

## Improving Elementary Science Instruction In the Oakland Unified School District

*Improving education in math and science is... about expanding opportunity for all Americans in a world where an education is the key to success. It's about an informed citizenry in an era where many of the problems we face as a nation are, at root, scientific problems. And it's about the power of science to not only unlock new discoveries, but to unlock in the minds of our young people a sense of promise, a sense that with some hard work -- with effort -- they have the potential to achieve extraordinary things.*

- President Barack Obama, remarks on the Education to Innovate campaign on November 23, 2009

*All students will graduate as caring, competent and critical thinkers, fully informed, engaged and contributing citizens, prepared to succeed in college and career.*

-Oakland Unified School District Vision 2009

### **Background**

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In May 2007, Oakland Unified School District adopted FOSS (Full Option Science System) as the science curriculum for grades K-5 at a cost of \$1,237,000. FOSS is a hands-on curriculum developed by the Lawrence Hall of Science over the past 25 years and distributed by Delta Education. Instead of focusing solely on textbook based instruction, FOSS emphasizes experiential and inquiry based learning.

Each grade level's curriculum consists of three kits covering the California Science Content Standards for life, physical, and earth science. Each kit consists of teacher guides, student textbooks and 1-4 large boxes which contain permanent and consumable materials for the activities. Live organisms are also used in most of the life science kits.

In addition to the curriculum materials, Oakland Unified School District provides ongoing FOSS implementation support through material distribution and refurbishment as well as professional development. FOSS kits are provided to all Oakland school sites on a districtwide rotational system. During any given trimester, an entire school, grades K-5, will teach the same strand:

earth, life, or physical science. At the start of the year, fully stocked kits are delivered to each school. At the end of each trimester, the kits are collected and exchanged with ones at another school site. At the end of the year, all kits are collected from school sites and fully refurbished over the summer.

The SMART (Science Materials and Resources for Teachers) Center has been in operation for more than 15 years providing materials and curriculum to elementary teachers. It now serves as the central refurbishment and distribution center for FOSS including a “Critter Room” for raising live organisms. Professional Development efforts include introductory and advanced workshop on topics such as integrating literacy, assessment, group management, and notebooking.

### **Problem Statement**

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Despite Oakland Unified School District’s significant investment in materials and implementation, science instruction remains inconsistent and de-prioritized in many classrooms. The following are the major barriers:

1. While the California Education Code and State Instructional Frameworks establish minimum instructional minutes for elementary ELA, math, and Physical Education, minimum required minutes do not exist for science.
2. The California Department of Education only mandates science testing in grade 5 while English Language Arts (ELA) and Math are tested annually starting in grade 2. This encourages schools to focus on ELA and Math.
3. State and Federal accountability measures are largely based on standardized tests. In Oakland Unified, schools that are labeled “under performing” (i.e. Program Improvement status) are expected to offer an additional 30 minutes of math and 30 minutes of ELA instruction, therefore limiting time for teaching science.
4. Schools with English Language Learners are required to offer 30 minutes of English Language Development (ELD) instruction in addition to the above.
5. Many teachers do not feel adequately prepared to teach science or integrate science into other subject areas and therefore focus on other subjects.

The major impact of these and other factors on elementary science education is the following:

- A. Despite the available resources and investment, many students are receiving limited science instruction. In May 2009, the OUSD Science Department surveyed elementary teachers regarding their science instruction. Teachers reported teaching science less than 30 minutes per week on average. Lack of time was reported as the primary obstacle.
- B. While the 5<sup>th</sup> grade Science California Standards Test (CST) scores increased significantly when the District initially adopted the FOSS curriculum in 2007 (26% to 36% proficient and advanced), the scores in 2009 remained steady with a 3% decrease in the number of students scoring proficient and advanced. Overall, scores in OUSD remain significantly lower than Alameda county and state scores. For example, in 2009, 49% of students in California scored proficient or advanced versus 54% in Alameda County and 33% in OUSD. Table 1 and 2 provide the details below.

Table 1: OUSD 5th Grade Science CST Scores by Proficiency Level

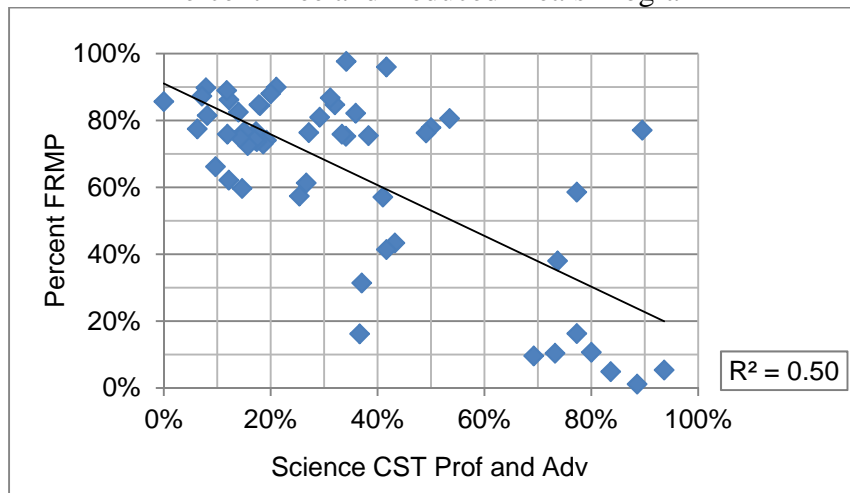
Proficiency Level	2006	2007	2008	2009
Advanced	3%	6%	10%	11%
Proficient	17%	20%	26%	22%
Basic	36%	36%	31%	35%
Below Basic	28%	21%	17%	17%
Far Below Basic	17%	18%	16%	15%

Table 2: OUSD 2009 5th Grade Science CST Scores vs. County and State

Proficiency Level	Oakland	Alameda County	California
Advanced	11%	26%	18%
Proficient	22%	28%	31%
Basic	35%	27%	30%
Below Basic	17%	11%	12%
Far Below Basic	15%	8%	9%

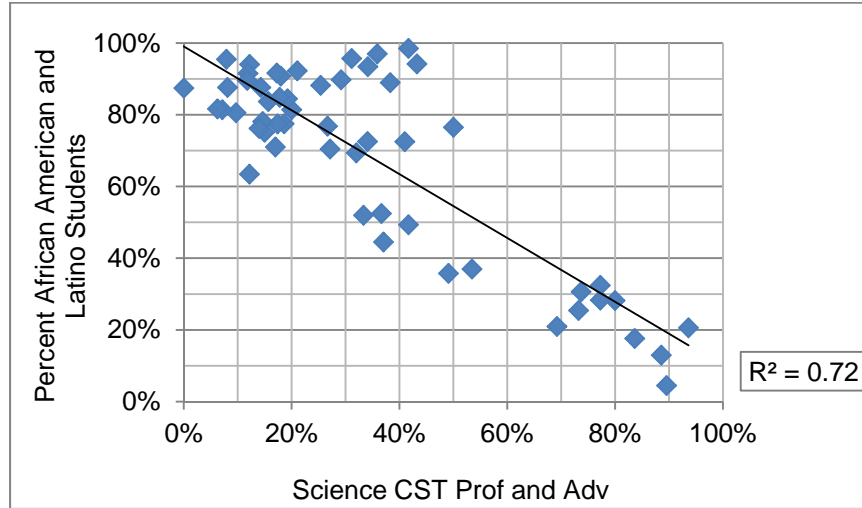
C. For the last eight years, California has developed a growing achievement and opportunity gap in science because ELA and Math are so heavily emphasized in low performing schools (California Teacher Advisory Council, 2009). This inequity also exists in OUSD. Most of the low performing schools are serving students of low socio-economic background and there is a strong correlation between the socioeconomics of the schools and the achievement level on the Science California Standards Test. Figure 1 illustrates the strong negative correlation between proficiency on the Grade 5 Science CST and percent of students participating in the federal Free and Reduced Meals Program. The higher the rate of participation in the meals program, the lower the proficiency level on the CST.

Figure 1: OUSD Proficiency on the Grade 5 Science CST vs. Percent Free and Reduced Meals Program



There also exists a strong negative correlation between the percentage of African American and Latino students and science achievement at school sites as illustrated in Figure 2. As the percentage of African American and Latino students increases, the science proficiency decreases.

Figure 2: OUSD Proficiency on the Grade 5 Science CST vs. Percent African American and Latino Students



A brief analysis of the proficiency levels of the major ethnic groups in OUSD also illustrates an achievement gap. As indicated in Table 3, the 2009 science proficiency levels range from 82% for Whites and 63% for Asians to 24% for African Americans and 20% for Latinos.

Table 3: OUSD 2009 5th Grade Science CST Scores by Ethnicity

Proficiency Level	African American	Latino	Asian	White
Advanced	5%	2%	27%	53%
Proficient	19%	18%	36%	29%
Basic	38%	41%	24%	12%
Below Basic	19%	23%	8%	2%
Far Below Basic	19%	16%	5%	3%
Students Tested	1076	1075	406	245
Percent Enrollment	34%	34%	13%	8%

An analysis of the proficiency levels of English Language Learners versus Fluent English Students (Fluent English Proficient and English Only) in the District also shows an achievement gap. As indicated in Table 4, the 2009 science proficiency levels for Fluent English students is 41% versus 12% for English Language Learners.

Table 4: OUSD 2009 5th Grade Science CST Scores by Language Learner Status

Proficiency Level	FEP + EO	EL
Advanced	15%	1%
Proficient	26%	11%
Basic	35%	35%
Below Basic	13%	30%
Far Below Basic	11%	24%
Students Tested	2126	810
Percent Enrollment	68%	26%

### **Proposed Action**

Science is a critical subject for all students, especially in elementary school. Studies have shown that early exposure to positive science learning experiences can lead to higher degrees of success in high school science courses and beyond (National Research Council, 2007). Science also provides important 21<sup>st</sup> century skills such as problem solving, critical thinking, communication, and collaboration. Science learning empowers children with a sense of agency as they interact with the world. It is a gatekeeper for college and the work place (Commission on Mathematics and Science Education, 2009, California Teacher Advisory Council, 2009)

Because of the importance of science education and the impact of elementary science instruction on secondary science classrooms and beyond, the OUSD Science Department proposes the following actions:

1. Require a minimum number of instructional minutes for hands-on FOSS science instruction starting in the 2010-11 school year. Proposed amounts are:

K-2 = 60 minutes per week

3-5 = 90 minutes per week

Although full implementation of the FOSS curriculum requires more time, this serves as a starting point to help all school sites establish science instruction.

2. Develop and encourage extensive integration of science with other subject areas. Science learning is correlated with increased achievement in ELA and Math. Additional time for science reading and writing within the FOSS curriculum can be integrated with ELA and ELD instruction. Other examples include:
  - Using science investigations to inspire students to write.
  - Providing authentic experiences for reading expository texts and vocabulary development, and use of academic language.
  - Providing content for ELA writing assessments.
  - Integrating existing district programs including Guided Language Acquisition Design (GLAD) strategies and Teach 4 Success practices.
3. Support school sites (as needed) to implement the minimum minute requirements. This may include assisting schools to reorganize their weekly schedules, providing additional

resources, and providing site-based coaching to improve science instruction at school sites that have not yet fully implemented the FOSS curriculum.

4. Continue on-going introductory workshops for each of the 18 FOSS kits as well as sessions on advanced topics such as notebooking, literacy integration, and group management. Provided professional development sessions tailored to entire school sites as needed.
5. Continue partnerships with local science organizations to provide resources to school sites, such as field trips, teacher grants, and district level events including the District Science Fair and Dinner with a Scientist.

**Implementation Timeline**

2010 Spring	<ul style="list-style-type: none"> <li>• Seek District and School Board approval for this proposal including School Board approval of instructional minutes requirements</li> <li>• Develop and implement a special orientation session for new teachers to OUSD</li> </ul>
2010-2011 School Year	<ul style="list-style-type: none"> <li>• Assist school sites in planning for the implementation of the proposal as outlined above</li> <li>• Continue district-wide science professional development</li> </ul>
2011 Summer	<ul style="list-style-type: none"> <li>• Develop and implement a Summer Science Leadership Institute</li> <li>• Develop and implement a Summer Institute focused on meeting the needs of English Learners through science (proposed California Postsecondary Education Commission grant)</li> </ul>
2011 Fall and Beyond	<ul style="list-style-type: none"> <li>• Full implementation of science instructional minutes districtwide</li> <li>• On-going site level and district-wide science professional development</li> </ul>

**Fiscal Impact**

In alignment with this proposal, the Science Department is pursuing and renewing funding from state grants and private foundations. With these external funding options, there will be little impact on the District budget.

**Long Term Impact**

We believe that if this proposal is fully implemented, long term impacts will include:

1. Improved science instruction and reduced teacher anxiety regarding science instruction.
2. A stronger science education foundation for ALL OUSD students.
3. Improved learning across all disciplinary areas.
4. Improved CST science scores at the elementary and secondary level.
5. Increased college readiness by preparing students to take UC “d” approved laboratory science courses in high school.
6. Additional funding from philanthropic organizations if OUSD commits to more science instruction.
7. OUSD serving as a model for elementary science education in California.

## References

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- *Status of the Teaching Profession*, Center for the Future of Teaching and Learning, 2009
- *Creating a Well-prepared Science, Technology, Engineering and Mathematics (STEM) Workforce: How Do We Get from Here to There?*, California Teacher Advisory Council, 2009
- *The Opportunity Equation: Transforming Mathematics and Science Education for Citizenship and the Global Economy*, Commission on Mathematics and Science Education, 2009
- *Addressing the Achievement Gap in STEM Disciplines for Underserved Communities*, 2009
- *Taking Science to School: Learning and Teaching Science in Grades K-8*, National Research Council, 2007.
- *Joint Task Force on Science*, California School Boards Association & California Science Teacher's Association, 2006

## Contact

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