12)	17	.55*	.25 to .86	21

Note: See discussion of Figure 8 for a description of column headings.
* $p < .001$
** $p < .0001$

Figures 10a and 10b show the random effects for the elementary, middle, and high school levels. The weighted mean effect size is statistically significant for elementary school ($p < .0001$) and high school ($p < .001$), but not middle school. The percentile gain for all three levels was positive.

Evaluation Question 3: Does the effect of Promethean technology differ between grade levels?

In order to answer this question, a meta-analysis was employed using the reported grade level for each independent treatment/control study as a moderator variable. The meta-analytic findings are reported in Figures 11a and 11b.

Figure 11a. Random Effects for Grade Level (Uncorrected)

Grade Level	N	$\overline{ES}$	95% CI	% Gain
K	1	.14	-.92 to 1.2	6
1	5	.59*	.16 to 1.01	22

Grade Level	N	$\overline{ES}$	95% CI	% Gain
2	5	.47*	.03 to .91	18
3	5	.56*	.10 to 1.01	21
4	2	-.05	-.56 to .45	-2
5	13	.44**	.21 to .67	17
6	16	.37*	.04 to .70	14
7	10	.01	-.30 to .31	0
8	6	.14	-.25 to .52	6
9	6	.45	.17 to .73	17
10	--	--	--	--
11	--	--	--	--
12	1	.13	-.79 to 1.06	5

Note: See discussion of Figure 8 for a description of column headings.
* $p < .05$
** $p < .001$

Figure 11b. Random Effects for Grade Level (Corrected)

Grade Level	N	$\overline{ES}$	95% CI	% Gain
K	1	.16	-.90 to 1.22	6
1	5	.70*	.16 to 1.23	26
2	5	.57*	.03 to 1.10	22
3	5	.65*	.10 to 1.20	24
4	2	-.06	-.57 to .45	-2
5	13	.52**	.25 to .80	20
6	16	.46*	.07 to .86	18
7	10	.01	-.35 to .37	0
8	6	.18	-.27 to .63	7
9	6	.52**	.24 to .81	20
10	--	--	--	--
11	--	--	--	--
12	1	.15	-.77 to 1.08	6

Note: See discussion of Figure 8 for a description of column headings.
* $p < .05$
** $p < .001$

Figures 11a and 11b show the random effects for each grade level, K-12. Recall from the earlier discussion regarding the sample for the evaluation study that some grades were not included in the meta-analysis due to teachers at the high school level having reported teaching more than one grade (see Figure 7 for reported grade levels). The weighted mean effect size is statistically significant for six grade levels: fifth and ninth grades ($p < .001$) and first, second, third, and sixth grades ($p < .05$). The percentile gain was positive for nine grade levels.

Evaluation Question 4: Does the effect of Promethean technology differ between academic content areas?

In order to answer this question, a meta-analysis was employed using the reported academic content area for each independent treatment/control study as a moderator variable. The meta-analytic findings are reported in Figures 12a and 12b.

Figure 12a. Random Effects for Academic Content Area (Uncorrected)

Content Area	N	$\overline{ES}$	95% CI	% Gain
Language Arts	20	.35*	.13 to.57	14
Mathematics	30	.36*	.14 to .58	14
Science	15	.39*	.15 to .64	15
Social Studies	15	.24	-.03 to .50	9

Note: See discussion of Figure 8 for a description of column headings.
* $p < .01$

Figure 12b. Random Effects for Academic Content Area (Corrected)

Content Area	N	$\overline{ES}$	95% CI	% Gain
Language Arts	20	.43*	.17 to .69	17
Mathematics	30	.44*	.18 to .70	17
Science	15	.47*	.18 to .76	18
Social Studies	15	.29	-.02 to .69	11

Note: See discussion of Figure 8 for a description of column headings.
* $p < .01$

Figures 12a and 12b show the random effects for four academic content areas: language arts, mathematics, science, and social studies. Five independent treatment/control studies were excluded from this analysis. One study did not have a reported content area. The other four studies involved unrelated content areas. The weighted mean effect size is statistically significant ($p < .01$) for language arts, mathematics, and science, but not for social studies. The percentile gain was positive for all four academic content areas.

Evaluation Question 5: Does the effect of Promethean technology differ based on length of teaching experience?

In order to answer this question, a meta-analysis was employed using the quartile rank of the length of teaching experience (reported in years) for each independent treatment/control study as a moderator variable. SPSS was used to compute the quartile rank for each independent treatment/control study. The meta-analytic findings are reported in Figures 13a and 13b.

Figure 13a. Random Effects for Length of Teaching Experience (Uncorrected)

Quartile Range (Years)	N	$\overline{ES}$	95% CI	% Gain
2 to 5	16	.34*	.06 to .61	13
6 to 9	18	.33**	.11 to .55	13
10 to 15	22	.36**	.12 to .60	14
16 to 32	15	.42*	.08 to .75	16

Note: See discussion of Figure 8 for a description of column headings.
* $p < .05$
** $p < .01$

Figure 13b. Random Effects for Length of Teaching Experience (Corrected)

Quartile Range (Years)	N	$\overline{ES}$	95% CI	% Gain
2 to 5	16	.42*	.09 to .75	16
6 to 9	18	.39**	.12 to .65	15
10 to 15	22	.44**	.15 to .73	17
16 to 32	15	.51*	.10 to .91	20

Note: See discussion of Figure 8 for a description of column headings.
* $p < .05$
** $p < .01$

Figures 13a and 13b show the random effects for the length of teaching experience (reported in years) divided into quartile ranks. 14 independent treatment/control studies were excluded from this analysis due to missing data regarding the teacher survey. The weighted mean effect size is statistically significant for the second and third quartiles ($p < .01$) and the first and fourth quartiles ($p < .05$). The percentile gain was positive for all four quartile ranks.

Evaluation Question 6: Does the effect of Promethean technology differ based on how long the teacher has used the technology?

In order to answer this question, a meta-analysis was employed using the quartile rank of the length Promethean technology has been used by the teacher (reported in months) for each independent treatment/control study as a moderator variable. SPSS was used to compute the quartile rank for each independent treatment/control study. The meta-analytic findings are reported in Figures 14a and 14b.

Figure 14a. Random Effects for Length of Promethean Technology Use (Uncorrected)

Quartile Range (Months)	N	$\overline{ES}$	95% CI	% Gain
1 to 5	17	.27*	.00 to .54	11
5 to 18	20	.31**	.08 to .54	12
24 to 27	16	.43**	.10 to .76	17
30 to 60	18	.42***	.19 to .66	16

Note: See discussion of Figure 8 for a description of column headings.
* $p < .05$
** $p < .01$
*** $p < .001$

Figure 14b. Random Effects for Length of Promethean Technology Use (Corrected)

Quartile Range (Months)	N	$\overline{ES}$	95% CI	% Gain
1 to 5	17	.32*	.00 to .64	13
5 to 18	20	.38**	.11 to .65	15
24 to 27	16	.53**	.13 to .93	20
30 to 60	18	.51***	.22 to .79	20

Note: See discussion of Figure 8 for a description of column headings.
* $p < .05$
** $p < .01$
*** $p < .001$

Figures 14a and 14b show the random effects for the length Promethean technology has been used by the teacher in each independent treatment/control study (reported in months) divided into quartile ranks. 14 independent treatment/control studies were excluded from this analysis due to missing data regarding the teacher survey. The weighted mean effect size is statistically significant for the fourth quartile ($p<.001$), the second and third quartiles ($p < .01$), and the first quartile ($p < .05$). The percentile gain was positive for all four quartile ranks.

Evaluation Question 7: Does the effect of Promethean technology differ based on the percentage of instructional time the technology is used in the classroom?

In order to answer this question, a meta-analysis was employed using the quartile rank of the percentage of instructional time Promethean technology has been used in the classroom for each independent treatment/control study as a moderator variable. SPSS was used to compute the quartile rank for each independent treatment/control study. The meta-analytic findings are reported in Figures 15a and 15b.

Figure 15a. Random Effects for Amount of Instructional Time Promethean Technology is Used (Uncorrected)

Quartile Range (Percentage)	N	$\overline{ES}$	95% CI	% Gain
10 to 40	18	.09	-.15 to .33	4
45 to 70	18	.40*	.11 to .69	16
75 to 80	18	.67**	.47 to .88	25
85 to 95	17	.18	-.05 to .40	7

Note: See discussion of Figure 8 for a description of column headings.
* $p < .01$
** $p < .0001$

Figure 15b. Random Effects for Amount of Instructional Time Promethean Technology is Used (Corrected)

Quartile Range (Percentage)	N	$\overline{ES}$	95% CI	% Gain
10 to 40	18	.11	-.17 to .39	4
45 to 70	18	.48*	.14 to .83	18
75 to 80	18	.82**	.56 to 1.07	29
85 to 95	17	.22	-.05 to .49	9

Note: See discussion of Figure 8 for a description of column headings.
* $p < .01$
** $p < .0001$

Figures 15a and 15b show the random effects for the percentage of classroom instructional time that Promethean technology has been used in the classroom divided into quartile ranks. 14 independent treatment/control studies were excluded from this analysis due to missing data regarding the teacher survey. The weighted mean effect size is statistically significant for the third quartile ($p < .0001$) and the second quartile ($p < .01$), but not the first and fourth quartiles. The percentile gain was positive for all four quartile ranks.

Evaluation Question 8: Does the effect of Promethean technology differ based on teachers' confidence in their use of the technology?

In order to answer this question, a meta-analysis was employed using the reported level of confidence in the use of Promethean technology in the classroom for each independent treatment/control study as a moderator variable. Teachers were asked to rank their level of confidence on a Likert scale from 1 (lowest) to 5 (highest). The meta-analytic findings are reported in Figures 16a and 16b.

Figure 16a. Random Effects for Perceived Confidence in Promethean Technology Use (Uncorrected)

Confidence	N	$\overline{ES}$	95% CI	% Gain
1	--	--	--	--
2	3	.18	-.20 to .55	7
3	18	.33*	.09 to .56	13
4	32	.33*	.12 to .55	13
5	18	.48**	.21 to .73	18

Note: See discussion of Figure 8 for a description of column headings.
* $p < .01$
** $p < .001$

Figure 16b. Random Effects for Perceived Confidence in Promethean Technology Use (Corrected)

Confidence	N	$\overline{ES}$	95% CI	% Gain
1	--	--	--	--
2	3	.20	-.18 to .58	8
3	18	.38*	.11 to .66	15
4	32	.41*	.15 to .66	16
5	18	.59**	.27 to .91	22

Note: See discussion of Figure 8 for a description of column headings.
* $p < .01$
** $p < .001$

Figures 16a and 16b show the random effects for the teachers' perceived confidence in their ability to use Promethean technology in their classrooms. 14 independent treatment/control studies were excluded from this analysis due to missing data regarding the teacher survey. The weighted mean effect size is statistically significant for confidence rank 5 ($p < .001$) and confidence ranks 3 and 4 ($p < .01$), but not confidence rank 2. The percentile gain was positive for all four reported levels of confidence.

Interpretation

The previous section presented the ANCOVA findings from the 85 independent treatment/control studies along with meta-analytic results of seven types of moderator variables using the computed effect size for the treatment (i.e., use of Promethean technology). In this section, the interpretations of those findings are discussed in greater detail. The discussion in this section is broken into three general sections: (1) interpretation of overall findings, (2) anomalies at different grade levels, and (3) interaction of moderator variables.

Interpretation of Overall Findings

To begin with, it is worth asking the question what is considered a large effect size? In other words, would a given effect size, .31 for example, be considered large or small? Using the following widely adopted range of effect sizes first established by Cohen (1988) for appraising the magnitude of an effect size, .31 would be considered a "medium" effect size.

Small	Medium	Large
ES ≤ .20	.21 to .79	ES ≥ .80

When the effect sizes reported in Figure 7 are grouped according to these criteria, 21 independent treatment/control studies have an effect size that would be considered "small," 42 have an effect size that would be considered "medium," and 22 have an effect size that would be considered "large." Overall, the weighted mean effect size (corrected for attenuation) of .44 would be considered "medium." However useful such designations might be, they are still arbitrary. For example, consider the lower and upper limit of the range for "medium" effect sizes, .21 and .79. The associated percentile gains are 8 (ES = .21) and 29 (ES = .79). So, 21 percentile points separate the expected gains between the two effect sizes, but they are both considered a "medium" effect.

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 5th highest in the control group. Figure 17 displays the overall results for the evaluation study based on this interpretation.

Figure 17. Interpretation of Overall Random Effects.

	$\overline{ES}$	Percentage of Control Group Scoring Lower than Treatment Mean	Rank of Average Student in Treatment Group in Control Group of 29
Uncorrected	.37	64%	10
Corrected	.44	67%	10

Figure 17 depicts the percentage of control group students who have scored lower than the average student in the treatment group (see second 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

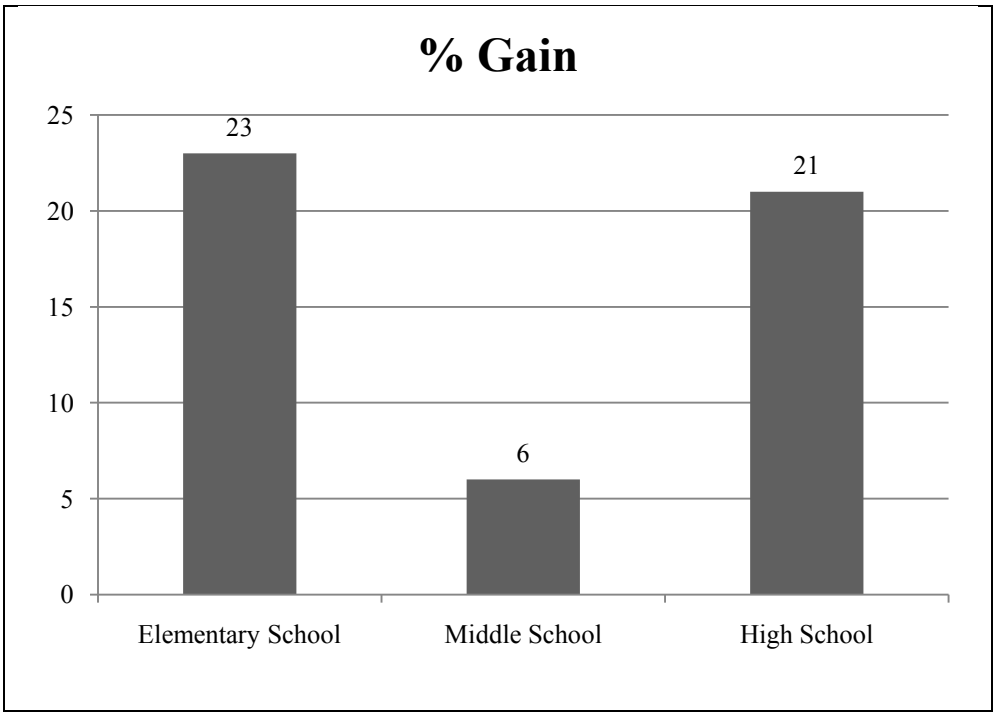
treatment group (i.e., the group that used Promethean technology) scored higher than 67% of the students in the control group (i.e., the group that did not use Promethean technology) and would be ranked 10th in the control group as opposed to 15th in the treatment group.

Figures 10 through 16 reported the meta-analytic findings for the seven types of moderator variables considered in this evaluation study. Again, using meta-analytic techniques, the ANCOVA findings for the independent treatment/control studies were aggregated into weighted mean effect sizes with respect to each moderator variable. According to Gene Glass, the recognized founder of modern meta-analysis (in Robinson, 2004), "the result of a meta-analysis should never be an average; it should be a graph" (p. 29). As such, the associated percentile gain for each weighted mean effect size (corrected for attenuation) pertaining to a moderator variable is displayed in the figures that follow. Doing so allows further discussion of any patterns that may be apparent in the graph.

Anomalies at Different Grade Levels

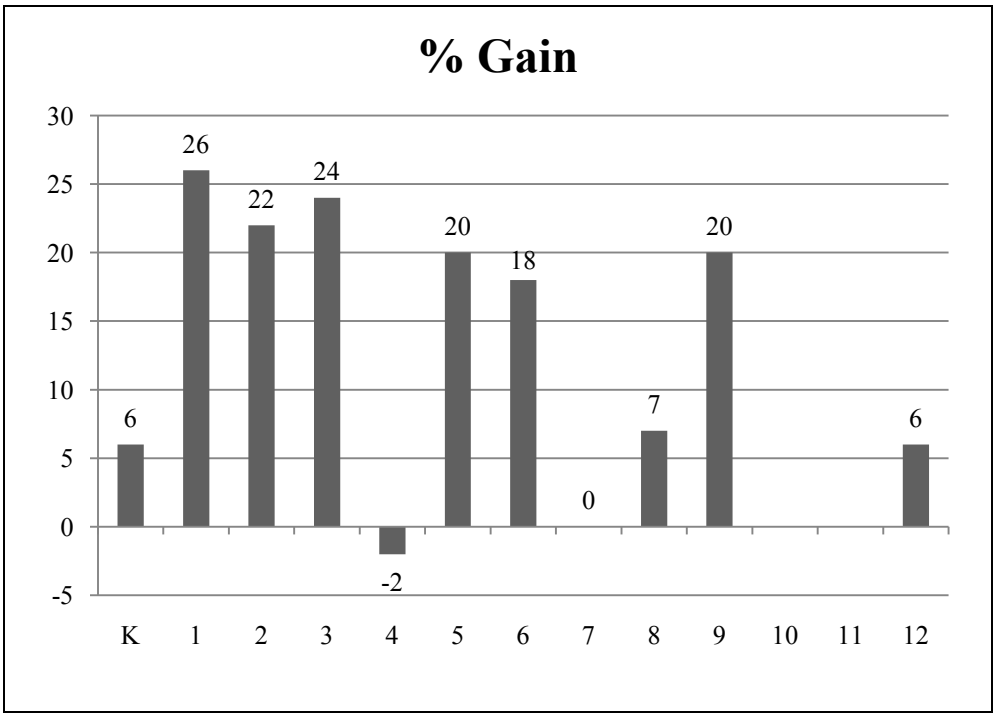
Figure 18 shows the percentile gain corresponding to the random effects for each school level.

Figure 18. Percentile Gain for Random Effects for School Level (Corrected)



This figure clearly shows that the percentile gain at the middle school level is considerably lower than the percentile gains for elementary school and high school. Given the overall effect of the use of Promethean technology demonstrated in this evaluation study, one would expect a higher percentile gain. One possible explanation for this anomaly is that one particular grade level within the middle school band of grade levels is responsible for the lower effect size and subsequent expected percentile gain. This is examined in Figure 19.

Figure 19. Percentile Gain for Random Effects for Grade Level (Corrected)



Of the 11 grades depicted in Figure 19, 7 grades exhibited a percentile gain less than 10 (recall from the discussion regarding Figure 3 that data were not available for grades 10 and 11). This may be attributed to a lack of independent treatment/control studies. For example, kindergarten and twelfth grade involved a single study and fourth grade involved two studies. Consequently, the stability of the findings in kindergarten, fourth grade, and twelfth grade is an issue. If more studies are done at these grade levels, the findings reported here would most likely change.

The remaining grades involved five or more studies (with the exception of tenth and eleventh grades for reasons discussed previously). Taken at face value, this graph indicates that four of the six grades at the elementary school level (K-5), one grade at the middle school level (6-8), and one grade at the high school level (9-12) exhibited percentile gains around 20. This is consistent with the percentile gain associated with the overall random effects for all 85 independent treatment/control studies.

Looking specifically at the middle school level, seventh grade exhibited no gain. Figure 7 shows that the percentile gain for five of the ten studies analyzed for seventh grade was negative. An examination of Figure 7 indicates that there were 19 studies in the entire set of 85 studies that demonstrated negative gains. Thus 26 percent of the studies that demonstrated negative gains were from grade 7. Clearly, the disproportionate number of studies with negative gains at the seventh grade level requires further scrutiny and will be the subject of subsequent reports.

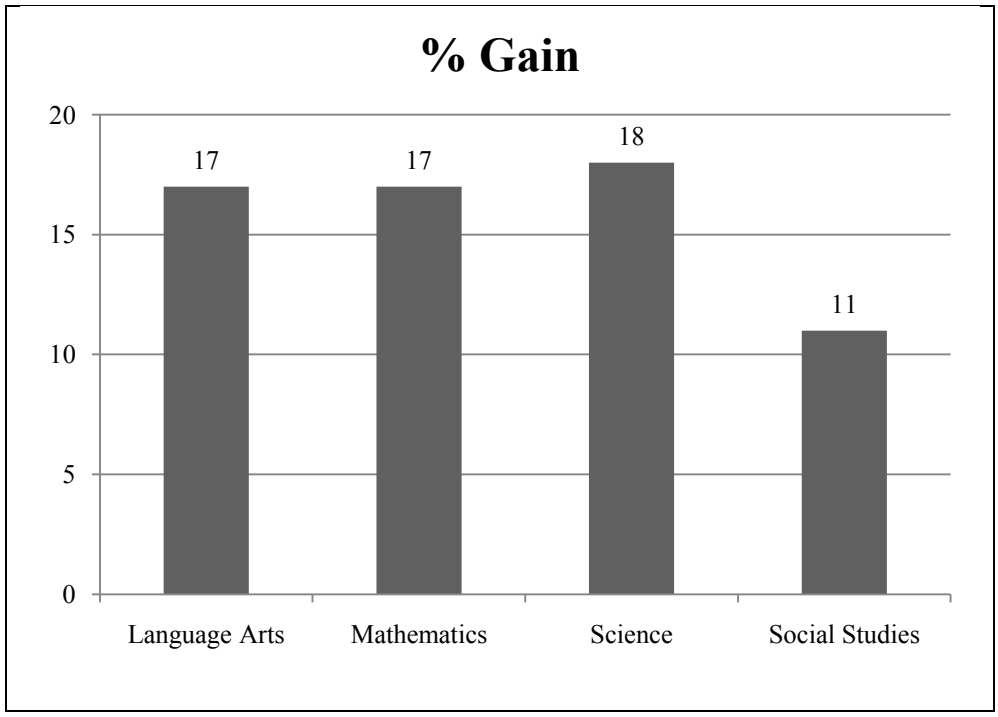
Interaction of Moderator Variables

The discussions above addressed two of the seven moderator variables considered in this study: school levels (i.e., elementary school, middle school, and high school) and grade levels. This section addresses the remaining five moderator variables:

- academic content area
- length of teaching experience
- how long teachers have used the technology
- percentage of time the technology was used in the classroom
- teachers' confidence in their use of the technology

We begin with academic content areas. Figure 20 depicts expected percentile gains for four subject areas.

Figure 20. Percentile Gain for Random Effects for Academic Content Area (Corrected)



All four academic content areas exhibited a percentile gain greater than 10 percent. Additionally, three of the four areas exhibited a percentile gain greater than 15 percent. These findings are relatively uniform across the four subject areas and were not examined further. The findings for the remaining four moderator variables are reported in Figures 21a, 21b, 21c, and 21d. The data for each figure were taken from survey responses incorporated in the directions to teachers for the study (see Appendix A). As mentioned previously, 14 studies were excluded due to missing survey responses.

Figure 21a. Percentile Gain for Length of Teaching Experience (Corrected)

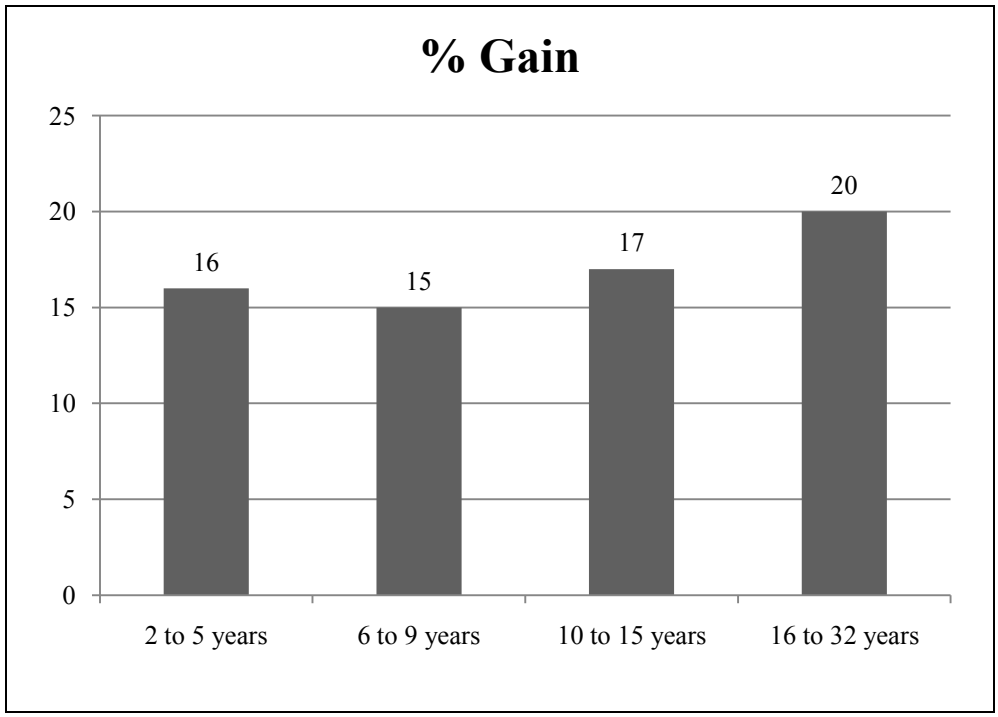


Figure 21b. Percentile Gain for Length of Promethean Technology Use (Corrected)

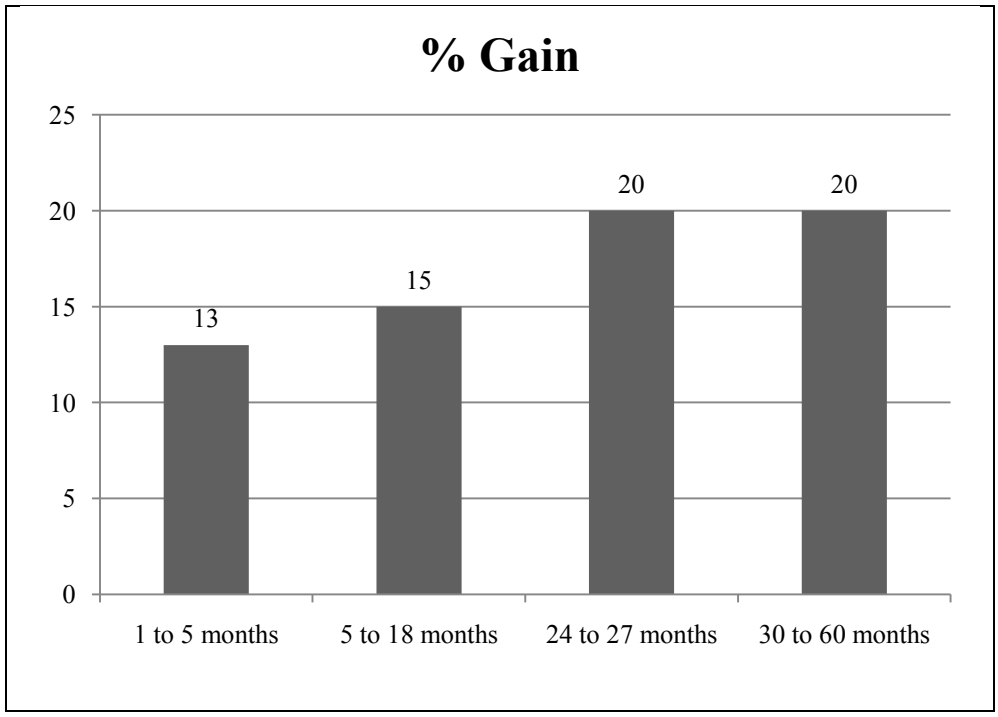


Figure 21c. Percentile Gain for Amount of Instructional Time Promethean Technology is Used (Corrected)

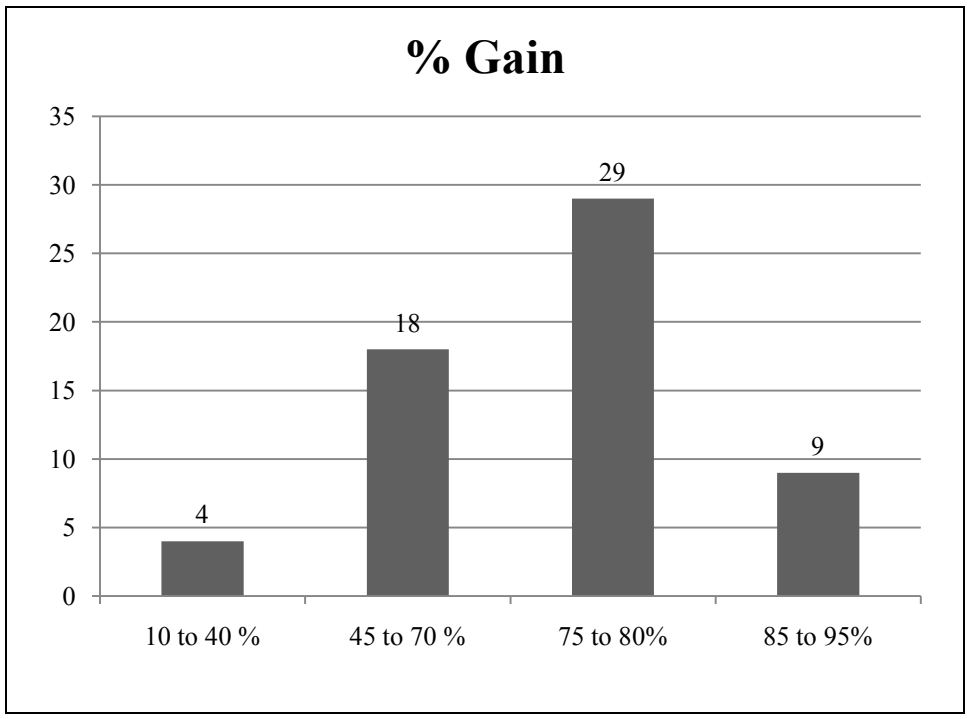
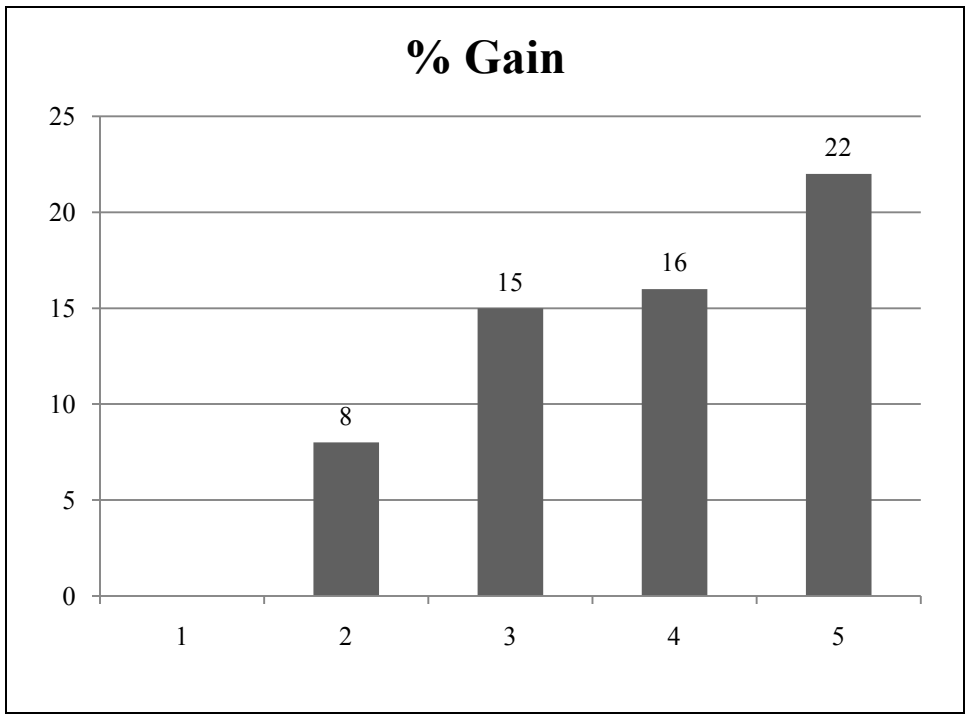


Figure 21d. Percentile Gain for Perceived Confidence in Promethean Technology Use (Corrected)



Figures 21a to 21d present the percentile gains for the moderator variables: length of teaching experience, how long teachers have used the technology, percentage of time the technology was used in the classroom, and teachers' confidence in their use of the technology. As mentioned previously, a quartile ranking of the survey responses was used to categorize the first three evaluation questions from the survey. The last variable involves a Likert scale regarding teachers' perceived confidence in their ability to use Promethean technology in their classrooms. The scale ranges from 1—lowest confidence to 5—highest confidence.

Figure 21a shows a relatively flat distribution of percentile gains. All four quartile ranks exhibit a percentile gain of 15 percent or more. It is interesting that as teaching experience increases, there is a slight increase in student achievement. Though slight, it still points to the possibility that the technology, when placed in the hands of experienced teachers, will produce better results.

Figure 21b appears to suggest that the longer Promethean technology is used in the classroom, the higher the percentile gain. In other words, a greater increase in student achievement may occur when teachers have more time to learn how to use the technology in the classroom. However, notice that instead of increasing, the percentile gain for both the third and fourth quartiles is the same. At face value, one might conclude that the effect on student achievement begins to plateau the longer a teacher uses Promethean technology.

Figure 21c depicts the amount of percentile gain associated with quartile rankings of the reported percentage of classroom instructional time that Promethean technology is used. It can be seen that up to a point an increase in student achievement is associated with increased use of the Promethean technology. However, this increase only occurs up to 80 percent of classroom instructional time. When the percentage of instructional time is greater than 85 percent, a considerable drop in percentile gain is apparent. In other words, this pattern suggests that increasing the use of Promethean technology in the classroom over 85 percent of the available instructional time has the potential to be detrimental to student achievement. Additionally, these findings suggest that using Promethean technology between 45 and 70 percent results in an 18 percentile point gain ($\overline{ES} = .48$). Increasing use of Promethean technology to between 75 and 80 percent results in an even larger gain in student achievement, 29 percent ($\overline{ES} = .82$).

Finally, Figure 21d indicates that the higher teachers rate their confidence in their ability to use Promethean technology, the higher the percentile gain. Basically, student achievement seems to improve when teachers are confident in their ability to use Promethean technology to augment their classroom instructional practices.

One can build a logical case that these last four moderator variables are related. Again they are:

- length of teaching experience
- how long teachers have used the technology
- percentage of time the technology was used in the classroom
- teachers' confidence in their use of the technology

Considering these as a set, one might predict relatively large percentile gains in student achievement under the following conditions:

- a teacher has 10 years or more of teaching experience
- a teacher has used the technology for two years or more
- a teacher uses the technology between 75 and 80 percent of the time in his or her classroom
- a teacher has high confidence in his or her ability to use the technology

Summary

This preliminary report for the evaluation study of the effects of Promethean ActivClassroom on student achievement sought to answer the following questions:

Evaluation Question 1: What effect does Promethean ActivClassroom have on students' achievement regarding the subject matter content taught by their teachers?
Evaluation Question 2: Does the effect of Promethean ActivClassroom differ between school levels?
Evaluation Question 3: Does the effect of Promethean ActivClassroom differ between grade levels?
Evaluation Question 4: Does the effect of Promethean ActivClassroom differ between academic content areas?
Evaluation Question 5: Does the effect of Promethean ActivClassroom differ based on length of teaching experience?
Evaluation Question 6: Does the effect of Promethean ActivClassroom differ based on how long the teacher has used the technology?
Evaluation Question 7: Does the effect of Promethean ActivClassroom differ based on the percentage of instructional time the technology is used in the classroom?
Evaluation Question 8: Does the effect of Promethean ActivClassroom differ based on teachers' confidence in their use of the technology?

The overall random effects for all 85 independent treatment/control studies 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 Promethean ActivClassroom and student achievement. When corrected for attenuation, the percentile gain associated with the use of Promethean ActivClassroom is 17 percent ($\overline{ES} = .44$). A reasonable inference is that the overall effect of a 17 percentile point gain is probably not a function of random factors that are specific to the independent treatment/control studies; rather, the 17 percentile point increase represents a real change in student learning. Additionally, the meta-analysis of the seven types of moderator variables indicated conditions under which the technology might produce maximum results. Lower than anticipated effects at the seventh grade level warrant further investigation.

Technical Notes

Technical Note 1: Conceptually an ANCOVA can be thought of in the following way: The covariate (i.e., pretest score) is used to predict students' performance on the posttest and the residual scores for each student are then used as the dependent measure. To illustrate, consider an independent treatment/control 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 Promethean technology to augment instructional practices in the classroom. However, Berk (2004) cautions that in actual practice this interpretation may not always be appropriate.

Technical Note 2: The meta-analytic findings in this evaluation study 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, assume that the population correlation between the use of Promethean technology 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 evaluation study, 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 this evaluation study consists of teacher designed assessments of student academic achievement, .75 was used as the reliability to correct for attenuation using the following formula:

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

where 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 7 was corrected for attenuation to produce the corrected meta-analytic findings considered in this report.

Technical Note 3: Independent variables can be analyzed as fixed effects or as random effects. In the context of ANOVA/ANCOVA, fixed effects are factors that are deliberately arranged by the researcher. In the case of this evaluation study, the treatment/control condition (i.e., the use of Promethean technology) is analyzed as a fixed effect. In contrast, random effects are factors that are not deliberately arranged. Instead, random effects are factors which are randomly sampled from a population of possible samples. Generally speaking, when independent variables are analyzed as random effects, the intent is to generalize results beyond the boundaries of the independent variables employed in the study. For example, if a researcher were interested in the effect that the quality of school leadership has on academic proficiency, the researcher could select a random sample of schools in order to estimate the amount of variance in student academic achievement attributable to differences between types of school leaders. Thus, using the sample, the researcher can make generalizations regarding the influence of school leadership on academic achievement as a whole. Additional research could attempt to replicate the findings by selecting a different random sample of schools for comparison. When fixed effects are employed one typically does not generalize beyond the boundaries of the independent variables in the study. Since the treatment versus control condition in this evaluation study was considered a fixed effect, generalizations should be considered with caution as they can be made only with respect to the use of Promethean technology by teachers involved in this study.

Technical Note 4: In Figure 7, 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 ≠ 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 Promethean technology) 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), is the difference between treatment and control means divided by an estimate of the population standard deviation.

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

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 Promethean technology is 90 on a standardized test and the mean of a group of students in a class that did not use Promethean technology 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 the use of Promethean technology 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 5: Within the context of meta-analysis, independent studies can be analyzed using a fixed effects or random effects model. Fixed effects models are based on an assumption of one true treatment effect common to every study. In other words, fixed effects models assume that exactly the same effect size underlies all studies in the meta-analysis. Random effects models do not assume the existence of a common treatment effect. In contrast, random effects models allow for the possibility that the effect size varies from study to study. Stated differently, random effects models make an assumption that the true treatment effects in the individual studies may differ from one another. Random effects models are often used to estimate this variance. (For a more thorough discussion regarding models used in meta-analysis, see Hunter & Schmidt, 2004.)

Appendix A

Instructions for Action Research Projects
Promethean Technology

Thank you for agreeing to participate in an action research study regarding the effectiveness and utility of the Promethean technology 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 the Promethean technology 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 the Promethean technology 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 the Promethean technology 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 the Promethean technology.

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.

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 Promethean technology. The third form is for students in the group that did NOT use the Promethean technology. 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 Promethean technology.

In addition to these requirements, you will 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 Promethean technology. 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.

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

School _____

Personal ID Number _____

Grade level taught_____

Topic (and general subject area) addressed during the unit with the Promethean class_____

Number of days the Promethean unit lasted_____

Topic (and general subject area) addressed during the unit with the class where Promethean was not used_____

Number of days the non-Promethean unit lasted_____

Were the Promethean and non-Promethean classes comprised of different students? (Y/N) _____

General description of what you did:

Promethean Class:

Non-Promethean Class

Scores for Students in the Group that **Used** the Promethean Technology

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 Promethean Technology

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							
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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 Promethean Activclassroom tools in your classroom? _____

How confident are you in your ability to use Promethean Activclassroom tools in your classroom?

Not at all Completely

1 2 3 4 5

Which lesson development software do you use? (Please check one.)

Activprimary _____

Activstudio _____

Which Learner Response System do you use? (Please check one.)

Activote _____

Activexpression _____

Do you use the Promethean Planet website? (Y/N) _____

What percentage of classroom instructional time do you use Promethean Activclassroom tools?

_____%

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