San Diego Unified School District's

Science Advisory Blue Ribbon Taskforce

Final Report:

ASSESSMENT OF SCIENCE EDUCATION & RECOMMENDATIONS FOR IMPROVING SCIENCE PERFORMANCE IN SDUSD

December 10, 2009

I. Executive Summary

San Diego Unified School District (SDUSD) should strive to have a world-class science program in order to enhance learning and prepare students for the educational and job opportunities that await them in a 21st century economy. Studies have concluded that there is a strong connection between learning in science and a wide range of other subjects, such as math and literacy. Maintaining strong science programs is critical for the success of students in all subjects while also helping develop many life skills that are rooted in analysis and investigation. Moreover, it is critically important that SDUSD invest in science programs as the region, state and nation move towards a 21st century economy that is strong in the high tech and clean tech sectors. San Diego's current and future employers will rely on a well-trained local work force; however, a strong science foundation must be built if students are going to be prepared to ultimately enter an ever-more-competitive work force.

San Diego is
1 of the top 10
cities for tech jobs,
according to Sept. 15, 2009,
US News & World Report.

The good news is that SDUSD has already made tremendous strides in this area. Over the past decade, the District has implemented innovative programs and invested necessary resources towards science education that has paid significant dividends. Some of these reforms included: broadening instruction to encompass more inquiry-based and hands-on models; providing teachers with the tools needed to effectively engage students such as increased professional development and the investment in FOSS kits and a central Science Resource Center; and leveraging District resources with outside funding and partnerships to implement innovative programs. These reforms were not without some missteps and controversy, which cannot and should not be overlooked. In particular, those reforms which were well communicated and had buy-in at the District and school/teacher levels were most well received. Even with these 'lessons learned', though, these reforms implemented by dedicated District staff and teachers have been a major success. Science education and student performance have improved dramatically in SDUSD since 2000 to the point where SDUSD now ranks competitively with coastal districts and is currently the most proficient urban district in California in science performance. We have proven that with proper vision and investment, San Diego can be a national leader in science programs.

Despite these positive results and the critical need for strong science programs among SDUSD students, an apparent change in focus of the most recent Administration combined with severe budget cuts has resulted in a reversal of the way science is taught in SDUSD. As a result of concerns raised about the long-term implications of the pronounced de-emphasis of science programs in the District, a Blue Ribbon Taskforce (BRTF) was formed to evaluate SDUSD's current science curricula and the delivery of the curricula and to make recommendations to the SDUSD Board of Education to improve SDUSD's science programs.

The BRTF recognizes that these are very difficult economic times, with more than $180 million cut from the District's budget over the last three years and anticipated cuts of up to $200M per year projected over the next several years. However, without a vision for what the District seeks to accomplish, there is little hope of continuing and building upon the successes already achieved. An examination of the findings by this task force will show an already successful

model for the treatment of science on many levels, meaning we do not need to 'reinvent the wheel', but largely build on what has already been achieved. Moreover, many steps can and should be taken that have minimal budget impact, but will go a long way towards ensuring a strong science foundation in SDUSD students with a relatively small investment. Lastly, members of the BRTF believe that funding and partnership opportunities exist – particularly with those in the high tech and clean tech sectors that will benefit from a more well-educated base of students – to implement programs that would otherwise be beyond the reach of the District as long as the need for and benefits of those programs are well articulated. With the proper attention, the BRTF is convinced that SDUSD can be *the* national model for science education and cooperation with the science industry. The District cannot afford to remove support for science instruction at this critical juncture.

The following report outlines in greater detail the makeup, goals and operating procedures of the BRTF; a brief history of SDUSD's science efforts over the past 20+ years; an assessment of performance of the District and local students in recent years; and key findings and recommendations.

Key Findings

(1) SDUSD has made great progress in science education in recent years, particularly in elementary school science, and should continue those programs that have proven successful;
(2) Elementary, middle and secondary schools have different needs and must be treated differently;
(3) To the extent resources are limited, the District should focus on strong elementary science programs that build a strong foundation for future learning;
(4) Secondary school science programs need a greater emphasis on preparing students for college *and* career pathways;
(5) Communication between the District and individual schools, teachers and the public to ensure 'buy-in' for recommendations is critical as many past failings of science reforms have resulted from perceived disenfranchisement.

Priority Recommendations

<u>Near Term</u>

(1) Professional development must be maintained so teachers have access to quality teaching strategies and materials, including centralized PD coordinated by a dedicated staff person (at the District Level) for elementary and middle schools.
(2) The Science Resource Center budget, including support for a dedicated and qualified staff managing science kit rotation and assembly, must be maintained to support teachers and science education in SDUSD schools.
(3) Enhancing science education at Program Improvement Schools as part of comprehensive curricula should be prioritized.
(4) The District should *consider* amending its graduation requirements to align more closely with admission requirements for UC and more importantly CSU and state universities, though issues of equity in providing instruction must be addressed.

(5) SDUSD should prioritize the use of innovative and career-tech courses (particularly those related to the GreenTech/CleanTech field) as a catalyst to more effectively engage a broad range of students.
(6) A comprehensive plan must be developed and implemented to aggressively pursue strategic partnerships and funding opportunities to implement recommendations provided by the BRTF.

Long Term

(7) The District must develop and communicate a clear vision for science education that includes a focus on SDUSD being a national leader in green technology/programs;

II. Committee Overview

San Diego Unified School District (SDUSD) Board members Richard Barrera and John Lee Evans established a Science Advisory Blue Ribbon Task Force (BRTF) to evaluate SDUSD's current science curricula and the delivery of the curricula to the classroom and make recommendations to the SDUSD Board of Education to improve SDUSD's science curricula and the delivery of the curricula to the classroom. A secondary goal of the BRTF was to engage the public in discussions about science education being provided in SDUSD schools.

Bruce Reznik, Executive Director of San Diego Coastkeeper (a partner with SDUSD on environmental science education), was asked to Chair the BRTF. The BRTF included 15 members with a broad range of expertise and perspectives, including K-12 educators, administrators, representatives from academia and the research community, parents, students, business leaders, nonprofit organizations and members from under-served schools and communities. (See Attachment A for a list of all BRTF members and groups).

The BRTF met six (6) times from September through December 2009 to address a wide range of topics. (See Attachment B for meeting minutes.) Some meetings included presentations from experts in relevant fields, and all meetings focused on having a productive dialogue among the members of the BRTF. Reaching consensus was a goal of the Committee (see Attachment C for meeting protocols), although participants agreed that this should not necessarily take precedence over developing a strong set of recommendations for the Board. It is noted in the report where consensus was not reached.

The deliverables of the BRTF includes this final report as well as a presentation of findings and recommendations at the SDUSD's Board of Education meeting on December 15, 2009.

III. Assumptions

In developing its recommendations, the Committee decided it would focus, within reason, on the needs of the District and its students more than the resources currently available to implement such recommendations. While the group was cognizant of existing resources, the BRFT stressed the need for 'big thinking' to develop a world-class science education program in the next 5-10

years. The Committee determined it was crucial to develop a vision that would provide something to strive for and can be used to develop partnerships and solicit funding needed to implement the recommendations. Focusing solely on resources currently available would necessarily limit the District's reach. In addition to resources, the BRTF agreed it should not underestimate the ability for SDUSD to alter its own requirements or the District's power to influence state and federal requirements to implement these recommendations. Therefore, the BRTF focused on what approaches will be best for students not limited by current standards or resources.

IV. History

While this report focuses primarily on recommendations to move SDUSD science education forward, it is important to first understand where the District has been over the past 20+ years. The 1980's through early 2000's was a period with frequent shifts in priorities with science education in SDUSD, which often resulted in controversy and conflict within the District and poor student performance. An increased focus on science and an attempt to think about system-wide change in the early 2000's (while not without some detractors) has resulted in improved performance, particularly in elementary schools. The past year, however, has seen a shift away from some of the efforts that have yielded positive results. Some of these key developments included (See Attachment D for more detailed history overview):

1990s-2000

- Physics First movement was implemented in SDUSD. Concerns arose with new sequencing and students' lack of math skills in the 9th grade as well as perceived top-down implementation (w/o teacher input) of reform.
- Urban Systemic Initiative (USI)/National Science Foundation (NSF) Grant provides teachers with Professional Development (PD) to increase pedagogy teaching skills and enhance students experience in the classroom. Teachers experienced hands-on science lessons and took experience back to their classrooms and more enthusiastically taught science to students.
- Professional development was provided to teachers and made a top priority. Much of this was formal professional development, but informal 'cluster' or 'peer' training also occurred. Additionally, training of teacher leaders was introduced through the K-12 Science Alliance to train teachers how to use the kits, which improved science lessons in the classroom.
- SDUSD first adopted FOSS kits in the late 90s bringing inquiry-based, hands-on science lessons in the classroom. FOSS has been instrumental in elementary science instruction ever since.
- High School graduation requirements and science sequence changed from 2 years (Life/Physical) to 3 years (Physics, Chemistry, Biology), which is above UC and CSU admission requirements but in line with UC/CSU recommendations. Some controversy exists as to whether SDUSD graduation standards should exceed admission requirements and how we can better align SDUSD, UC and CSU standards.

- In 1998 SDUSD cancelled an agreement with USI/NSF and further science funding did not occur due to an increased focus on literacy and mathematics. As a result, there is no science support for teachers (science PD stopped and Science Department disappeared).

2000 – 2007

- New science adoption process began. Harcourt was the adopted science textbook and FOSS was adopted as supplemental kits-based curriculum to provide more hands-on learning.
- New funds were available from a new NSF grant to reinstate Science Department and focus on science.
- Science Resource Center was established in the early 2000's to supply teachers with science kit materials and materials refurbishment once kits were used so that teachers and students have materials needed to teach science effectively. Prior to centralization, evidence suggests that many kits were not being used or properly refurbished.
- Professional Development resumed as Science Resource Teachers and Administrative personnel were hired with an emphasis on science again.
- In 2004, FOSS kits were being blended with enrichment curriculum (e.g. Project SWELL) to enhance the existing science lessons. Such programs have provided real-world relevance to science instruction in many instances.

San Diego Unified School District, the City of San Diego and San Diego Coastkeeper partnered to enhance the existing science curricula with Project SWELL, a San Diego-focused environmental education program. The program has educated more than 160,000 children about pollution prevention and ocean health using hands-on science.

- Teachers were not universally using the FOSS kits, so PD began in kit training, pedagogy, reading and writing in science (writing observations, how they came to conclusions and data in notebooks), inquiry, questioning strategy and science content.
- First science benchmark exams were introduced in grades 3 - 5. Students are tested every 12 weeks in Physical, Earth and Life Sciences, providing a better understanding of performance of curricula and delivery.
- Standards Based Report Cards implemented in some identified schools.

2007 – 2008

- New science adoption process began to adopt District-approved science curricula for the next seven years. The adoption committee was formed consisting of teachers, principals and administrators.
- FOSS/CA was approved for adoption by Adoption Committee, Board of Education and District to continue inquiry-based learning in science.

May – July 2008

- Science Resource Teachers began FOSS/CA curriculum implementation process with parents, teachers and administrators.

- Science PD was scheduled on District calendar for the year ensuring teachers were trained on the kits and comfortable teaching them in the classroom.
- District-wide adoption of standards-based report cards as assessment piece, providing another tool to evaluate performance of science instruction in SDUSD.

September 2008

- Science Resource Center crew began preparing and refurbishing kits for disbursement to school sites ensuring teachers had materials to adequately teach hands-on science.

December 2008

- SDUSD reorganization #1 – Elementary Science Department moved under the umbrella of the Office of Elementary Instructional Support. The Content Departments are organized into Elementary, Middle and High School.
- National and local budget crises impacts SDUSD.

Early 2009

- Elementary Content Resource Teachers told that they were only to support non-Program Improvement schools, resulting in no support for the teachers and students that need it the most.
- In response to the budget crisis, in February the District attempted to return ~$2 million in FOSS kits that had been purchased, including some used/processed kits. This resulted in potential litigation by the publisher (Delta Education). Ultimately, a compromise was reached with Delta Education to return about $900,000 in FOSS kits. Remaining life science kits were broken down to support SDUSD's larger class size in order to meet goal of each class having its own kit. While a solution was found to address immediate concerns, intended return of FOSS kits signaled intent to move away from many successful reforms in science instruction.

June – December 2009

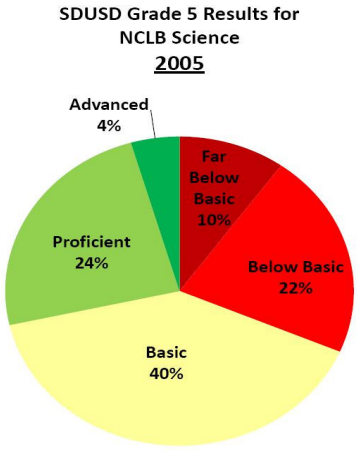
- SDUSD reorganization #2 - Office of Elementary Support is now Curriculum Instruction organized into Curriculum and Writing, Professional Development, and Coaching and Mentoring. There is no science specific PD or training happening now or scheduled in the near future, and there is no District referral for schools.
- All content central office Resource Teachers excessed and required to apply for newly created positions under the reorganization.
- Application process began for non-content specific Resource Teachers to be hired. Only two Science Resource Teachers retained in new positions, greatly limiting science expertise within the District. There are currently no Elementary and Middle School Science Resource Teachers. Resource Teachers facilitated Science Resource Center during the summer ensuring science kits were assembled and delivered to schools.
- There is currently no one managing the Science Resource Center, and no budget to refurbish FOSS kits (the Science Resource Center Costs about $360,000/year, including materials and clerk costs, not including transportation/fuel). As there is nobody responsible for accounting for all kits, some are being sent with things missing; some schools have too many kits; others too few.

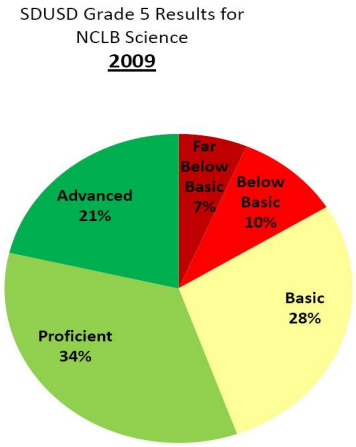
- Currently 9 people doing PD for entire District and there is no direct science support given to teachers and students except for logistical site needs.

V. Assessment of District Performance

The Committee agreed that an increased emphasis on science and several reforms undertaken by the District and individual teachers and schools (as outlined below) has improved science learning and student performance in SDUSD, particularly in elementary school. This improvement has been borne by improved scores on the California Standards Test (CST) and District's Standards Based Report Card (SBRC). For example, in 2007 14.6% of 5th grade students were below basic standards on the CST; by 2009 that number had decreased to 9.8%. During this same period, students performing at the advanced proficiency level increased from 9.1% to 21.3%. In 2007, 24 % of 8th grade students were below basic standards; by 2009 that number had decreased to 16 %, and students performing at the advanced proficiency level increased from 15.6% to 27.3%. During the same timeframe, 26% of 10th grade students were below basic standards and the number decreased to 15.6 %; while students performing at the advanced proficiency level increased from 4.5 % to 15.7 %. Test scores in science outpaced advancements in other subjects, and SDUSD is now competitive with coastal districts in terms of science performance and is currently the most proficient urban district in California. (See Attachment E for summary of test results.) The Committee agreed that the standardized test data results accurately reflect increased performance in science among SDUSD students, though standardized tests alone do not tell the whole story. Additional indicators should be developed.

Despite these positive results, the Committee unanimously agreed that an apparent change in focus of the (previous) Administration combined with severe budget cuts has resulted in science being dramatically de-emphasized in SDUSD schools. SDUSD is moving away from the strategies that have resulted in improved science performance, which was of grave concern to the BRTF members who believe the District could regress quickly and dramatically and undermine the science foundation that has been built. This is particularly troubling now as the San Diego region is focusing on being a high-tech center and will rely on a base of residents with strong science backgrounds. The group felt strongly that we need to determine which steps were critical in improving science scores, identify how we can continue and build on these activities, and to also identify other steps that should be taken to improve performance that have not yet been pursued by SDUSD.





VI. Findings & Recommendations

Visioning

How Children Learn

1. **How children learn**: Developing an understanding of how students learn is vital to providing conceptual science instruction.
2. **Importance of science in elementary schools**: Seeds of success in science learning start in elementary school. Students from very early grades can make connections of science with all subjects (math, literacy, etc.). Scientific inquiry skills start as early as kindergarten. Through science learning, many skills are developed rooted in analysis and investigation.
3. **Role of inquiry-based learning**: Inquiry-based learning, particularly in elementary school, is a critical component of building a strong science foundation.
4. **Need for real-world relevance**: To be most effective, science curricula should have 'real world' relevancy to students and address areas of interest to them.
5. **Time for science**: The District must examine how we structure time with teachers and students so teachers have sufficient time to teach science. The current blueprint for the amount of time a teacher has to spend on each subject is rigid, which can limit time needed to learn key subjects.
6. **Interplay of subjects**: The District should work to foster a better understanding of the interplay between learning in various subjects (enhanced science = enhanced math = enhanced literacy and vice versa) to improve overall instruction.

Recommendation

a. SDUSD should explore allowing more flexible/less rigid requirements for the time teachers must instruct in certain subjects, starting classes before Labor Day and updating testing schedules.

SDUSD Vision & Goals

7. **Need for clear vision**: SDUSD must develop a clear and well-communicated vision and goals that meet the needs of the greatest number of students. This includes the notion that SDUSD should prepare students for college *and* career pathways.
8. **Common definitions**: Reaching agreed-upon definitions of hands-on and inquiry-based science education is crucial as part of this vision and goal-setting exercise, as these terms are often (mistakenly) used interchangeably. Inquiry-based science education generally refers to a pedagogical style where students are involved in developing meaningful questions, designing ways to answer them (usually through experimentation), and drawing conclusions supported by the evidence. Sometimes the questions can be posed by the teacher or the textbook.
9. **Differentiate different grade levels**: Elementary, middle and secondary schools have different needs and must be treated differently.

Recommendations

b. SDUSD should develop a vision, goals and desired outcomes for science education with clearly defined terminology that meet the needs of the greatest number of students, including the notion that SDUSD should prepare students for college *and* career pathways.

Elementary School

10. **Importance of elementary school science**: Science education is particularly crucial and should be prioritized at the elementary school level to build a strong foundation of science and an awareness of concepts among students. Inquiry-based methods, including the use of FOSS, provide a strong foundation for elementary students and should be prioritized.
11. **District support**: Centralized leadership role in science (a specific 'point of contact' in the District) is needed for elementary schools as teachers do not have content expertise.
12. **Assessment**: Implementation of benchmarks and assessment has been an important tool in evaluating student performance in science and should be continued.

Recommendations

c. The District should continue with efforts that have proved effective and successful over the past 5+ years, including the use of inquiry-based education, FOSS kits and hands-on programs as well as enrichment curriculum, centralized professional development and assessments/ benchmarks.
d. To the extent resources are limited, priority for science education should be given to elementary school science, where there is less content expertise among teachers and where a foundation for learning among students is built.

Middle School

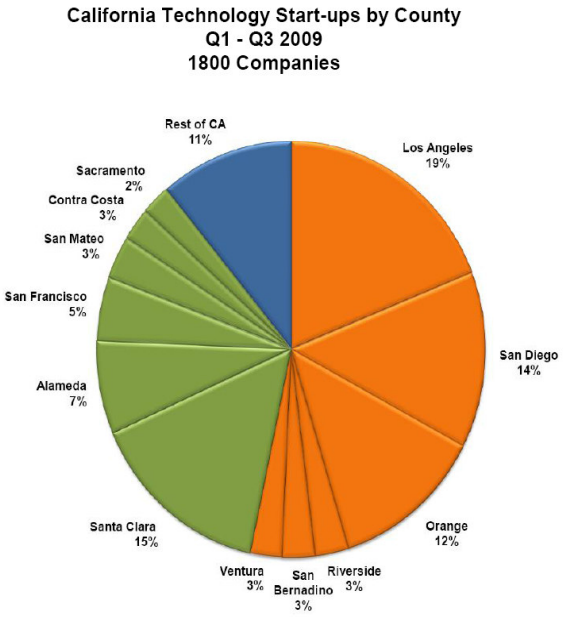
13. **Addressing needs of middle school students**: The BRTF unfortunately did not have time to adequately address middle school science instruction. To the extent the needs of middle school students were addressed, no consensus was reached. Some committee members believe middle school should be treated like elementary school, with heavily centralized professional development and District support. Others felt that because of the content expertise of middle school teachers, a more decentralized focus (as was advocated for secondary schools) was appropriate. Additional work is needed to develop recommendations for middle school science.

Secondary School

14. **Sequencing**: Re-sequencing the Physics, Chemistry, Biology science instruction with a more flexible program seems to have benefited students. Some task force members believe, in particular, elevating Earth Sciences as an entry level class (rather than a previous focus on teaching 'physics-first') helped prepare students for subsequent science courses. Providing

individual schools the flexibility to sequence science classes based on their student populations and needs also seems to have been beneficial.

15. **Graduation requirements**: Graduation requirements in SDUSD are generally more stringent than University of California (UC) and California State University (CSU) 'a-g' admission criteria for science ('d' requirements for laboratory; 'g' for elective). With fewer students going to UC/CSU schools (particularly UC), SDUSD should focus on reaching and preparing students for other (non-UC/CSU) opportunities. To the extent graduation requirements are linked to the state's university system, they should be geared more towards CSU (which are in some instances less stringent than UC) as more students will go into one of the 23 CSU members.
16. **Innovative Courses**: Innovative courses can meet UC/CSU requirements and enhance learning opportunities in SDUSD by reaching students who are not engaged or feel disenfranchised by traditional college-track courses. SDUSD should seek to certify these innovative courses. While classes must be made available for all schools for UC/CSU certification, courses should also be individualized at the school level to meet students' needs. Focus groups for innovative courses may be a valuable tool; teachers can be used for such focus groups.
17. **Career-Tech**: Similarly, career-tech courses (which can be approved by UC/CSU, but are not allowed by SDUSD to meet graduation requirements) can be used to reach students not engaged by traditional college-track courses. Despite pre-conceptions, career-tech courses can be rigorous, help achieve the goal of simultaneously developing 'hand and mind' skills in students, are structured, standards driven and assessment oriented. Career-tech courses can be important to providing college credits and pathway to automatic enrollment to State colleges (including SDSU).



CONNECT Innovation Report; National University System Institute for Policy Research

The data shown are new company start-ups in 7 technology sectors for the first 3 quarters of 2009. The CONNECT Innovation Report for Q3 2009 will be published in the SDBJ on Monday, December 14 and on the CONNECT website.

18. **Using technology to augment traditional classes**: There may be potential to use digital textbooks and eventually online courses to meet certain graduation requirements. Many digital textbooks are currently approved and can be implemented rapidly in SDUSD. While it may be difficult for online courses to meet certain UC/CSU requirements due to lack of wet lab and quality control, exploring online options is needed, particularly as budget cuts in the District necessitate creative (and cost-effective) solutions. Similarly, mobilizing laboratory components can also be explored as a way to reduce costs.

19. **GreenTech/CleanTech**: Linking science education with 'green technology' components (e.g. urban farming programs; allowance of courses like biotechnology, etc.) offers students a better education by linking the theoretical with real-world, local issues. Such courses also help train students for increasing careers in the green-tech sector, and will provide the workers that will allow San Diego to become a true green-tech leader (which could provide tremendous economic as well as environmental benefits for the region).
20. **Equity**: While it is important to offer innovative and career-tech courses to engage the greatest number of students and to prepare those students for college and career, we must also be careful to balance the goal of engagement with equity – we must not place students in certain tracks because of their background. All students should have equal access to a broad array of classes that meet the needs and interests of the SDUSD student body.
21. **District Role**: Centralized expertise may be less necessary at the secondary school level as teachers have greater content expertise, and may not be viable due to limited District resources.

Recommendations

e. The District should *consider* amending its graduation requirements to align more closely with admission requirements for UC and more importantly CSU and state universities to allow a greater number of students access to colleges and universities they are more likely to attend. SDUSD should consider adopting UC/CSU requirements as currently drafted while advocating for more consistent requirements to UC and CSU schools. SDUSD should also explore the potential of allowing dual-credit (college and HS) courses.

f. SDUSD should prioritize the use of innovative and career-tech courses (particularly those related to the GreenTech/CleanTech field) as a catalyst to more effectively engage the broad range of students. SDUSD must be creative in implementation within existing constraints (SDUSD graduation requirements and UC/CSU admission requirements), including continuing to apply all such courses for 'a-g' certification. To the extent needed, SDUSD should advocate to address federal, state and local regulations that limit what courses receive credit and who can teach what to promote the use of such courses, including developing a dialogue with UC/CSU. While classes must be made available for all schools for certification, courses should also be individualized at the school level to meet students' needs. Focus groups for innovative courses may be a valuable tool; teachers can be used for such focus groups. In pursuing these recommendations, it will be important to consider potential impacts on providing access to courses equitably.

g. The District should explore opportunities to develop on-line (web-based) curricula/programs and digital textbooks and should pursue resources to develop 21st century infrastructure to prepare students for careers in the high-tech/green-tech sectors.

h. As part of its vision, the District should seek to be a national leader in the GreenTech/CleanTech sector (in terms of courses offered, partnerships and implementing green programs).

Program Improvement Schools

22. Program Improvements schools (lower performing schools, typically in underserved communities, that fail to meet accountability standards two years in a row) need science education and PD the most.

Recommendation

i. Enhancing science education at Program Improvement Schools as part of comprehensive curricula should be prioritized.

District Support

District Organization & Resources

23. **District organization**: Two District reorganizations (moving from content based to grade level to non-grade level specific) in a short period have created significant uncertainty within SDUSD. There seems to be a lack of clarity and consistency about implementation of the second reorganization.
24. **Need for District content expertise**: The lack of content area expertise and structures to take advantage of that expertise is a major shortcoming, particularly at elementary school science. There are currently no science resource teachers, and only two employees at the District level with science expertise. Science resource teachers are critical in supporting science education by:
    - Training teachers to use units of study
    - Providing summer PD for Summer Institutes and Lesson Studies
    - Supporting FOSS/CA Implementation (there is currently no science support for FOSS/CA adoption despite 6 more years in this adoption cycle
    - Helping achieve benchmarks
    - Helping maintain a consistent vision for science education
25. **District resources**: At its peak, SDUSD's Science Department budget was $4.1 million with 8 Resource Teachers (4 Elementary, 2 Middle and 2 High School), 2 Program Managers and 3 Stock Clerks working on science kit assembly. This budget has been cut severely since then, to today where the department does not exist. Identifying funding opportunities to increase available resources for science education is crucial.

Recommendation

j. SDUSD must increase its content expertise for science at the District level.

Professional Development

26. **Importance of PD**: Professional development is critical to ensuring that teachers have the proper tools and are sufficiently prepared (making them more fulfilled and passionate). Student achievement is positively correlated with professional development. *Centralized PD* from content experts is particularly critical at the elementary school level.
27. **PD for inquiry-based learning**: Professional development is important for inquiry-based coursework by encouraging teachers to:

- Engage in inquiry themselves
- Reflect on their own learning
- Respond to student's thinking (by showing videos from classrooms)
- Identify students ideas (from that transcripts of the videos)

28. **Lesson study**: One particularly effective, though resource-intensive form of professional development is lesson study, which is a very hands-on way for teachers to interact with Science Resource Teachers to refine a practical way of getting through lessons. Teachers take a look at their own practice and compare it to their peers to see how they engage kids in science. One suggestion is to make lesson study a project with the principal's approval.
29. **Peer-to-peer PD**: Because PD has been such a focus in the District in recent years, some peer-to-peer PD is still occurring despite budget cuts and elimination of formal programs. It is uncertain, however, how long this can/will be maintained or how comprehensive it is absent a more formal program.

Recommendation

k. Professional development must be maintained so teachers have access to quality teaching strategies and materials. Centralized PD coordinated by a dedicated staff person (at the District Level) is essential for elementary and middle schools. Resources should be pursued to continue lesson study PD.
l. Collaborative peer-to-peer PD should be explored at the secondary school level, including exploring partnerships with local universities and colleges (particularly with contact training) and employing a 'coaches model'. More work is needed to refine approach for collaborative PD for secondary schools.
m. SDUSD should explore adding content element (including science) to existing technology PD (i.e. SMART Boards) in elementary school. SMART Board training is currently ongoing, so adding content element leverages existing work.

Science Resource Center

30. **Importance of the SRC**: The Science Resource Center has been a critical tool to the success of science at SDUSD. Prior to the Center, individual schools were responsible for distributing FOSS kits to teachers and refurbishing those kits, which often did not happen due to insufficient resources. Having a centralized Resource Center has helped hold people accountable for materials and getting kits out on time. Additionally, having SDUSD refurbish kits is more cost effective as the District is able to leverage their larger orders to ensure best prices. It costs an estimated $3 to $4 per student to maintain the SRC, which was seen as a critical investment by the Committee. Proper tools and support systems (including professional development at the SRC must be provided to teachers - teachers often do not have time to create these tools themselves). Currently, the Center operates as a warehouse without anyone overseeing science refurbishment. There is no accountability and kit rotations have been delayed. Currently, a PD Resource Teacher for Instruction Support has been called to help get kits out to schools (which is required to comply with laws mandating equal provision of materials among schools), which is a red flag as one person is being called upon to do two jobs.

Recommendation

n. The Science Resource Center budget must be maintained to support teachers and science education in City Schools, particularly at the elementary level. A Science Resource Teacher or other dedicated and qualified central staff managing science kit rotation and assembly is essential.

Outreach & Collaboration

In-District Communication

31. **Top-Down/Bottom-Up Buy-in**: Getting buy-in from teachers as well as administrators is crucial to the success of science education in SDUSD. It is important to engage teachers early and in an iterative process to ensure successful implementation of science reform, including the inquiry method, into SDUSD. Much of the hesitation about inquiry-based learning and other reforms stems from earlier efforts to incorporate this method into SDUSD that some teachers felt was imposed upon them with little feedback or adequate instruction, and without valuing their 'in the classroom' expertise.
32. **Importance of District-School communication**: Through the course of Committee discussions, not all participants were fully aware of SDUSD, CSU/UC requirements, which highlights the need to improve communication between and among the District and individual schools. Also discussed was the need to access the passion of teachers to drive the process – we need to have a dialogue as to where their passion comes from to better engage them and students in the process.
33. **Importance of School-School communication** Partnering with other schools is also important. Teachers need to be talking to other teachers and students should get opportunity to work with other school teachers and students for collaboration.

Recommendation

o. The District should develop a communications plan to promote effective District-to-School; School-to-District; and School-to-School dialogue. This plan should include a focus on communications between 'core academics' and career-tech at the secondary level. It is particularly important to develop an iterative process between the District and individual schools and teachers to dialogue proposed reforms to take advantage of expertise at all levels in an open discussion and ensure ultimate buy-in from all sectors.

Developing Partnerships

34. **Partnering with outside groups**: Developing broad-ranging partnerships is critical to developing a more robust and innovative science curricula. At the peak of the Science Department, it was estimated that the Department head spent approximately 20% of her time on public outreach to develop collaborations with key community partners, including significant funding for local programs. Some community partners who played a key role in supporting the District's science program and enhancing student performance included:
    - National Science Foundation (NSF)

- California Math and Science Program (CaMSP)
- San Diego State University (CIPS, PISCES, Resource Center and SDUS Foundation)
- San Diego Science Alliance (MSSELI)
- San Diego Coastkeeper and the City of San Diego, Think Blue (Project SWELL)
- USD
- UCSD
- K-12 Alliance

35. **GreenTech/CleanTech Partners**: SDUSD should look to potential partners that will benefit from enhanced science performance in students, such as the high-tech, green-tech center, trade unions (e.g. IBEW) and the like.
36. **Taking advantage of local expertise**: We have tremendous expertise and resources in San Diego from our colleges and universities – partnerships between high schools and UCSD/SIO/USD/SDSU, etc. should be encouraged.
37. **Need for central contact**: With no dedicated science department or staff, there is nobody available to explore or cultivate these partnerships and funding opportunities. The District may be leaving them on the table by not reaching out to the broader science community or possible partners.

Recommendation

p. A comprehensive plan must be developed and implemented to aggressively pursue strategic partnerships and funding opportunities to implement recommendations provided by the BRTF. In particularly, SDUSD should explore partnerships with high-tech/clean-tech sectors, local colleges and universities, and publishers (leveraging purchasing power) to assist with developing and implementing innovative programs.