EXECUTIVE SUMMARY

CLOSING THE ACHIEVEMENT GAP

Using the Environment as an Integrating Context for Learning

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STATE EDUCATION AND ENVIRONMENT ROUNDTABLE

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State Education and Environment Roundtable

The Roundtable is a cooperative endeavor of education agencies from 12 states working to improve student learning by integrating the environment into K-12 curricula and school reform efforts. The Roundtable provides opportunities for them to exchange skills, experience, and resources that will help them enhance their respective programs. It also collects and disseminates information on existing school improvement programs to enable state agencies to build from a foundation of practical experience.

The following agencies are members of the Roundtable:

California Department of Education
Colorado Department of Education
Florida Office of Environmental Education
Iowa Department of Education
Kentucky Environmental Education Council
Maryland State Department of Education
Minnesota Department of Families, Children, and Learning
Minnesota GreenPrint Council
New Jersey Department of Education
Ohio Department of Education
Pennsylvania Department of Education
Texas Education Agency
Washington Office of the Superintendent of Public Instruction

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Preface

Several years ago, representatives of the state education agencies that comprise the State Education and Environment Roundtable became interested in the potential of environment-based education programs to improve student learning, change long-standing pedagogical paradigms, and influence the way young people learn to live successfully in the world that surrounds them. In the face of limited research on the efficacy of environment-based education programs, Roundtable members designed a study to identify the most innovative and successful programs, describe their effectiveness, and analyze their commonalities and differences. They also sought to identify the factors that contributed to the success of these programs and any challenges they encountered during implementation.

This is an Executive Summary of the report that resulted from that study. It focuses on a specific area of environmental education: using the environment as an integrating context for learning (EIC). This term, coined by the Roundtable, encompasses the educational practices that the group believes should form the foundation of environment-based education programs in America's schools.

EXECUTIVE SUMMARY

Using the Environment as an Integrating Context for learning (EIC) defines a framework for education: a framework for interdisciplinary, collaborative, student-centered, hands-on, and engaged learning. It has begun to transform curricula in a growing number of schools across the United States and may have the potential to significantly improve K-12 education in America.

This report, prepared by the State Education and Environment Roundtable, is the story of the schools, teachers, and students who are involved in implementing EIC. It presents the results of a nationwide study; describes the major concepts and assumptions underlying EIC; explores a range of successful EIC programs across the United States; identifies the major characteristics of successful EIC programs; and, analyzes the implications of EIC-based education for student learning and instruction.

EIC-based learning is not primarily focused on learning about the environment, nor is it limited to developing environmental awareness. It is about using a school's surroundings and community as a framework within which students can construct their own learning, guided by teachers and administrators using proven educational practices. EIC programs typically employ the environment as a comprehensive focus and framework for learning in all areas: general and disciplinary knowledge; thinking and problem-solving skills, and basic life skills, such as cooperation and interpersonal communications.

The observed benefits of EIC programs are both broad-ranging and encouraging. They include:

- better performance on standardized measures of academic achievement in reading, writing, math, science, and social studies;
- reduced discipline and classroom management problems;
- increased engagement and enthusiasm for learning; and,
- greater pride and ownership in accomplishments.

What is EIC: Basic Concepts

Environment as the Integrating Context for learning designates pedagogy that employs natural and socio-cultural environments as the context for learning while taking into account the "best practices" of successful educators. Because EIC programs are located in diverse natural and community settings, each program requires a unique design. However, despite the different designs, the 40 successful programs examined in this study share these fundamental educational strategies; they:

- break down traditional boundaries between disciplines;
- provide hands-on learning experiences, often through problem-solving and project-based activities;
- rely on team teaching;
- adapt to individual students and their unique skills and abilities; and,
- develop knowledge, understanding, and appreciation for the environment–community and natural surroundings.

Education based on EIC approaches can be implemented across all geographic and socio-economic settings. Since the ecosystems surrounding schools and their communities vary as dramatically as the nation's landscape, the term "environment" may mean different things at every school; it may be a river, a forest, a city park, or a garden carved out of an asphalt playground. In creating an EIC curriculum, educators have the opportunity to define the local environment broadly, to encompass natural ecosystems and the socio-cultural systems in their community.

EDUCATIONAL BENEFITS OF EIC-BASED LEARNING

Evidence gathered from this study of 40 schools indicates that students learn more effectively within an environment-based context than within a traditional educational framework. By providing a comprehensive educational framework, instead of traditional compartmentalized approaches, EIC appears to significantly improve student performance in reading, writing, math, science and social studies, and enriches the overall school experience.

Students exposed to programs using EIC approaches often become enthusiastic, self-motivated learners. In addition to traditional subject-matter knowledge and basic life skills, EIC students gain a wealth of added educational benefits, including: a comprehensive understanding of the world; advanced thinking skills leading to discovery and real-world problem-solving; and, awareness and appreciation of the diversity of viewpoints within a democratic society.

The following sections describe this study's findings in eight key areas:

- general educational benefits;
- language arts;
- math;
- science;
- social studies;
- thinking skills;
- interpersonal abilities; and,
- revitalized teaching.

The evidence presented here comes from site visits to the 40 study schools; interviews with more than 400 students, and 250 teachers and administrators; four different surveys of the educators; and, comparative studies of standardized test scores, GPAs, and attitudinal measures. (Details about these data and their sources appear in the full report. "Design of the Study," at the end of this document, summarizes the Roundtable's research methodology. "Study Schools," lists the schools that participated in the study.)

General Educational Benefits

Fourteen of the study schools conducted comparative analyses of data from both EIC and traditional students. These schools each collected different types and combinations of data, including: comprehensive and subject-matter-specific standardized tests, grade point averages (GPAs), disciplinary actions, attendance, and student attitude measures.

Based on analysis of both comprehensive and subject-matter specific, standardized tests, all of these 14 schools found that quantitative measures of achievement affirm the academic benefits of EIC-based learning. Their data indicate that most students in EIC programs earn higher grades and score better in reading, writing, and math—benefits school administrators attribute to EIC approaches.

These 14 schools conducted a total of 39 comparative analyses of academic achievement using comprehensive and subject-matter specific, standardized tests and grade point averages. Thirty-six, 92 percent, of these comparisons indicate that students who have been in EIC programs academically outperform their peers in traditional programs. (Two of the three cases where traditional students performed as well or better than EIC students related to math scores in programs where math was not integrated into the EIC program.) Table 1 provides a summary of the results of the comparative analyses of comprehensive standardized tests scores and GPAs at these 14 schools.

TABLE 1. Summary of Comparative Analyses of Comprehensive and Discipline-specific Standardized Tests Scores and GPAs.

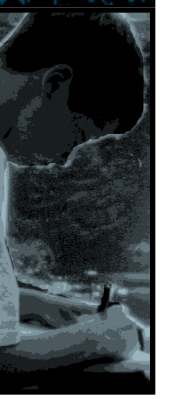
Area of Assessment	Assessments Indicating EIC Students Perform Better than Traditional Students		Total Assessments Administered
	Percent	Number	
Comprehensive Assessment	100%	9	9
Language Arts	100%	17	17
Math	71%	5	7
Science	75%	3	4
Social Studies	100%	2	2
Totals	92%	36	39

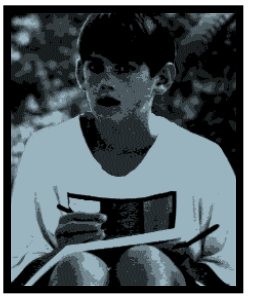
Five of these schools also analyzed data that compared student behavior, attendance and attitudes, between EIC and traditional students. Their data indicate that most students in EIC programs cause fewer discipline problems than their traditional peers—improvements educators at the study schools credit to their EIC programs.

These five schools conducted a total of 9 comparative analyses of behavioral data. All nine, 100 percent, of these comparisons indicate that students who are in EIC programs perform better on these measures than their peers in traditional programs. Table 2 provides a summary of comparisons of these behavioral data at the five schools that conducted these studies.

TABLE 2. Summary of Comparative Analyses of Disciplinary Actions, Attendance and Student Attitudes.

Area of Assessment	Assessments Indicating EIC Students Perform Better than Traditional Students		Total Assessments Administered
	Percent	Number	
Improved Student Behavior	100%	4	4
Improved Attendance and Attitudes	100%	5	5
Totals	100%	9	9





Language Arts:

Improving Reading, Writing, and Speaking Through Environment-based Education

"I think that our TAAS language arts test results really support what current research tells us... if language arts skills and concepts are taught within the context of a meaningful whole, they are learned more easily, and they are retained longer."

Judy Zimny, principal, Hotchkiss Elementary School, Texas

All 17 comparative studies of language arts achievement data found that standardized measures affirm the academic benefits of EIC-based learning for reading, writing, and general language skills. On the average, the EIC students outperformed their peers from traditional programs at all nine of the schools that conducted these analyses.

As they became involved in first-hand study of the natural and socio-cultural systems that make up their world, EIC students at all the study schools grew more enthusiastic and proficient in developing and applying language arts skills. They like reading about nature and their community; they enjoy writing about issues affecting society; and, they welcome the chance to express their ideas at public meetings and in presentations. These increased opportunities facilitate the development of strong skills in reading, writing, and oral expression.

Educators reported that significant effects of EIC on students' learning of language arts include (percent of survey respondents):

- improved development of language arts skills (93%). When students read, write, and speak about topics that interest them, they are more likely to make an effort to strengthen these important skills.
- greater enthusiasm for language arts (94%). When allowed to explore the environment and related community topics, students commonly express a growing interest in developing their language arts skills.
- more success in communicating with others (94%), and with public and private agencies (91%). Presented with extensive opportunities to make presentations, students gain confidence, an expanding technical vocabulary, and greater ability to make persuasive oral presentations.

The environment's widespread appeal to students creates diverse opportunities to nurture their language arts skills. As EIC students concentrate on subjects of interest and importance to them, they become more capable and confident readers, writers, and speakers.

MATH:
GAINING SKILLS THROUGH ENVIRONMENT-BASED LEARNING

"When I taught the kids math skills like measuring, in the classroom, they forgot it and couldn't make use of it. When the students had a chance to use these skills on our nature trail, they not only learned better but could apply and remember their math skills longer."

Kim Flynn, math teacher, Jackson County Middle School, Kentucky

All five comparative studies of achievement data from programs where math was integrated into EIC found that standardized measures affirm the academic benefits of environment-based learning. On the average, the EIC students outperformed their peers from traditional programs at all five of the schools that conducted these analyses.

Students learning in the context of the environment begin to look at math a little differently. Instead of thinking that math is only abstract concepts, these students learn that math skills are tools that they can use to quantify and analyze connections among natural and socio-cultural systems.

Learning in the context of their local community fosters deeper understanding of math and enables students to more readily master crucial skills. They see how math connects to other disciplines which helps them interpret what they discover when studying economics, geography, science, and other subject areas.

Educators reported that the principal effects of EIC on students' math knowledge and skills included (percent of survey respondents):

- improved understanding of mathematical concepts and content (73%). The hands-on experiences and problem-solving activities fostered in EIC, offer students concrete learning opportunities and help them to more fully understand abstract mathematical ideas.
- better mastery of math skills (92%). First-hand experiences in applying math to authentic problems help EIC students understand these skills more thoroughly than their traditional peers.
- more enthusiasm for studying math (89%). As they apply their emerging skills to problems that are relevant to them, students become more motivated and enthusiastic about math and begin to understand its value in everyday life.

Learning in the context of the environment helps students recognize the practical value of math for quantifying and understanding the world around them. As their perception of math changes, students become more committed to its study.

Science:
Using Environment-based Education to Explore the World

"The kids became so excited about the simple topics that kids didn't become excited about before in traditional classes, they really convinced me that the integrated approach was worthwhile. Now, science-wise ... the kids remember things better and for a longer period of time."

Michael Melin, science teacher, Tahoma High School, Washington

EIC students scored higher, on three of four comparative studies of standardized science achievement data, than their peers from traditional programs. In the fourth comparative study, EIC and traditional students scored equally.

When compared to their traditionally educated peers, it appears that EIC students more effectively master scientific knowledge and skills, and achieve a deeper understanding of scientific concepts and processes. They are also better able, than traditionally educated students, to discern the connections between what they learn in science and applications in the real world. Consequently, they are more capable of transferring their scientific knowledge to interdisciplinary tasks at school, at home, and in their communities.

Teachers and administrators reported that the primary effects of EIC on students' learning of science included (percent of survey respondents):

- increased knowledge and understanding of science content, concepts, processes, and principles (99%). The hands-on, minds-on approaches typical of EIC enable students of all ability levels to improve their performance, and gain a better understanding and appreciation for science.
- better ability to apply science to real-world situations (99%). Involvement in real-world, project-based activities seems to help students refine their abilities in scientific observation, data collection, analysis, and formulating conclusions.
- greater enthusiasm and interest in learning science (98%). Engagement in learning about their community and natural surroundings builds students' interest and dedication to studying science.

EIC students have the chance to blend subject matter from multiple fields of science and other disciplines to accomplish academically rich and challenging tasks. As they apply fresh approaches to solving problems, rather than passively listening and taking notes, they develop a clearer and deeper understanding of the importance of scientific knowledge and processes.

Social Studies: Joining the Community through Environment-based Education

"They're not going to remember the capital of Oregon.
But, these big interdisciplinary projects we do...
those are the ones they're going to remember down the line."

Sue Fogel, social studies teacher, Chariton Middle School, Iowa

Ninety-six percent of teachers and principals responding to the Learning Survey reported that EIC-based learning helped their students develop and improve their knowledge of social studies. It appears that students better understand the complex interrelationships and connections among individuals, communities, and society when they have the chance to apply their social studies knowledge in real-word settings. At the same time, they develop a deeper, contextual understanding of history, geography, and political systems.

Educators reported that the key effects on students' acquisition of social studies knowledge and skills included (percent of survey respondents):

- greater comprehension of social studies content (95%). Studying society in the context of the local environment helps students see the connections between economic, political, legal, and cultural systems.
- more advanced skills in applying civic processes to real-life situations (97%). Students more effectively learn how to apply social studies skills when they experience authentic lessons about how government works and societies operate in the context of their community and natural surroundings.
- growing enthusiasm for social studies (95%). Innate interest in the environment combines with the students' growing understanding of the connections between socio-cultural and natural systems to make them more enthusiastic about learning social studies.

In the context of their local environment, students begin to make connections between geography, history, politics, economics, and natural resources in their region. Making such connections sparks students' interests, engages them in their schoolwork, and helps them learn the significance of social studies within a context that is personally meaningful.

As EIC students apply their social studies skills to everyday situations, they begin to recognize the relevance of their decisions to their community and their environment. As a result, the EIC approach helps to produce active, involved citizens who develop a deeper understanding of their roles and responsibilities as members of a democratic society.

Thinking Skills: Developing Reasoning through Environment-based Learning

"Now, I find myself trying to make connections in everything I do.
It's a subconscious thing that happens.
After you learn this way for two years, it just comes naturally."

Doug, junior, Lincoln High School, California

The problem-solving, project-based methods inherent in EIC support the development of students' thinking skills across the continuum of Bloom's "taxonomy of the cognitive domain." After switching to EIC approaches, students' cognitive abilities appear to grow more rapidly, they become better able to synthesize information, and to think more strategically.

Students in EIC programs begin to ask thought-provoking questions, approach their teachers with creative ideas, and explore new ways of reasoning. Ninety-six percent of Learning Survey respondents reported that students in EIC programs developed higher-level, critical-thinking skills than those of their traditional peers.

Educators reported that EIC has important effects on students' thinking skills including (percent of survey respondents):

- increased ability to think creatively (98%). The ever-changing character of the environment and its complex interactions with socio-cultural systems make it an especially good context for students to apply and develop creative-thinking skills.
- greater proficiency in solving problems and thinking strategically (97%). EIC students learn how to combine diverse kinds of knowledge to arrive at soundly-reasoned decisions and well-conceived strategies to address the issues that concern them and their communities.
- better application of systems thinking (89%). EIC approaches help students develop their capacity to examine and understand the complex interrelationships and interactions that take place among diverse socio-cultural and natural systems.

Giving students the freedom to explore their surroundings and develop their own questions about the functions, connections, and interrelationships they observe facilitates the development of high-level thinking skills. The environment serves as a rich context within which students can gather, analyze, and begin to understand the many factors that affect individual, business, community, and governmental decisions.

Interpersonal Abilities: Getting Along Together

"Learning is easier with a whole bunch of people.
You don't have to do everything by yourself.
If you don't understand something there are other people to help you with it."

Andrew, 7th grader, North Arlington Middle School, New Jersey

The emphasis of EIC approaches on problem-solving, project-based activities, and team teaching creates an atmosphere of collaboration among students and teachers. As students work together, mentor their peers and younger students, and observe teachers working in teams, they have the opportunity to develop interpersonal skills that will serve them throughout their lives. The collaborative learning atmosphere encouraged within EIC programs helps students to learn to understand others, develop a sense of community, and comprehend their place in the world.

As they participate in the many collaborative activities typical of EIC programs, students learn to communicate with their peers, function democratically, and work together toward mutual goals. Each student has an opportunity to contribute their individual talents and to demonstrate their expertise to their peers. Students then begin to recognize the value of diverse individual contributions to their group projects and encourage each other as they work side-by-side.

Educators reported that the primary effects on the interpersonal skills of EIC students include (percent of survey respondents):

- better ability to work in group settings (98%). Environment-based learning helps students discover their own skills and appreciate those of others because it capitalizes on a variety of abilities.
- stronger communication skills (94%). As they work together, students learn to share ideas, discuss their reasoning, and develop new ideas that emerge from team discussions.
- acting with greater civility toward others (93%). Working together in EIC programs, students begin to treat each other with more care and they exhibit more self-discipline.

As students collaborate on EIC projects and problem-solving activities, they venture into new working relationships with other students and adults. When EIC teachers involve parents, administrators, community members, and business leaders in the teaching process, they give students a greater sense of community. Students see that others care and want to support them in their educational pursuits. Such community participation helps students avoid the feelings of isolation they may experience in traditional educational settings.

Revitalized Teaching: Through Environment-based Education

"I'm on my 33rd year of teaching and I have never been more excited about anything in that whole 33-year period than I am about this program."

Wayne Pikal, teacher, Little Falls High School, Minnesota

The positive effects of using the environment as the context for learning reach beyond students to encompass teachers as well. Teacher interest and engagement are important because enthusiastic teachers help students become more enthusiastic.

Educators at all 40 study schools described consistent and significant growth in their enthusiasm and commitment to teaching after their school implemented an EIC program. Many of the over 250 educators who participated in the study consider their EIC endeavors the highlight of their career.

Teachers and administrators reported that the principal effects on educators of adopting EIC approaches include (percent of survey respondents):

- increased enthusiasm and commitment toward teaching (95%). Many teachers commented that adopting EIC approaches had revitalized their interest in education and their profession.
- better working relationships with their students and colleagues (94%). The increased enthusiasm of both teachers and students helps them become a learning-teaching team focused on the same objectives.
- more opportunities to explore new subject matter than traditional, discipline-based teaching (95%). Teachers find that the interdisciplinary nature of EIC programs challenges them to continue their professional development and personal growth, to learn new content and skills, and to explore how to interconnect subject areas.
- frequent occasions to use innovative instructional strategies (96%). Teachers discover that EIC, because of its problem-solving, project-based methods, is particularly amenable to alternative instructional strategies, authentic assessment, team teaching, and cross-disciplinary instruction.

Strong administrative support plays a crucial role as teachers move from their long-practiced methods toward innovative pedagogies and more effective student assessment. The guidance of principals, assistant principals, and school district personnel are especially important to teachers while they develop and test new instructional approaches such as EIC.

Working together closely with their students in real-world situations, many EIC teachers report that they feel deeply rewarded as they see students, some for the first time ever, respond enthusiastically to what they are learning.

LAST WORDS—FIRST STEPS

This study indicates that EIC, using the environment as an integrating context for learning, holds great promise for helping to "close the achievement gap" in reading, writing, math, science, and social studies. The environment can provide a meaningful context around which educators can create a curricular framework that intrigues learners and revitalizes teachers.

When teams of educators use elements of the real world as focal points for learning and teaching, they help students strengthen a variety of academic skills. They can also guide students toward a deeper understanding of the concepts that span traditional disciplinary boundaries and which are extremely difficult to effectively teach using conventional, classroom-bound educational methods.

By helping students apply their classroom knowledge across a wide spectrum of academic and authentic problems, EIC approaches build bridges between theory and reality, schools and communities, children and their futures. EIC helps students make sense of their studies and their world by helping them put the pieces together.

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"Closing the Achievement Gap: Using the Environment as an Integrating Context for Learning" presents the main body of this report. It is designed to provide educators and educational decision-makers with the detailed results of this study and accounts of successful EIC programs, schools, and the educators who were instrumental in creating these programs. The full report contains four sections:

Introduction: describes the research and study design;
Discussion: explains the major concepts that underlie EIC;
Results: presents qualitative data, quantitative data, and survey results regarding the educational effects of EIC on acquisition of language arts, math, science, and social studies. It also contains results related to students' attitudes and behavior; thinking and interpersonal skills; the effects on teachers and instructional practices; and,
Stories of Success: contains detailed accounts of particularly successful EIC programs at six schools and personal profiles of six EIC teachers and administrators.

The Roundtable has produced two videos that are companion pieces to this report:

"Closing the Achievement Gap: A Video Summary" provides an overview of the results of this study including comments from several educators (14 minutes).

"Beyond Walls, Across Disciplines" is a CINE Golden Eagle award-winning video in two parts. Part One documents a series of visits, over an eight month period, to an elementary, middle, and high school that are implementing EIC (39 minutes). Part Two shows the creative ways that teachers at these three schools are using the environment to integrate instruction across the disciplines (27 minutes).

Copies of the full report and the videos are available for a nominal price from:

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Summary of Study Design

Lacking sufficient data in the research literature, Roundtable members designed the present study to focus on one specific topic: the effects on learning and instruction of using the environment as an integrating context in K-12 schools. They asked the research team to identify the most innovative and successful programs based on the comprehensive educational practices that define EIC.

The research team had four major objectives in studying these programs:

- to describe their common features;
- to identify the "best practices" that characterize their pedagogies;
- to examine the factors that led to their success or challenged them; and
- to compile data on the effects on students, learning, teachers, and instruction.

Roundtable representatives and other educators from the 12 member states identified potential study schools. The principal criteria for inclusion in this study were: degree of integration of the environment in the curriculum; longevity of the program; and, extent of team teaching employed in the program. The selection process also took into account demographic and socio-economic factors.

This report is based on a study of 40 schools from across the United States that have adopted the concepts and frameworks of EIC including: 15 elementary, 13 middle, and 12 high schools. It is informed by comments and experiences gathered through interviews with more than 250 teachers and principals, and more than 400 students.

Following preliminary telephone interviews, a member of the research team visited each of the schools for a full day. During these visits, the researcher observed classes; interviewed teachers, administrators, students, and, in some cases, parents and alumni; and, gathered samples of curricular materials, student work, and, where possible, the results of any comparative analyses of achievement that the school had conducted.

To buttress interview data and avoid the possibility of misinterpreting comments, the research team asked the interviewees to complete four instruments concerning the effects of EIC:

- **General Site Survey:** regarding student and teacher participation, program history and school characteristics;
- **Learning Survey:** assessing students and learning;
- **Teaching Survey:** concerning teachers and instruction; and,
- **Domains Survey:** charting effects on students' knowledge, skills, retention, and attitudes toward learning resulting from implementing an EIC program.

This study is mainly qualitative rather than quantitative. It is based on the opinions of participating students and educators as reflected in the surveys and interviews; comparative analyses of standardized achievement and behavioral data, where available; the observations of the researchers; and, the research team's interpretation and analysis of these opinions and observations. Although this study was not intended to be quantitative, the research team collected as much quantitative data as possible to provide additional insight into the experiences of the study schools.

Although evidence from 40 schools can not be considered conclusive, this study brings together a major body of knowledge gained from experienced educators and successful programs.

Study Schools

CALIFORNIA

Kimbark Elementary School
N. Verdemont Elementary School
Open Charter Elementary School
Lincoln High School
Piner High School

COLORADO

Nederland Elementary School
Logan School
Glenwood Springs High School

FLORIDA

Wakeland Elementary School
Merritt Brown Middle School
Taylor County High School

IOWA

Waterville Elementary School
Chariton Middle School
Metro High School

KENTUCKY

Wheatley Elementary School
Jackson County Middle School
Clay County High School
Valley High School

MARYLAND

Hollywood Elementary School
Centreville Middle School
Western School of Technology
and Environmental Science

MINNESOTA

Dowling Elementary School
Central Middle School
Little Falls High School

NEW JERSEY

Watchung Elementary School
North Arlington Middle School
Marine Academy of Science
and Technology

OHIO

Indian Hills Elementary School
Troy Intermediate School

OREGON

Waldo Middle School

PENNSYLVANIA

Park Forest Elementary School
Huntingdon Area Middle School
Radnor Middle School
State College High School

TEXAS

Hotchkiss Elementary School
Baker Junior High School

WASHINGTON

Bagley Elementary School
Rock Creek Elementary School
Komachin Middle School
Tahoma High School