

**CALIFORNIA STUDENT ASSESSMENT
PROJECT**

PHASE TWO

**THE EFFECTS OF
ENVIRONMENT-BASED EDUCATION
ON STUDENT ACHIEVEMENT**

JANUARY 2005

CONDUCTED BY THE STATE EDUCATION AND ENVIRONMENT ROUNDTABLE

ON BEHALF OF THE

CALIFORNIA DEPARTMENT OF EDUCATION

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EXECUTIVE SUMMARY

Introduction

From the inception of the State Education and Environment Roundtable in 1995, its state members have been deeply interested in the potential of environment-based education programs to improve academic achievement, attain school improvement goals and influence how young people learn to live successfully in American society and the world at large. SEER has designed several studies to: identify innovative, successful environment-based programs; analyze and report on their effectiveness; and, describe their common educational practices. This effort has led to national and state-based studies that have documented benefits ranging from better performance on standardized measures of academic achievement to reduced discipline and classroom management problems. This study, the California Student Assessment Project, provides further evidence that supports the research presented in SEER's 1998 report *Closing the Achievement Gap: Using the Environment as an Integrating Context for Learning* and the first California Student Assessment Project (2000).

Qualitative Program Comparisons

SEER utilized an instrument from its evaluation framework to analyze the environment-based education practices of each school in the study. SEER's evaluation protocols are based on the Concerns Based Adoption Model (CBAM) developed by the University of Texas at Austin and the Southwest Regional Educational Development Laboratory (SEDL). An Innovation Configuration (IC) instrument is one of the diagnostic tools that the CBAM method uses to assess how instructional practices are being implemented by classroom teachers. SEER worked with a staff consultant from SEDL to develop an IC instrument specific to environment-based education strategies. SEER's instrument focuses on seven instructional strategies:

- **Integrated-interdisciplinary instruction** — curriculum that interconnects multiple subject-matter areas;
- **Community-based investigations** — exploration of real-world, local issues and involvement in service activities;
- **Study of natural and social systems** — opportunities for students to explore the interactions among the natural and social systems that constitute the local community;
- **Collaborative instruction** — curricular planning and instruction that involves interdisciplinary teams of teachers, community members and other formal and non-formal educational partners;
- **Learner-centered, constructivist approaches** — opportunities for students to capitalize on individual learning styles, and develop personal skills and abilities;
- **Cooperative and independent learning** — student grouping that fosters teamwork while developing individual knowledge and skills; and,
- **Authentic assessment** — evaluation of students' standards-based knowledge and skills using a combination of performance-based and traditional measures.

SEER's research team used this IC instrument to collect uniform qualitative data on instructional practices used at the treatment and control schools for this study. The findings of the interview process are summarized in case story narratives included in the descriptions associated with each paired-school comparison. The narratives are intended to provide the reader with a description of the instructional strategies used at the treatment and control schools.

Paired School Comparisons

The document reports the results of comparative analysis of four matched treatment and control pairs of schools. The results are based on comparison of standardized test data from California's STAR (Standardized Testing and Reporting) assessment system representing five school years of scores from second through fifth grades in reading, math, language and spelling. The research team used the API statewide ranking of similar schools to identify appropriate control schools to compare with the treatment schools.

The four pairs of schools included in the study are as follows:

- Brookside Elementary (treatment) and Rancho Elementary (control)
- Open Charter School (treatment) and Riverside Drive Elementary (control)
- Maguire Elementary (treatment) and Pleasant Valley Elementary (control)
- Thomas Elementary (treatment) and Tamalpais Valley Elementary (control)

Results

This study affirmed the findings of the original California Student Assessment Project and SEER’s report, Closing the Achievement Gap. Students in the environment-based study schools scored higher than their traditionally educated peers on standardized test scores in the content areas of reading, math, language and spelling. In the schools utilizing environment-based approaches students performed higher than or equal to their peers in more traditional programs.

The following table summarizes the data from the four paired school comparisons. It reports the number of instances when either the “treatment” or “control” school scored significantly higher than its counterpart. The entries in the “treatment” and “control” columns indicate the total number of years, out of the combined study years (a possible 20), in which students in the treatment and control schools scored significantly higher on the standardized tests administered in each subject area. Blank cells indicate that there was not a significant difference between student scores at the two schools.

Table 1. Combined Standardized Test Score Data: All Study Schools

Grade	Reading		Math		Language		Spelling		Total	
	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control
2	9		7	1	7	1	5	2	28	4
3	8		11	1	7		8		34	1
4	10		10	2	8	1	6		34	3
5	10		11	2	10	2	7		38	4
									134	12

Students in the study’s environment-based programs outperformed their traditionally educated peers as evidenced by the year-to-year standardized test data in four core subject areas.

The most notable quantitative evidence includes:

- In 100% of the reading assessments, treatment students scored as well or better than control students
- In 92.5% of the math assessments, treatment students scored as well or significantly higher than control students
- In 95% of the language assessments, treatment students scored as well or significantly higher than control students
- In 97.5% of the spelling assessments, treatment students scored as well or significantly higher than control students
- In over 96% of all cases treatment students scored as well or significantly higher than control students
- In only 4% of the cases control students scored significantly higher than treatment students
- In 42% of the cases treatment students scored significantly higher than control students in reading, math, language and spelling

The treatment programs provide students with hands-on methodologies that allow them to apply knowledge and skills to relevant, real-world learning opportunities in their local communities. Students in the treatment schools are gaining the added benefits of standards-based interdisciplinary instruction, learner-centered methodologies, student-centered courses of study and community-based learning contexts.

Through interdisciplinary studies, teachers in the environment-based programs are connecting state standards from multiple disciplines to simultaneously address content and skills from a variety of subject areas. The rich, comprehensive learning atmosphere fostered by environment-based programs provides opportunities for students to investigate the interaction of the natural and social systems that comprise their local environment, increasing their awareness of the complexity of life in their community while, at the same time, fostering civic responsibility.

These engaging programs appear to better connect students to their learning by allowing them to take a more active role in their studies. Students in these environment-based programs are often engaged in cooperative learning groups that help them develop teamwork skills. Multiple assessment methods including performance assessments, self-evaluation rubrics, portfolios, and standardized tests provide teachers in these programs with a more accurate appraisal of each student’s level of achievement.

The findings of this study will certainly bolster the discussion on the need to connect environment-based programs to state and national content standards and other formal education efforts.

PREFACE

From SEER's inception in 1995, its state members have been deeply interested in the potential of environment-based education programs to improve academic achievement, attain school improvement goals and influence how young people learn to live successfully in American society and the world at large. After an extensive literature review on the efficacy of environment-based education yielded limited results, SEER staff designed a study to: identify innovative, successful environment-based programs; analyze and report on their effectiveness; and, describe their common educational practices.

They also sought to identify the factors that contributed to program successes and ascertain challenges faced in the implementation of these programs. This effort led to a study of 40 schools in 13 states, documented in SEER's 1998 report, *Closing the Achievement Gap: Using the Environment as an Integrating Context for Learning*¹. As a result of this research effort, SEER developed its school improvement model, the EIC Model™².

The findings of *Closing the Achievement Gap* included benefits ranging from better performance on standardized measures of academic achievement in reading, writing, math, science and social studies; reduced discipline and classroom management problems; and, increased engagement and enthusiasm for learning.

SEER subsequently conducted a study, published in 2000, for the California Department of Education's Office of Environmental Education. This study, the *California Student Assessment Project*, sought to gather further evidence of the effects of environment-based education on student achievement and attendance rates. The *California Student Assessment Project* documented the results of analyzing data from eight sets of paired-school

comparisons. The report indicated that students in the environment-based programs scored higher than their traditionally educated counterparts in standardized measures of language arts, math, science and social studies. In addition, students in the treatment groups had higher scores than control-group students in reports about attendance rates.

This report provides further evidence that appears to substantiate the research presented in SEER's *Closing the Achievement Gap* report and first *California Student Assessment Project*.

¹ *Closing the Achievement Gap* presents the conceptual framework of the EIC Model™. For further information please contact: State Education and Environment Roundtable
13648 Jackrabbit Road
Poway, CA 92064
(858) 676-0272
www.seer.org

² EIC Model™ (using the Environment as an Integrating Context for learning), defines a framework for education: a framework for interdisciplinary, collaborative, student-centered, hands-on and engaged learning. The EIC Model™, a term coined by the State Education and Environment Roundtable, encompasses the educational practices that the group believes should form the foundation of environment-based education in America's schools. The conceptual structure of the EIC Model™ and SEER's research results can be found in "Closing the Achievement Gap: Using the Environment as an Integrating Context for Learning," by Gerald A. Lieberman and Linda L. Hoody (1998, 2002).

INTRODUCTION

Environment-based education represents an instructional vehicle with compelling potential for school improvement and reform efforts. Yet, despite the benefits of providing students with real-world learning and student-centered educational opportunities, environment-based education proponents have been unable to achieve a strong presence in today's formal education systems.

The purpose of this research project was to revisit the study schools in the original California Student Assessment Project, published in 2000, in order to further document the educational efficacy of environment-based educational practices when compared to traditional education methods. This project was designed to determine if there were measurable changes in academic achievement, as indicated by standardized test scores, for students who learn in environment-based education programs (treatment) when compared to students in traditional programs (control).

Instructional practices that utilize the local environment as an educational framework allow students to apply subject-matter content and skills in the real-world contexts of their local communities. Environment-based education engages students in their learning and offers opportunities for students to take an active role in developing their own courses of study. By employing learner-centered approaches and utilizing cooperative learning methods, teachers provide students with opportunities to capitalize on their individual learning styles and develop personal skills and abilities.

Through community-based investigations teachers connect content standards from multiple disciplines to create relevant interdisciplinary units. Such instruction takes advantage of partnerships with community organizations and the expertise of non-formal educational professionals by making them part of the instructional team.

This study was conducted by the State Education and Environment Roundtable (SEER). SEER's research team identified the treatment and control schools after a thorough review of schools included in the original *California Student Assessment Project*. This report includes the research design, study methods, paired schools' demographic data, STAR test scores in four core subject matter areas, case study descriptions of the participating schools, data analysis and a summary of research results.

METHODOLOGY

Quantitative Data

SEER's research team contacted the original study schools from the *California Student Assessment Project* to determine the viability of including their programs in this follow-up research project. The researchers determined that only the four elementary schools from the original study could provide five years of standardized test data for this study.

In the original study the research team based the choice of comparison schools on general demographic data available from the California Department of Education (CDE). Since the original *California Student Assessment Project*, the CDE has focused its internal analysis on a classification system called "Similar Schools Ranks." The similar schools rankings use a mixture of demographic characteristics, CDE states that "this information (can be used) as a reference point for judging their academic achievement against other schools facing similar challenges. Second, schools may improve their academic performance by studying what similar schools with higher rankings are doing." (See Table 1 for details regarding the demographic characteristics used to identify similar schools.)

The similar schools ranking provides a rigorous, comparative methodology that is accepted by the California Department of Education and the larger formal education community. The research team therefore decided to use the API's statewide ranking of schools to identify appropriate "control" schools to compare with the study schools (treatment). The standardized test scores from these control schools provided the comparative data for this study. (See Appendix A for background information regarding the Academic Performance Index [API].)

Table 1. Demographic Characteristics Used to Identify Similar Schools

The PSAA law requires that the following school demographic characteristics, or factors, be used to identify the similar schools:	
School Demographic Characteristics	How Characteristics Are Determined
Pupil mobility	% of students who first attended the school in the current year
Pupil ethnicity	% of students in the school in each of these ethnic categories: American Indian or Alaska Native; Asian; Pacific Islander; Hispanic or Latino; African American not Hispanic; Filipino; White not Hispanic
Pupil socioeconomic status	Average of all parent educational level responses for the school % of students in the school that participated in the free or reduced price lunch program
Percentage of teachers who are fully Credentialed	% of teachers in the school who are fully credentialed
Percentage of teachers who hold emergency credentials	% of teachers in the school who hold emergency permits
Percentage of pupils who are English language learners	% of students in the school who are classified as English language learners
Average class size per grade level	Average class size at the school for each grade level: K–3; 4–6; Core academic courses in departmentalized programs
Whether the schools operate multi-track year-round educational programs	Schools are categorized as either operating or not operating multi-track year-round educational programs

¹ *Parent Guide to the 2000 Similar Schools Ranks based on the Academic Performance Index, Public Schools Accountability Act.* California Department of Education. January 2001.

This report uses standardized test data from California’s STAR (Standardized Testing and Reporting) assessment system. The SAT-9, California’s Standards Tests, and a test for English Learners comprise the STAR program. At the time data were collected for this report, STAR consisted of a standardized national test based on California curriculum standards in English/language arts and math in all grades; history/social science and science in grades 9-11; writing in grades 4 and 7; and, a test for Spanish-speaking students who have been in a California district for a year or less (SABE-2). SAT-9 (Stanford-9) is the Stanford Achievement Test, Form 9. Students in grades 2 through 11 must take the nationally normed SAT-9, augmented with questions keyed to the state’s curriculum standards. In 2002 the California Achievement Test, 6th Edition, replaced the SAT-9. The STAR scores analyzed for this report represent the four paired populations of treatment and control schools for the 1997-98, 1998-99, 1999-2000, 2000-01 and 2001-02 school years.

All test data reported in this document were evaluated for statistical significance at the 5% level with a P value < 0.05.

Qualitative Program Comparisons

Over the past nine years, SEER has worked collaboratively with its member state departments of education to generate an evaluation framework, based on the Concerns Based Adoption Model (CBAM) developed by the University of Texas at Austin and the Southwest Regional Educational Development Laboratory (SEDL). An Innovation Configuration (IC) instrument is one of the diagnostic tools that the CBAM method uses to assess how instructional practices are being implemented by classroom teachers. SEER worked with a staff consultant from SEDL to develop an IC instrument specific to environment-based education strategies. SEER’s instrument focuses on seven instructional strategies:

- **Integrated-interdisciplinary instruction** — curriculum that interconnects multiple subject-matter areas;
- **Community-based investigations** — exploration of real-world, local issues and involvement in service activities;
- **Study of natural and social systems** — opportunities for students to explore the

interactions among the natural and social systems that constitute the local community;

- **Collaborative instruction** — curricular planning and instruction that involves interdisciplinary teams of teachers, community members and other formal and non-formal educational partners;
- **Learner-centered, constructivist approaches** — opportunities for students to capitalize on individual learning styles, and develop personal skills and abilities;
- **Cooperative and independent learning** — student grouping that fosters teamwork while developing individual knowledge and skills; and,
- **Authentic assessment** — evaluation of students' standards-based knowledge and skills using a combination of performance-based and traditional measures.

SEER's research team used this IC instrument to collect uniform qualitative data on instructional practices used at the treatment and control schools for this study. In all but one case, the principal of the treatment and control schools took part in an IC-based interview that averaged one hour. (The principal of Open Charter Elementary School asked that he be exempt from the interview process because of his short tenure as acting administrator. Lead teachers in Open Charter's program were therefore interviewed as part of the data collection process.)

The findings of the interview process are summarized in the case story narratives included in the descriptions associated with each paired-school comparison. The narratives are intended to provide the reader with a description of the instructional strategies used at the treatment and control schools.

Paired School Comparisons

This document reports the results of comparative analysis of the four matched schools, treatment and control pairs. The results are based on standardized test data from 1998-2002 representing second through fifth grades in reading, math, language and spelling.

The four pairs of schools included in this study are as follows:

- Brookside Elementary (treatment) and Rancho Elementary (control)
- Open Charter School (treatment) and Riverside Drive Elementary (control)
- Maguire Elementary (treatment) and Pleasant Valley Elementary (control)
- Thomas Elementary (treatment) and Tamalpais Valley Elementary (control)

The results of the paired comparisons are presented in separate sections of this report. Each of these sections includes the following major components:

- descriptions of both the control and treatment schools;
- table of similar school ranking demographic data; and,
- analysis of student scores in reading, math, language and spelling for grades 2-5 for the school years 1998-2002.

It is important to note that, as a result of student mobility, it is difficult to determine the percentage of the student population at each site that changed from year-to-year. It is also important to note that not all students at a school are tested and, as a result, the number of test scores reported for a school does not always equate to the student population.

RESULTS

PAIRED COMPARISON BROOKSIDE AND RANCHO ELEMENTARY SCHOOLS

Brookside Elementary (treatment)

Brookside Elementary School is part of the Ross Valley School District in Marin County. The school serves a suburban population of approximately 500 K-5 students on two campuses. Brookside earned the California Distinguished School Award in 1996 and is also a recipient of the Golden Bell Award.

Throughout the school year, Brookside students make use of an array of outdoor instructional settings. Both campuses utilize gardens and local outdoor areas for integrated studies as well as discipline-specific instruction. There is a focus on project-based learning at the school, providing students with opportunities to participate in a variety of community-based investigations.

Brookside teachers use thematic units to connect multiple disciplines and address mandated standards. Brookside teachers incorporate field work into their studies of ecosystems and as enrichment for classroom lessons. For example, students gain first-hand knowledge of the interdependence of creek-side habitats and the agricultural uses of the area through their work on riparian restoration projects. Fourth and fifth graders from the upper campus are involved in standards-based, creek-bed restoration through the STRAW Project (Students and Teachers Restoring A Watershed). The Bay Institute and the Center for Ecoliteracy jointly manage the STRAW network of teachers, students, community members and restoration experts to initiate watershed studies and restoration efforts in two counties. Watershed projects through STRAWS set the stage for a variety of field studies throughout the region.

The school has campus gardens that are used to connect students' knowledge and skills in a number of subject areas. In the upper grades, teachers integrate content standards into garden-based lessons, linking garden study to disciplinary areas throughout the curriculum. Kindergarten through second-grade students use the gardens for journaling, scientific observation and plant study. Plant life cycles are observed and investigated; colonial herbs are grown and researched; and, native plants and their uses are studied. The school grounds and nearby open areas are used to extend learning settings to include outdoor locations for scientific observation, writing and reading.

With a science and social studies emphasis, third graders at Brookside study their county. The

students select their own location to study, detailing their discoveries through photography and oral reports. They also investigate local Miwok Indian sites and join in the activities of "Miwok Days," a springtime celebration that features Miwok crafts including rope weaving.

The culmination activities of Brookside's fourth-grade study of California history includes making missions, creating PowerPoint presentations, panning for gold, making lariats and performing as living history characters. In another popular fourth-grade unit, which has been extended throughout the district, students study business practices using the local shopping mall as the model. They develop business plans, apply for loans to buy materials and produce homemade products that they sell at a school-wide fair.

The teachers at Brookside utilize a variety of collaborative learning strategies, thus most classrooms at Brookside employ some form of cooperative student grouping. Student teams work in flexible-level groupings, often assigned by the teacher, with guidance on how to work most effectively. Emphasis is placed on coordinating active exploration, problem-solving approaches and inquiry-based instruction.

Because Brookside's upper-level teachers specialize in subject-matter areas, they rotate students for discipline-specific studies. During these times, students are not organized by homeroom classes, but are mixed into new classes utilizing homogeneous grouping. The teachers make a concerted effort to exercise flexibility in forming student groups with the goal of providing students with opportunities to evaluate and synthesize presented information in the development of higher-level thinking skills.

In addition to fostering development of teamwork skills, Brookside's teachers help students capitalize on their individual learning styles by taking into account students' personal needs and interests. During the third week of each school year a team made up of the principal, school psychologist, resource specialist and the classroom teacher meet to discuss every student, identify any needs the student may have socially or academically and to determine the appropriate resources and instructional techniques to address these needs. Teachers also conduct grade-level meetings to discuss the most effective methods to work with individual students.

Brookside's school climate is one that promotes both individuality among the teachers and professional collaboration and support. Teachers have a common preparation period during the workday which allows them to have weekly grade-

level planning meetings. In addition, teachers throughout the district hold monthly grade-level meetings. Most curricular planning is done in grade-level teams with specific planning time for environment-based projects. Community members are used as resources, helping to enrich the overall curriculum.

Student work at Brookside is assessed using a variety of methods. The STAR assessment series is administered to nearly every student in the district. Unit tests, developed by the teachers, are used throughout the district. Many teachers also have students develop their own rubrics to assess assignments. Students' grades are derived from standardized tests, scores on their presentations, performance tasks and grades for final products.

Performance tasks were developed and refined by teachers at each grade level. These tasks are presented as a menu of options, from which the teachers select two assessments. Portfolios are used in multiple subjects to show student mastery of skills, in addition to their academic growth. Language Arts portfolios are used in fifth and seventh grades in the district. Grade-level teams meet to score the portfolios. Students communicate their subject-matter knowledge and skills in a variety of ways, such as the ecosystem mural created by one fourth-grade class. Students also write letters of reflection on their personal and academic growth.

Kandee Adams, Brookside's principal for five years, reports that it has been a struggle to continue to have a strong environment-based program — state-approved curriculum has become a driving force in curricular design and adopted texts now have a stronger foundational role in the curriculum than in past years. Despite these challenges, including the new curriculum standards and continuous turnover of staff, Ms. Adams affirms Brookside's commitment to hands-on learning, as stated in their site plan. She also stresses that the faculty recognizes the need to quantify the educational effects of their environment-based program.

Rancho Elementary (control)

Rancho is a California Distinguished School, and offers a district-wide program offering a structured approach to instruction. Rancho was founded in

1976 when a group of parents went looking for a school program that emphasized basic skills, student discipline and responsibility, parent involvement in school, regular homework and high academic expectations. In the 70's era of open classrooms, Rancho's parents wanted a back-to-basics school. The School Board supported their request and established an "essentialist school" in the Novato community. A staff of experienced teachers was hired to help accomplish the objectives of the essentialist school.

Rancho's principal describes the school as serving students from an upper/middle class predominantly Caucasian population. Rancho is a "school of choice," with a very lengthy waiting list that operates by a lottery system. As stated in their school vision, "priority is given to the fundamental tools of learning in the core academic areas of reading and phonics, grammar, writing and spelling, speaking, mathematics, science, and social studies." Technology as a learning tool and critical thinking skills are also perceived as "basic skills of the future."

Rancho's educational program is traditionally based and centers on classroom activities. The teachers predominantly work in their individual classrooms; there is not an emphasis on team teaching or interdisciplinary instruction. The school embraces a sequentially articulated educational program that includes developmentally appropriate approaches to developing basic skills. A few classes in the upper grades employ cooperative learning approaches.

The curriculum is textbook- and worksheet-driven in a structured classroom environment. Although there is a creek on school property, the former principal did not allow teachers to do creek studies with their students, the new principal has decided to change this policy. In past years, hands-on learning was not encouraged or supported at Rancho.

The staff has only recently begun to work on the shift to California's updated state standards and standards-based testing. Assessment of student learning is conducted by teachers and is based on state content standards. Few Rancho teachers use rubrics for assessing student products.

Table 2. Similar School Comparison Data: Brookside and Rancho*

Similar School Comparison	Brookside	Rancho
Grade Levels at School	K-5	K-5
Student Enrollment	526	489
Population Status	Urban fringe of a large city	Urban fringe of a large city
% Free or Reduced Lunch	3.6	2.9
% English Learner	3.4	0.4
Average School-wide Class Size	20.4	22.2
* Information based on 2001-02 school year as reported by Ed-Data: Education Data Partnership, California Department of Education.		

Summary of Test Score Comparisons

Over 3300 sets of student data were collected for the five-year comparison of Brookside and Rancho Elementary Schools.

The following table indicates the number of instances when either the “treatment” or “control” school scored significantly higher than its counterpart. The entries in the “treatment” and

“control” columns indicate the number of years, out of the five study years, in which the indicated school’s students scored significantly higher on the standardized tests administered in each subject area. Blank cells indicate that there was not a significant difference between student scores at the two schools.

Table 3. Standardized Test Score Data: Brookside and Rancho

Grade	Reading		Math		Language		Spelling		Total	
	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control
2	2		1		1	1			4	1
3	2		2	1	1		2		7	1
4	2		1	1		1	1		4	2
5	1		1	2	1	2			3	4
									18	8

Analyzing the Brookside and Rancho Elementary test scores produces the following observations:

Reading (all grades)

- In all cases, Brookside students scored as well or better than Rancho students
- In 35% of the cases, Brookside students scored significantly higher than Rancho students

Math (all grades)

- In 25% of the cases, Brookside students scored significantly higher than Rancho students
- In 20% of the cases, Rancho students scored significantly higher than Brookside students

Language (all grades)

- In 15% of the cases, Brookside students scored significantly higher than Rancho students
- In 20% of the cases, Rancho students scored significantly higher than Brookside students

Spelling (all grades)

- In all cases, Brookside students scored as well or better than Rancho students

Grade 2

- Brookside students scored significantly higher in reading in 40% of the cases (2 of 5 years)
- Brookside students scored significantly higher in math in 20% of the cases (1 of 5 years)
- Brookside students scored significantly higher in language in 20% of the cases (1 of 5 years)
- Rancho students scored significantly higher in language in 20% of the cases (1 of 5 years)

Grade 3

- Brookside students scored significantly higher in reading in 40% of the cases (2 of 5 years)
- Brookside students scored significantly higher in math in 40% of the cases (2 of 5 years)
- Rancho students scored significantly higher in math in 20% of the cases (1 of 5 years)

- Brookside students scored significantly higher in language in 20% of the cases (1 of 5 years)
- Brookside students scored significantly higher in spelling in 40% of the cases (2 of 5 years)

Grade 4

- Brookside students scored significantly higher in reading in 40% of the cases (2 of 5 years)
- Brookside students scored significantly higher in math in 20% of the cases (1 of 5 years)
- Rancho students scored significantly higher in math in 20% of the cases (1 of 5 years)
- Rancho students scored significantly higher in language in 20% of the cases (1 of 5 years)
- Brookside students scored significantly higher in spelling in 20% of the cases (1 of 5 years)

Grade 5

- Brookside students scored significantly higher in reading in 20% of the cases (1 of 5 years)
- Brookside students scored significantly higher in math in 20% of the cases (1 of 5 years)
- Rancho students scored significantly higher in math in 40% of the cases (2 of 5 years)
- Rancho students scored significantly higher in language in 20% of the cases (1 of 5 years)
- Rancho students scored significantly higher in language in 40% of the cases (2 of 5 years)

PAIRED COMPARISON OPEN CHARTER AND RIVERSIDE DRIVE ELEMENTARY SCHOOLS

Open Charter School (treatment)

Open Charter is a public elementary school within the Los Angeles Unified School District. It was founded in 1977 by parents looking for an alternative to traditional school programs. The school's kindergarten through fifth-grade students are randomly selected and represent the ethnic, racial and socio-economic population of the Los Angeles basin. Open Charter has been recognized, nationally and internationally, for its innovative instructional methods.

From its inception, Open Charter emphasized recognized concepts in education reform — thematic instruction, active learning and multi-age grouping. At one time the school received major contributions of equipment and staff support from Apple Computer to help it emphasize of technology-supported educational practices. Although the association with Apple has ended, technology remains an integral part of Open Charter's instructional program.

Open Charter is organized into seven multi-age clusters, each led by a team of two teachers. Each cluster occupies a double-sized open classroom, creating a learning environment in which the students are encouraged to freely move. The curriculum at Open Charter is organized around the school-wide theme of "Interdependence: Human Interaction with the Environment." The school bases its educational philosophy on the premise that children are natural learners and thus provides a learning environment that promotes experiential, constructivist approaches. Classroom studies emphasize learning through active exploration, originality and creative personal expression. The comprehensive "systems approach" is a focal point for Open Charter students. Open Charter's teachers emphasize the interaction and interrelationships of components within the natural and social systems the students are studying.

The diversity of learning settings varies among the classes. Some teachers utilize extensive field trips in the local community to extend their curriculum and provide their students with first-hand experiences. Other teachers integrate out-of-classroom studies centered on areas of campus as focal points for their curriculum. Wide-ranging field work in the local community provides one cluster with the framework they need to design and build a city 100 years in the future. This theme integrates all aspects of the class as students assume roles such as mayor and city council in working to establish their city's government. Another group of students focuses on

their local bioregion through an in-depth study of the natural systems that constitute their local environment. Field studies in a local wetland ecosystem, investigation of abandoned mines and a trip to an outdoor science school are examples of the learning settings used to initiate this cluster's studies of wildlife, literature and cultural arts related to their local region.

The school's 2,000 square-foot garden serves as an outdoor classroom where students study plant biology; learn about nutrition; record rates of decomposition in the study of soils; and, complete creative writing and art projects. When Open Charter came to occupy their new campus, concrete slabs were cleared away so students could help create model ecosystems of native plant communities. In partnership with the TreePeople organization, the school received funding for this project that has grown to include a rainwater-collecting cistern.

Open Charter's teaching teams connect skills and content from multiple subject areas into an interdisciplinary curriculum that addresses each cluster's theme. Textbooks, novels, films and print media are used as supplementary materials. Students' skill levels and learning styles also inform curriculum planning and instructional delivery. Teachers report being taken in new, unexpected directions as a result of students' interests and curiosity in current or historic events.

The teachers at Open Charter work in a highly collaborative environment. Virtually all aspects of the curriculum are designed in team-planning sessions. Regularly scheduled planning time is provided for the teaching pairs, grade-level teams and for instructional teams that cross the grade levels. In support of the founding philosophy, Open Charter's educational endeavors are supported by a Governing Council of parents, teachers and the site administrator — all sharing in the decision-making process. Involvement of the greater community is evidenced by the invitations extended to local authors, community performing arts groups and parents to share their talents and expertise with the students.

Because Open Charter's culture promotes collaboration and teamwork, students learn within a variety of cooperative learning environments. Students regularly work in small teams utilizing hands-on approaches in meaningful, real-world contexts. Most commonly, Open Charter's students work in groups of mixed ability levels.

Student work at Open Charter is assessed using a wide variety of methods. Combinations of teacher observation, traditional testing and performance assessments — including portfolios and journals —

are used. Teachers report using individual student conferencing to evaluate students' levels of comprehension. In some clusters, students present a reflection of their own learning and write self-evaluations as part of their parent conferences. Students also work with teachers to create rubrics to evaluate their own work.

Riverside Drive Elementary School (control)

Riverside Drive Elementary School is located in Sherman Oaks, California, in the eastern San Fernando Valley. First opened in 1938, Riverside is one of 426 elementary schools within the Los Angeles Unified School District (LAUSD). Riverside is a LAUSD School for Advanced Studies, providing gifted and high-ability students with grade-level curriculum taught to a greater depth and complexity.

Riverside's upper/middle class school population is primarily Caucasian, with African American, Israeli and Hispanic students also representing the student body. The school offers seven special-day classes serving 150 students, as well as programs that serve 145 GATE students. Seventeen of Riverside's teachers have attended training to receive GATE certification.

Riverside's educational program is traditionally based and primarily centered on self-contained classroom activities. The teachers form two first-, second- and third-grade triads for art, science, social studies, music and drama. For the core subjects, the school staff uses the state-adopted Open Court program. In the Open Court system, students receive a balance of literature and explicit, systematic phonics instruction to enhance writing and language arts skills and strategies. Students most often work individually, although recent staff development focused on the incorporation of cooperative learning practices. Riverside's principal estimates that about half to two-thirds of the teachers are currently utilizing cooperative student grouping.

Enrichment programs at Riverside include a tuition-based kindergarten program and Super School — an after-school program of activities including Spanish instruction, tennis lessons and a homework club. An emphasis on music and art led the staff to pursue of an Arts Prototype grant from LAUSD to fund a visual and performing arts program. Parents receive a small stipend for helping with the music/performing arts program at the school.

When Riverside's test scores dropped in 2001, the new administrator began looking for ways to boost

achievement. She realized the staff needed to strengthen standards-based instruction and adopt the state's new scoring rubrics. The principal also asked the school's predominately veteran staff to teach students test-taking strategies. During the 2001-02 school year, test prep was covered during the same time period once a week. The staff was also asked to address the need for "commonality" throughout the school, both academically and socially. While the students were scheduled into a common PE block, the staff began to conduct regularly scheduled, grade-level meetings. These instructionally focused meetings were also attended by the half-time literacy and math coach, with the principal joining every fourth gathering.

Weekly grade-level meetings continue to allow the teachers to plan together and articulate their instruction. The teachers use end-of-unit assessments and conduct LAUSD performance-based writing tests in grades 2-5.

Riverside's students have spent limited time exploring the local community. Third graders have done a walking trip of Los Angeles with a follow-up study of city life. Other classes have visited the public library and have participated in field trips built into various units of study, such as participation in special events at a nearby shopping center. Students' community service activities have included work to benefit a local hospital.

Riverside parents are actively involved in school activities through the school's PTA, an active Booster Club and Special Education Advisory Committee. Parents paid for a school computer lab and fund the salary of the computer teacher. Parents were also instrumental in the grant-writing process that led to an award of a \$10,000 grant from the City of Los Angeles for a Literacy Garden.

The school has partnerships with a number of agencies and organizations. TreePeople and Operation Clean Sweep have been involved in the school's tree planting and beautification efforts. Washington Mutual has conducted banking activities with Riverside students and actor Kirk Douglas sponsored construction of a new playground. Other beneficial partnerships have been fostered with Westfield Shopping Center, a nearby convalescent home and the local Whole Foods Market. College students from nearby Valley College work in the office and provide support in the classrooms. The school also provides meeting space for local scout troops and a variety of other community groups.

Table 4. Similar School Comparison Data: Open Charter and Riverside Drive*

Similar School Comparison	Open Charter	Riverside Drive
Grade Levels in School	K-5	K-5
Student Enrollment	365	778
Population Status	Large city	Large city
% Free or Reduced Lunch	28%	26.1%
% English Learners	16.8%	14.4%
Average School-wide Class Size	22.8	19.5
* Information based on 2001-02 school year as reported by Ed-Data: Education Data Partnership, California Department of Education.		

Summary of Test Score Comparisons

Over 3600 sets of student data were collected for the five-year comparison of Open Charter and Riverside Elementary Schools.

The following table indicates the number of instances when either the “treatment” or “control” school scored significantly higher than its counterpart. The entries in the “treatment” and

“control” columns indicate the number of years, out of the five study years, in which the indicated school’s students scored significantly higher on the standardized tests administered in each subject area. Blank cells indicate that there was not a significant difference between student scores at the two schools.

Table 5. Standardized Test Score Data: Open Charter and Riverside

Grade	Reading		Math		Language		Spelling		Total	
	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control
2	3		3		4		3		13	
3	5		5		3		3		16	
4	4		4		5		4		17	
5	5		5		4		5		19	
									65	

Analyzing the Open Charter and Riverside Elementary test scores produces the following observations:

Reading (all grades)

- In all cases, Open Charter students scored as well or better than Riverside students
- In 85% of the cases, Open Charter students scored significantly higher than Riverside students

Math (all grades)

- In all cases, Open Charter students scored as well or better than Riverside students
- In 85% of the cases, Open Charter students scored significantly higher than Riverside students

Language (all grades)

- In all cases, Open Charter students scored as well or better than Riverside students

- In 80% of the cases, Open Charter students scored significantly higher than Riverside students

Spelling (all grades)

- In all cases, Open Charter students scored as well or better than Riverside students
- In 75% of the cases, Open Charter students scored significantly higher than Riverside students

Grade 2

- Open Charter students scored significantly higher in reading in 60% of the cases (3 of 5 years)
- Open Charter students scored significantly higher in math in 60% of the cases (3 of 5 years)
- Open Charter students scored significantly higher in language in 80% of the cases (4 of 5 years)

- Open Charter students scored significantly higher in spelling in 60% of the cases (3 of 5 years)

Grade 3

- Open Charter students scored significantly higher in reading in 100% of the cases (all 5 years)
- Open Charter students scored significantly higher in math in 100% of the cases (all 5 years)
- Open Charter students scored significantly higher in language in 60% of the cases (3 of 5 years)
- Open Charter students scored significantly higher in spelling in 60% of the cases (3 of 5 years)

Grade 4

- Open Charter students scored significantly higher in reading in 80% of the cases (4 of 5 years)
- Open Charter students scored significantly higher in math in 80% of the cases (4 of 5 years)
- Open Charter students scored significantly higher in language in 100% of the cases (all 5 years)
- Open Charter students scored significantly higher in spelling in 80% of the cases (4 of 5 years)

Grade 5

- Open Charter students scored significantly higher in reading in 100% of the cases (all 5 years)
- Open Charter students scored significantly higher in math in 100% of the cases (all 5 years)
- Open Charter students scored significantly higher in language in 80% of the cases (4 of 5 years)
- Open Charter students scored significantly higher in spelling in 100% of the cases (all 5 years)

**PAIRED COMPARISON
EDNA MAGUIRE AND PLEASANT VALLEY
ELEMENTARY SCHOOLS**

Edna Maguire Elementary (treatment)

Maguire Elementary School serves 400 kindergarten through fifth-grade students from suburban Marin County. Just 10 miles north of the Golden Gate Bridge, Maguire opened in 1990 with 400 students. The school earned the California Distinguished School Award in 1998 and received an honorable mention in 2002. The school population — described by its administrator as middle to upper middle class — is predominantly Caucasian, with a small number of Asian, East Indian and Hispanic students. The district's ESL program resides at Maguire where approximately 17 languages are spoken.

Of the original staff, just two teachers returned in the 2000-01 school year. The school's principal reports quite a few changes in the last few years including a dramatic drop in student enrollment when a new school opened in the district in 2000. Four of Maguire's teachers transferred to the new school. A number of Maguire teachers are working on their CLAD credential and many have had training in differentiated instruction, sheltered instruction and Gardner's "Multiple Intelligences." Maguire teachers are also trained in "Complex Instruction," designed to promote academic success for all students in the school's heterogeneous classrooms, in which teachers use complex tasks to encourage development of higher-order thinking skills through group-work activities. These tasks challenge all students to use individual intellectual abilities and learning styles.

Diverse settings, including school site and off-campus areas, are used for instruction at Maguire. Instruction is designed to connect learning to multiple disciplines; meet learning objectives; and, facilitate understanding of natural and social systems. Teachers focus on connecting disciplines to simultaneously develop knowledge and skills in multiple subject areas; students work concurrently in several subjects on interrelated aspects of the same theme or project, such as a year-long study of the seasons. In these projects, the connection between humans and their place in the natural world is emphasized. Students begin the year studying the native inhabitants of the local area, progressing to an investigation of how ancient cultures once explored their world. Toward the end of the year, students learn about how present civilizations interact with their environment.

Maguire students explore their local surroundings through activities such as the investigation and

mapping of their local creek. Some of Maguire's classes are affiliated with the STRAW Project. STRAW (Students and Teachers Restoring A Watershed), a joint effort of The Bay Institute and the Center for Ecoliteracy, is a network of teachers, students, community members and restoration experts. The project provides students and their teachers with needed resources for watershed studies and restoration of riparian areas. STRAW-supported projects have helped Maguire students to learn about how humans interact with the land, use its resources and change the landscape. Teachers report that investigating these issues has helped make learning more relevant to their students.

Early in the school year, students study the Miwok people of Marin. Literature is connected to language arts and geographic investigations. Art and drama are integrated through the study of a local artist who creates sculptures from natural materials. Students write plays based on the legends that the students themselves created. In spring, students investigate how their present community inhabits the land. Maguire students participate in other standards-based activities such as studying the Western movement, replicating settlers' activities of planting wheat, baking bread and writing poetry. Teachers connect the study of nutrition to the students' garden projects, involving local growers as resources. Students learn to prepare snacks and salads from garden produce and make applesauce from fruit they harvest from the school's orchard. Utilizing grade-level garden plots, all students at Maguire use the one-third acre school garden throughout the school year.

A popular year-long collaborative effort of the four, third-grade classes focused on the content of the social studies curriculum "Community" from the point of view of continuity and change. Seventy-five students, four teachers and various parent volunteers worked together to develop the project. Students ventured into a variety of locations to initiate their investigations of social issues within their local community. Then, capitalizing on the students' original work, each class developed a piece of the project to share with the other classes. Students created all of the artwork and learned keyboarding skills to word-process their text. They learned to scan and import pictures into their documents, and even mastered the process of "morphing" images to demonstrate change over time.

An extensive school garden program is instructionally integrated into all aspects of the curriculum through an interdisciplinary approach that incorporates the core subjects of science, math, language arts and social studies. The Garden

Advisory Board (with a teacher from every grade level and a garden coordinator) is a network of parent volunteers who lead small groups of students in the garden. The planting, harvesting, composting, and maintenance of the garden and orchards provide students with opportunities to observe natural cycles and systems, and enrich specific subject-matter instruction. In support of Maguire's garden-centered curriculum students, teachers and parents participate in the School Environmental Education Docents (SEED) program. SEED trains docents (typically parents) and teachers, and provides resources to carry out hands-on, garden-based learning with students.

Topics generated by student interest are often the starting point for learning at Maguire. Real-world problems and issues, either selected by the teacher or identified by students, are used to generate instruction. Teachers report that these problem-solving opportunities allow students to apply the skills and concepts they have learned to something genuine and relevant to their everyday lives. Writing and research topics often evolve from work in the garden and other out-of-class experiences. For instance, when students observed snail damage in their garden they discussed options for managing the pests. Experiments were then conducted to identify the most effective and appropriate method of removal.

Authentic learning experiences allow Maguire's students to identify and address problems they encounter in their school community. They are able to perform action projects and communicate what they have learned through reports and presentations. For example, when faced with the problem of trash in their garden, students took action. They conducted research and developed a solution. Students priced garbage cans and selected their placement throughout the school grounds. They worked closely with the school custodian to successfully implement their plan.

Maguire, a three-year grantee of the Center for Ecoliteracy, recently took part in a school-wide effort focusing on recycling and composting to launch a recycling initiative. Five waste centers — to handle recycling, composting and garbage — have been set up in the grade-level wings of the school. Each week students graph the waste, with the help of trash monitors and fifth-grade trash measurers, and report their findings to the entire school. The PTA supported the effort by sponsoring a fundraising initiative involving plastic lunch box dividers complete with the school logo.

Teacher collaboration is encouraged and supported by the administration at Maguire. Thus, team teaching is a widespread instructional strategy,

maintained by common daily prep time for the grade-level teams. Additional planning time is made available through an early release day once a week. Such arrangements have allowed the fifth-grade team to develop a six-week coordinated program each year. All disciplines are integrated into the program using a theme or issue as the context. Each teacher takes responsibility for teaching their subject area specialty.

Grant money in the past has been earmarked for staff development and release time for teachers to work collaboratively. This time has been used to focus on planning environment-based curriculum. These funds have also been used to award mini-grants to teachers to implement innovative projects they have designed. Teachers at every grade level have also developed planning guides for parents to strengthen this instructional partnership.

Community members and parents contribute to curricular planning and instruction. Experts from the community enhance units of study by sharing their expertise with students. For instance, local astronomers have regularly visited classrooms and have even helped fifth-grade students plan a star party to enhance astronomy lessons. Community businesses have also adopted Maguire classrooms. In one instance, the Marin Bank helped a group of students with an economics unit tied to their math curriculum.

Students have led community projects, including a student-council sponsored toy drive. Student concern also led to raising funds to provide meals for the homeless. The students organized a produce sale from their garden, and donated profits from selling the potato and onion harvest to the local food bank. This led to the idea of starting a garden bed specifically to support the food bank.

Maguire's educators recognize the value of having a well-educated, dedicated parent community, and support a strong PTA. The principal estimates that 80% of Maguire's parents are active in school activities performing such duties as regularly helping in the classrooms, spearheading volunteer drives, running fundraisers and coordinating beautification efforts. The PTA also has two new leadership roles, heading up the Community Concerns group and Garden Advisory Board.

Students at Maguire are encouraged to be innovative, creative thinkers and problem solvers. Strong evidence of this school-wide emphasis is demonstrated by the fourth-grade Conflict Manager Program and the fifth-grade student council. The fourth-graders' responsibilities center around helping fellow students solve problems primarily at lunchtime and during recesses. As a result of one ongoing

conflict, these students were instrumental in the purchase of a game table.

The fifth-grade student council facilitates daily activities including crossing guard duty and more challenging assignments such as community outreach and special community events. A foundational element of these programs is the TRIBES training in life skill development that many of the teachers have received.

The TRIBES program influences much of the group interaction on site. Cooperative grouping throughout the school translates into multi-grade level teaching in the garden as well as cooperative teaming in the classroom. Students work independently and in cooperative groups that are typically defined by the teachers.

Multiple strategies are used by the teachers to assess students' mastery of skills and knowledge. Observation, portfolios, journals, self assessment, traditional tests, and rubrics are used to evaluate students' content knowledge and skill acquisition. Student understanding of interdisciplinary connections is evaluated through interdisciplinary projects and the use of complex instruction.

Maguire has a history of involvement with the Evaluation Task Force (ETF) that involves feeder schools to the Tamalpais Union High School District. ETF began as a network of thirty schools spread across southern Marin County to ensure that all students had access to comparable learning experiences and curriculum. The three cornerstones of ETF's triangulated assessment system are standardized norm-referenced tests (SAT9), standards-based assessments that document growth over many years (portfolios), and on-demand or "snapshot" performance tests (math tasks, reading and direct writing assessments).

Teachers from the schools of eleven districts formed discipline-specific groups to work on curriculum. Their work resulted in curriculum guides that defined the scope and sequence of subject matter in math, science, social studies, language arts, computers, foreign language, and health. ETF hosted professional development workshops to support the use of the common curricula and a broad professional learning community was conceived.

Pleasant Valley (control)

Pleasant Valley Elementary is one of nine K-5 schools in the Novato Unified School District. The school was built in 1965 and has an enrollment of nearly 440 students. The staff consists of 25 certificated classroom teachers; music teachers; resource, reading and speech specialists; and a part-time psychologist.

Pleasant Valley boasts a high level of parental involvement. Each year, approximately 14,000 hours of volunteer time are logged. The school's leadership team (made up of the principal, staff members and parents) works to develop the school plan, annual parent survey and district-generated school site survey.

Educational programs at Pleasant Valley are traditionally based and primarily center on classroom activities. There is a focus on differentiated instruction and every teacher is responsible for delivering "sheltered instruction."

Pleasant Valley's students enjoy regular off-campus adventures, including a fourth-graders' overnight trip to Fort Ross on the Russian River, and the fifth-grade, four-day outdoor education experience at Walker Creek Outdoor School. During these field study trips, instructors incorporate state science standards, with the curriculum focusing on earth sciences.

With a standards-based umbrella, some teachers work to create crossover subject-area studies such as integrating Language Arts with core literature. Students are divided into leveled reading groups where students with scores below the 40th percentile are targeted to work with reading specialists. Small-group reading instruction is also evident in literature circles provided for the students. Other core subject areas are addressed in specialized programs such as a science lab where the students go with their teacher one class period weekly for hands-on physical science experiences.

Once a week the school has a minimum day to allow for staff to conduct independent planning; meet in cross-grade teams; or, listen to a featured presenter. Twice monthly grade-level meetings are held during this time slot. Teachers have a one-hour prep period each day in two 30-minute slots. Grade levels are scheduled for the same prep times to allow for long-term, collaborative planning and to insure consistency of themes being taught across the grade levels. A staff advisory representative from each grade level meets each month with the principal in addition to the weekly planning meetings. With these layers of communication, Pleasant Valley teachers are encouraged to plan together, share resources, and collaborate in delivering their curriculum.

Even though the EL population is small, a fervent attempt is being made by the Pleasant Valley staff to involve the EL families into the school culture to a greater extent. The staff provides traditional educational opportunities, such as career day, as well as instruction in cultural practices with events such as their multicultural holiday program.

Although the school at one time used a cluster model of classroom design, with funding from the PTA and the district, Pleasant Valley has recently worked to change their physical instructional space to involve more classrooms in a new configuration. They are connecting multiple grades to common rooms, at the same time creating smaller learning environments. These “pods” allow for a more intimate learning space used by teachers and resource specialists.

At Pleasant Valley assessment drives instruction. In an attempt to define student performance before

instruction, pre-assessments are routinely administered. Assessment is built into the instructional model and criterion-referenced performance standards are addressed for all students. A portfolio is kept for each child in addition to scores on standards-based assessments. Pleasant Valley is also involved with the Bay Area School Reform Collaborative (BASRC) a foundation-funded assessment and school-reform effort.

Table 6. Similar School Comparison Data: Maguire and Pleasant Valley*

Similar School Comparison	Maguire	Pleasant Valley
Grade Levels in School	K-5	K-5
Student Enrollment	400	438
Population Status	Urban fringe of a large city	Urban fringe of a large city
% Free or Reduced Lunch	4.3%	4.1%
% English Learners	7%	2.5%
Average School-wide Class Size	22.1	21.9
* Information based on 2001-02 school year as reported by Ed-Data: Education Data Partnership, California Department of Education.		

Summary of Test Score Comparisons

Over 3400 sets of student data were collected for the five-year comparison of Maguire and Pleasant Valley Elementary Schools.

The following table indicates the number of instances when either the “treatment” or “control” school scored significantly higher than its counterpart. The entries in the “treatment” and

“control” columns indicate the number of years, out of the five study years, in which the indicated school’s students scored significantly higher on the standardized tests administered in each subject area. Blank cells indicate that there was not a significant difference between student scores at the two schools.

Table 7. Standardized Test Score Data: Maguire and Pleasant Valley*

Grade	Reading		Math		Language		Spelling		Total	
	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control
2	1		1	1	1			2	3	3
3			2		1				3	
4	2		2	1	2				6	1
5	3		3		2		1		9	
									21	4

Analyzing the Maguire and Pleasant Valley Elementary test scores produces the following observations:

Reading (all grades)

- In all cases, Maguire students scored as well or better than Pleasant Valley students
- In 30% of the cases, Maguire students scored significantly higher than Pleasant Valley students

Math (all grades)

- In 40% of the cases, Maguire students scored significantly higher than Pleasant Valley students
- In 10% of the cases, Pleasant Valley students scored significantly higher than Maguire students

Language (all grades)

- In all cases, Maguire students scored as well or better than Pleasant Valley students
- In 30% of the cases, Maguire students scored significantly higher than Pleasant Valley students

Spelling (all grades)

- In 5% of the cases, Maguire students scored significantly higher than Pleasant Valley students
- In 10% of the cases, Pleasant Valley students scored significantly higher than Maguire students

Grade 2

- Maguire students scored significantly higher in reading in 20% of the cases (1 of 5 years)
- Maguire students scored significantly higher in math in 20% of the cases (1 of 5 years)
- Pleasant Valley students scored significantly higher in math in 20% of the cases (1 of 5 years)
- Maguire students scored significantly higher in language in 20% of the cases (1 of 5 years)
- Pleasant Valley students scored significantly higher in spelling in 40% of the cases (2 of 5 years)

Grade 3

- Maguire students scored significantly higher in math in 40% of the cases (2 of 5 years)
- Maguire students scored significantly higher in language in 20% of the cases (1 of 5 years)

Grade 4

- Maguire students scored significantly higher in reading in 40% of the cases (2 of 5 years)
- Maguire students scored significantly higher in math in 40% of the cases (2 of 5 years)
- Pleasant Valley students scored significantly higher in math in 20% of the cases (1 of 5 years)
- Maguire students scored significantly higher in language in 40% of the cases (2 of 5 years)

Grade 5

- Maguire students scored significantly higher in reading in 60% of the cases (3 of 5 years)
- Maguire students scored significantly higher in math in 60% of the cases (3 of 5 years)
- Maguire students scored significantly higher in language in 40% of the cases (2 of 5 years)
- Maguire students scored significantly higher in spelling in 20% of the cases (1 of 5 years)

**PAIRED COMPARISON
WADE THOMAS AND TAMALPAIS VALLEY
ELEMENTARY SCHOOLS**

Wade Thomas Elementary (treatment)

Thomas Elementary School serves a suburban population in Marin County. This elementary school of kindergarten through fifth-graders has an enrollment of nearly 340 students. The student population is principally Caucasian with a strong community of Korean and Vietnamese families. The school's Life Skills Program focuses on character education and includes a "buddy program," a student conflict managers program, and an active Student Council which all support the school-wide goal of creating a positive learning environment.

The staff at Thomas makes a concerted effort to insure that every student receives individualized instruction. To that end, a five-member team holds class reviews the first month of school to evaluate each student and identify specific needs. The team is made up of the principal, a resource specialist, speech specialist, school psychologist and the classroom teacher. The team reviews the class list, targets issues for specialized care and identifies resources for every student, including GATE and special-needs students. The principal also evaluates each student's record of test scores to target students falling below the proficient level.

Instruction at Thomas is primarily delivered through classroom-based lessons. The diversity of learning settings used by Thomas teachers provide opportunities for students to participate in many projects. Out-of-classroom experiences in a variety of settings (museums, local businesses and the school garden) are connected to classroom studies in order to meet specific learning objectives and/or content standards.

A school-wide effort is made to present curriculum in an interdisciplinary manner. Mathematics and reading receive the greatest emphasis, as identified in the School Improvement Plan. The core curriculum includes interdisciplinary activities and project-based learning with a concentration on technology, an area in which teachers are given release time for training. A specialist works with the teachers to integrate technology into several curricular areas including math, social studies and science.

Fourth and fifth graders at Thomas participate in the regional STRAW Program (Students and Teachers Restoring A Watershed). Through STRAW, the students have assisted in creek restoration efforts on local ranchlands. This work has enabled students to explore land-use patterns while developing a sense of their civic role in the

community. Students also study the interactions of natural and social systems, specifically as these systems' interrelationships relate to their creek restoration activities. Math, science and creative writing are all incorporated into the student's STRAW activities. Instruction focuses on topics derived from real-world, community problems and issues identified by the teachers and students.

Half of the classrooms at Thomas, mostly in the primary grades, have been involved in the program SEED (School Environmental Education Docents). The program supports volunteers to work with teachers in an effort to expand environment-based education in the classroom. SEED's personnel have trained volunteers and teachers; provided resources for them to carry out hands-on projects with students; offered free plants, seeds, tools; and, advice on how to start gardening projects at the school. A central effort has been the school's habitat gardens in several locations on campus. Butterfly gardens, a vegetable garden and California native plant gardens have also been developed. To accomplish these gardening activities, first through fifth graders are paired to work in school-garden plots.

Outside resources — various community members and professionals — are regularly invited to the school to provide the students with a diversity of classroom experiences. Where once students ventured to the Lawrence Hall of Science, the "Hall" now comes to the school with their traveling educational programs. Classroom instruction is also enriched by parent volunteers. In one instance, a father who is a stock broker agreed to lead a unit on fractions using the stock market as a framework. The three-month unit had students develop stock portfolios to follow their investments. Students learned to add, subtract, multiply and divide fractions, and convert them into decimals to determine their gains or losses in the stock market. The project culminated with a trip to the San Francisco Stock Exchange for a first-hand experience of the stock market in action. Another partnership, with the county dump, developed into an extended unit on recycling. For a three-week period students performed a waste audit that allowed them to analyze their waste management system, study the impact of recycling and observe the benefits of bringing a pig to school to consume waste products from the cafeteria.

Although much of the curriculum is based on state-determined standards and school district learning objectives, students at Thomas have an active role in directing their own learning. Students are allowed to pursue individual areas of interest within a framework determined by the content

standards, as outlined by the teachers. The many projects undertaken at Thomas are frequently initiated and directed by students. In one such case, a fourth/fifth-grade class developed a language-arts project after watching a production of Shakespeare's *Much Ado About Nothing*. These inspired students decided to write and present their own Shakespearean plays. The students developed their own rubrics for evaluation and established a timeline for completion of the project.

Teachers employ cooperative learning strategies in all subject areas. Students work as groups, such as in their literature circles, to complete reports and to develop projects. Groups are organized both by teachers and by students. Teachers make an effort to organize teams that will take advantage of individual student's strengths while encouraging group communication and development of teamwork skills. To foster life-skill development a "buddy project" was initiated to partner a younger student with an older student. The pairs benefit from such activities as reading together and sharing lunches.

Student groupings typically change weekly, or even monthly, depending on the unit of study. In the upper grades, classroom organization focuses on a strong governing process-based learning model. Here, students are empowered to run the class based on their studies of the governing of the colonies. The class governor carries out the routine business of the day and helps collaborate efforts with the other fifth-grade classrooms to do simulations including appropriate Parliamentary procedure.

Teachers at Thomas work individually and collaboratively. Planning often occurs within grade-level teams while instruction is primarily delivered by individual teachers. Some teachers do work together on inter-class projects involving multiple grade levels. Thomas also has a mentor teacher program to provide one-on-one support for new teachers. With support from the district, teachers have regularly scheduled meetings every Wednesday afternoon. One day a month teachers gather for district-wide, grade-level meetings. Once a month grade-level meetings are held at the school site for teams to plan units of instruction.

Student mastery of skills and knowledge is assessed using multiple strategies. Conventional, standardized tests are complemented with student self-evaluations, student-teacher interviews, teacher observation and task-based assessments. The school participates in the district-wide Education Task Force assessments, which require students to develop portfolios of their work in various subject areas. Each principal administers grade-level performance tasks in science and social studies that

have been aligned to the state standards. These assessments match the district's units of study. Many of the classroom assessments at Thomas are scored using rubrics that have been created by teachers and students. Students benefit by receiving feedback on end-of-unit assessments. With these exit scores in hand, the grade-level teaching teams meet with the principal for review, to discuss how to improve uniformity and determine how to improve students' performance.

The school is involved in a variety of community outreach programs. Each class sponsors a separate project including the adoption of a needy family as part of an all-school community project. The story *The Velveteen Rabbit* inspired one class of fourth graders to design and build toys from recycled materials. Their toys were auctioned off and all proceeds were donated to a homeless family in their community. The school also partners with local organizations to benefit the developmentally disabled; seniors; and, to sponsor food drives at Easter, Thanksgiving and Christmas. Community events, such as their Earth Day festival, involve every class. Students make banners, sing songs, and write poetry to commemorate the day. Local businesses, including a nearby organic farmer, donate snacks and students serve produce from the school garden.

Tamalpais Valley (control)

Tamalpais Valley School is situated in a quiet area only five minutes from the Golden Gate Bridge. As one of six schools in the Mill Valley School District, Tamalpais Valley opened in 1952 and serves a residential area within a five-mile radius of the school. This suburban school, of 350 kindergarteners through fifth graders, is considered upper-middle class. The students are supported by 19 teachers in 17 classrooms, two Learning Center teachers, a librarian, and 12 specialists for music, art, science, the Library/Media Center, P.E., dance and technology.

The district supports strong language arts and science programs, including a district-developed literature program. The school does not rely on texts for all subjects, instead teachers utilize programs such as FOSS for science. The PTA has further supported science education by funding a K-3 science resource specialist. The PTA also supports the work of each class in the school garden.

Tamalpais Valley's principal reports that most teachers make use of outdoor areas to develop environmental awareness with their students, not as a context to address content standards. The school's nature program utilizes a nearby creek and

forested areas for nature walks, but these are not structured to enhance academic achievement, per se. Instead, the teachers involved are seeking to have affective impacts on students — addressing such topics as the importance of protecting plant life and the potential effects of pollutants on the natural environment.

Some monthly visits to the creek are for the purpose of collecting scientific data, however. Students walk to the creek to collect scientific information and record their findings in their creek journals and on the school website. The students document their observations of air and water temperature; the creek’s depth and width measurements; and, rate of flow. Students also record observations of the riparian plants and animals they encounter.

The school utilizes *For Earth’s Sake* (FES), a mobile resource center that delivers environmental education materials to schools throughout the county. The FES project was established to help teachers create environmental stewards and educate citizens on the concept of positively impacting the community’s waste stream. The project involves the collection of unwanted materials from local businesses that are then distributed to schools. Educational resources are also available from FES for teachers to use in their classrooms.

The third- through fifth-grade classrooms are involved in a “save the watershed” program. Other hands-on projects include a third-grade integrated social studies and science unit on the Miwok Indians. Tamalpais also has a school-wide recycling program that involves composting efforts.

Throughout the years, the school staff has placed emphasis on learner-centered approaches, with training to assist teachers in implementing constructivist instructional methods. Many classrooms at Tamalpais incorporate cooperative grouping of students. These collaborative student teams are generally determined by the teacher.

Assessment is determined by the grade-level teams and is a combination of end of chapter/unit tests, standardized measurements and performance-based testing. The teachers conduct reading and math remediation as indicated by results of testing.

Because the community is committed to the support of a rich educational experience, parents, teachers and local businesses have partnered with the school. Community service projects have included collections for food drives through the Student Council Food Bank, a Christmas collection drive to benefit the burn unit at a local hospital and volunteering for Special Olympics.

Table 8. Similar School Comparison Data: Thomas and Tamalpais Valley*

Similar School Comparison	Thomas	Tamalpais Valley
Grade Levels in School	K-5	K-5
Student Enrollment	333	391
Population Status	Urban fringe of a large city	Urban fringe of a large city
% Free or Reduced Lunch	2.4%	4.1%
% English Learners	1.5%	1.3%
Average School-wide Class Size	20.9	21.6
* Information based on 2001-02 school year as reported by Ed-Data: Education Data Partnership, California Department of Education.		

Summary of Test Score Comparisons

Over 2400 sets of student data were collected for the five-year comparison of Thomas and Tamalpais Elementary Schools.

The following table indicates the number of instances when either the “treatment” or “control” school scored significantly higher than its counterpart. The entries in the “treatment” and

“control” columns indicate the number of years, out of the five study years, in which the indicated school’s students scored significantly higher on the standardized tests administered in each subject area. Blank cells indicate that there was not a significant difference between student scores at the two schools.

Table 9. Standardized Test Score Data: Thomas and Tamalpais Valley*

Grade	Reading		Math		Language		Spelling		Total	
	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control
2	3		2		1		2		8	
3	1		2		2		3		8	
4	2		3		1		1		7	
5	1		2		3		1		7	
									30	

Analyzing the Thomas and Tamalpais Elementary test scores produces the following observations:

Reading (all grades)

- In all cases, Thomas students scored as well or better than Tamalpais students
- In 35% of the cases, Thomas students scored significantly higher than Tamalpais students

Math (all grades)

- In all cases, Thomas students scored as well or better than Tamalpais students
- In 45% of the cases, Thomas students scored significantly higher than Tamalpais students

Language (all grades)

- In all cases, Thomas students scored as well or better than Tamalpais students
- In 35% of the cases, Thomas students scored significantly higher than Tamalpais students

Spelling (all grades)

- In all cases, Thomas students scored as well or better than Tamalpais students
- In 35% of the cases, Thomas students scored significantly higher than Tamalpais students

Grade 2

- Thomas students scored significantly higher in reading in 60% of the cases (3 of 5 years)
- Thomas students scored significantly higher in math in 40% of the cases (2 of 5 years)
- Thomas students scored significantly higher in language in 20% of the cases (1 of 5 years)
- Thomas students scored significantly higher in spelling in 40% of the cases (2 of 5 years)

Grade 3

- Thomas students scored significantly higher in reading in 20% of the cases (1 of 5 years)
- Thomas students scored significantly higher in math in 40% of the cases (2 of 5 years)
- Thomas students scored significantly higher in language in 40% of the cases (2 of 5 years)
- Thomas students scored significantly higher in spelling in 60% of the cases (3 of 5 years)

Grade 4

- Thomas students scored significantly higher in reading in 40% of the cases (2 of 5 years)

- Thomas students scored significantly higher in math in 60% of the cases (3 of 5 years)
- Thomas students scored significantly higher in language in 20% of the cases (1 of 5 years)
- Thomas students scored significantly higher in spelling in 20% of the cases (1 of 5 years)

Grade 5

- Thomas students scored significantly higher in reading in 20% of the cases (1 of 5 years)
- Thomas students scored significantly higher in math in 40% of the cases (2 of 5 years)
- Thomas students scored significantly higher in language in 60% of the cases (3 of 5 years)
- Thomas students scored significantly higher in spelling in 20% of the cases (1 of 5 years)

SUMMARY OF ALL PAIRED COMPARISONS

Within the limits of the variable student populations and fluctuating school faculty, it appears that students in schools that have adopted environment-based approaches are demonstrating statistically significant academic benefits when compared to traditional programs. Researchers analyzed over 12,700 sets of student data collected at eight study schools, over the five-year period of this project. This research has determined that, in analyzing test scores for the study's pairs of similar schools, students in the environment-based schools outperformed their peers in the control schools.

The following table summarizes the data from all of the four-school comparisons. It reports the number of instances when either the "treatment" or "control" school scored significantly higher than its counterpart. The entries in the "treatment" and "control" columns indicate the total number of years, out of the combined study years (a possible 20), in which students in the treatment and control schools scored significantly higher on the standardized tests administered in each subject area. Blank cells indicate that there was not a significant difference between student scores at the two schools.

Table 10. Combined Standardized Test Score Data: All Study Schools

Grade	Reading		Math		Language		Spelling		Total	
	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control
2	9		7	1	7	1	5	2	28	4
3	8		11	1	7		8		34	1
4	10		10	2	8	1	6		34	3
5	10		11	2	10	2	7		38	4
									134	12

Students in the study's environment-based programs outperformed their traditionally educated peers as evidenced by the year-to-year standardized test data in the core subject areas of reading, math, language and spelling.

The most notable quantitative evidence includes:

- In 100% of the reading assessments, treatment students scored as well or better than control students
- In 92.5% of the math assessments, treatment students scored as well or significantly higher than control students

- In 95% of the language assessments, treatment students scored as well or significantly higher than control students
- In 97.5% of the spelling assessments, treatment students scored as well or significantly higher than control students
- In over 96% of all cases treatment students scored as well or significantly higher than control students
- In only 4% of the cases control students scored significantly higher than treatment students
- In 42% of the cases treatment students scored significantly higher than control students in reading, math, language and spelling

Table 11. Combined Standardized Reading Test Score Data: All Study Schools

	Reading		Reading		Reading		Reading		Total	
	Brookside	Rancho	Open	Riverside	Maguire	Pleasant Valley	Thomas	Tamalpais Valley		
Grade	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control
2	2		3		1		3		9	
3	2		5				1		8	
4	2		4		2		2		10	
5	1		5		3		1		10	
									37	

Analyzing the **reading test data** produces the following observations:

- In all cases, treatment students scored as well or better than control students
- In 46% of the cases, treatment students scored significantly higher than control students

Table 12. Combined Standardized Math Test Score Data: All Study Schools

	Math		Math		Math		Math		Total	
	Brookside	Rancho	Open	Riverside	Maguire	Pleasant Valley	Thomas	Tamalpais Valley		
Grade	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control
2	1		3		1	1	2		7	1
3	2	1	5		2		2		11	1
4	1	1	4		2	1	3		10	2
5	1	2	5		3		2		11	2
									39	6

Analyzing the **math test data** produces the following observations:

- In 92.5% of the cases, treatment students scored as well or better than control students
- In 49% of the cases, treatment students scored significantly higher than control students
- In 8% of the cases, control students scored significantly higher than treatment students

Table 13. Combined Standardized Language Test Score Data: All Study Schools

	Language		Language		Language		Language		Total	
	Brookside	Rancho	Open	Riverside	Maguire	Pleasant Valley	Thomas	Tamalpais Valley		
Grade	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control
2	1	1	4		1		1		7	1
3	1		3		1		2		7	
4		1	5		2		1		8	1
5	1	2	4		2		3		10	2
									32	4

Analyzing the **language test data** produces the following observations:

- In 95% of the cases, treatment students scored as well or better than control students
- In 40% of the cases, treatment students scored significantly higher than control students
- In 5% of the cases, control students scored significantly higher than treatment students

Table 14. Combined Standardized Spelling Test Score Data: All Study Schools

	Spelling		Spelling		Spelling		Spelling		Total	
	Brookside	Rancho	Open	Riverside	Maguire	Pleasant Valley	Thomas	Tamalpais Valley		
Grade	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control
2			3			2	2		5	2
3	2		3				3		8	
4	1		4				1		6	
5			5		1		1		7	
									26	2

Analyzing the **spelling test data** produces the following observations:

- In 97.5% of the cases, treatment students scored as well or better than control students
- In 32.5% of the cases, treatment students scored significantly higher than control students
- In 2.5% of the cases, control students scored significantly higher than treatment students

CONCLUSIONS

It is important to consider the fact that in schools where environment-based approaches have been incorporated, students are performing higher than or equal to their peers in more traditional programs. In these schools, they are gaining the added benefits of standards-based interdisciplinary instruction, learner-centered methodologies, student-centered courses of study and community-based learning contexts.

Through interdisciplinary studies, teachers connect state standards from multiple disciplines to simultaneously address content and skills from a variety of subject areas. Community-based instruction also capitalizes on partnerships with community members and experts in multiple areas of expertise. The rich, comprehensive learning atmosphere fostered by environment-based programs provides opportunities for students to investigate the interaction of the natural and social systems that comprise their local environment, increasing their awareness of the complexity of life in their community while, at the same time, fostering civic responsibility. Students' environment-based work allows them to interact with a variety of community members, providing benefits such as exposure to various career opportunities and forming learning partnerships with formal and non-formal educational partners.

These engaging programs appear to better connect students to their learning by allowing them to take a more active role in their studies. Students in these environment-based programs are often engaged in cooperative learning groups that help them develop teamwork while simultaneously

developing individual skills such as communication. Multiple assessment methods including performance assessments, self-evaluation rubrics, portfolios, and standardized tests provide teachers in these programs with a more accurate appraisal of each students' level of comprehension. In addition, learning opportunities such service projects that address identified community needs allow students to rely on personal abilities, and develop their own learning styles, as they work to strengthen basic life skills.

This study affirms the findings of the original *California Student Assessment Project*, published in March 2000 and SEER's 1998 report, *Closing the Achievement Gap: Using the Environment as an Integrating Context for Learning*. Schools that have adopted environment-based educational practices offer promising approaches for academic improvement and reform efforts. These programs, exemplified by the case stories of the treatment schools, provide students with hands-on methodologies that allow them to apply knowledge and skills to relevant, real-world learning opportunities in their local communities.

The findings of this study will certainly bolster the discussion on the need to connect environment-based programs to state content standards and other formal education efforts. It is the hope of SEER's researchers that this report help support a statewide, if not inter-state, network to document the effects of environment-based programs, on students and instructional practices, and strengthen the credibility of this research by increasing the number and diversity of study schools.

APPENDIX A

The API, Academic Performance Index, is a statewide ranking of schools according to test scores. API ranking (by elementary, middle, or high school) is a comparison to 100 similar schools and growth targets. API demographics are included in this report in the following categories: grade levels in school; total enrollment; population status; percentage of free/reduced lunches; EL — English learners, designated as students who are not sufficiently proficient in the English language to succeed in the school's regular instructional programs (formerly designated as LEP — Limited English Proficient); and, average school-wide class size.

The reports and data files available through the API website are based on STAR, CAHSEE, and CAPA results and are subject to revision because districts, on behalf of their schools, have the right under the federal No Child Left Behind Act to appeal the Adequate Yearly Progress (AYP) or Program Improvement (PI) status of their schools. API is part of the AYP, and therefore may be affected by such appeals.

As stated on the California Department of Education website:

“The API is the cornerstone of the Public Schools Accountability Act (PSAA) of 1999. It measures the academic performance and progress of schools. Annual growth targets for future academic improvement are determined for schools based on the API. Schools that reach their annual targets may be rewarded. Schools that do not meet their targets may be eligible for interventions or subject to sanctions.”

“The PSAA is designed to measure the academic improvement of California public schools, reward those schools that meet their improvement goals, and help those schools that do not meet their goals.”

“How are the similar schools ranks used? The similar schools ranks can be used in at least two ways. First, schools can use this information as a reference point for judging their academic achievement against other schools facing similar challenges. Second, schools may improve their academic performance by studying what similar schools with higher rankings are doing. Similar schools ranks are not used in any way as the basis for awards or sanctions.”

API reports can be found at <http://api.cde.ca.gov> on the California Department of Education website.