Science For All: Promoting Interest and Participation in a Diverse Middle School

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ABSTRACT

This case study examines the impact of school climate on students’ attitudes and interests in science and science-related careers. Two schools within a very diverse suburban school district were examined from the perspective of student surveys and formal interviews of students, science department chairs, school counselors, as well as researcher notes about the school atmosphere and informal interviews with other school personnel. Results indicate that although students in both schools are similar with respect to overall science interest and their beliefs that they could pursue science as a career, their attitudes vary quite considerably with respect to school science and their perceptions of teacher expectations. The attitudes and beliefs of school personnel that may explain the differences in creating a positive science climate are also discussed.
INTRODUCTION

During the past decade, the state of California has made considerable changes to its standards for student achievement and school accountability through standardized test scores has become the norm in determining school success. At the elementary level the shift from a more integrated curriculum to a focus on math, reading and language arts has often left the teaching of science and/or social studies as a Friday afternoon reward or it has been removed from the curriculum altogether. This lack of science access is alarming with respect to nurturing future scientists and engineers, particularly girls and minorities whose representation in the scientific workplace continues to lag behind in comparison to white males and Asian Americans (National Science Board, 2004). This barrier makes it more challenging for science educators and reform efforts to have real impact on the state of science in our schools. In a bold statement of concern for students’ access to science, the National Research Council (NRC, 1996) announced the following:

All students, regardless of gender, cultural or ethnic background, physical or learning disabilities, aspiration, or interest and motivation in science, should have the opportunity in science, should have the opportunity to attain higher levels of scientific literacy than they currently do. (pg. 6)

This statement suggests that access to quality science instruction should be part of the yardstick used to measure effective schools. At the middle school level, where all students have a regular science class it begs the question, how can we measure the effectiveness of science education given the consistency of access?

Considerable attention has been paid to understanding which factors create a successful school. Some argue that principal leadership plays a critical role in creating an effective school (Heck and Marcoulides, 1993), however it is only part of a larger picture.
Research by Johnston (1985, 1995) posits that effective schools create a culture of achievement that aims to support and nurture the accomplishments of all students. Furthermore, the culture maintains high expectations for success on multiple levels, academically, artistically and athletically. It also strives to make learning opportunities more authentic and meaningful. But, most importantly, the guiding force of effective schools is student success. As such, it not only demands the best efforts of its students, but teachers, administrators and support staff as well.

Because teachers play a critical role in each student’s learning process, the quality of science education is largely dependent on the quality of instruction that students receive, so indicators of teacher quality are very important in the assessment of science education (Darling-Hammond & Hudson, 1988). Others suggest that outside of facilitating the learning environment, teachers can largely influence the science attitudes of students. For example, Haladyna, Olsen and Shaughnessy (1982) argue that attitudes toward science are determined by three independent constructs: teacher, student, and learning environment. Variables in each of these constructs can be endogenous, or under the direct control of the school environment and/or exogenous, being outside the control of the schools. The endogenous teacher and learning environment variables are important because they have the greatest influence on attitudes and they are also easy to modify to nurture changes in attitudes. Furthermore, within the endogenous construct, they concluded that the teacher’s enthusiasm was a contributory factor in developing students’ positive attitudes towards science.

Research conducted in Taipei examining classroom climate and science-related attitudes of junior high school students in both metropolitan and rural schools has also
suggested that intense competition, a characteristic that is often associated with the scientific field, may have positive effects on students’ science attitudes (Lin & Crawley, 1987). Although Lin and Crawley found no differences in science attitudes between boys and girls, others have suggested that the competitive nature of science is one major factor that steers girls and women away from science (Brickhouse, Lowery, & Schultz, 2000).

This paper is part of a longitudinal study focusing on girls’ and minorities’ interests, attitudes and perceptions about science and science-related careers with the aim of understanding why this population of students is largely underrepresented in the fields of science and engineering. While the primary goal is to understand students’ developing science identities and how this impacts their later involvement in science, gaining insight about the climate of school science may be critical in shedding light on the overall goal of the project. As such, given the challenges to creating a more diverse population of scientists, what can schools do to encourage science interest and participation among girls and minorities? This study examines the factors that contribute to a community of science learners within a diverse middle school (School A) and issues that may impede science involvement at a competing middle school (School B) within the same district employing the same standards, curriculum and textbook.

METHODS

Sources of Data

The comparison study of two diverse suburban middle schools (Grades 6-8) developed from multiple sources of data representing the perspectives of teachers, administrators, school counselors and students. These data include the following: structured one-on-one interviews with the science department chairs, counselors, and
students; researcher notes of informal discussions with school administrators and other science teachers; items from a larger survey focusing on seventh-grade students’ science interests and attitudes as well as other school experiences; and the researchers own experiences within the school environment.

While an assistant superintendent within the district characterized these schools as being quite similar with respect to student demographics, they are actually quite different. The demographics of each school are outlined in Table 1.

<table>
<thead>
<tr>
<th>Enrollment by Ethnicity</th>
<th>School A</th>
<th>School B</th>
</tr>
</thead>
<tbody>
<tr>
<td>African American</td>
<td>23.2</td>
<td>23.6</td>
</tr>
<tr>
<td>Asian</td>
<td>7.1</td>
<td>5.7</td>
</tr>
<tr>
<td>Hispanic or Latino</td>
<td>36.7</td>
<td>52.6</td>
</tr>
<tr>
<td>White (not Hispanic)</td>
<td>32.3</td>
<td>17.1</td>
</tr>
<tr>
<td>Other</td>
<td>0.7</td>
<td>1.0</td>
</tr>
<tr>
<td>Total Enrollment</td>
<td>1481</td>
<td>1477</td>
</tr>
<tr>
<td><strong>Free and Reduced Lunch</strong></td>
<td>39.3</td>
<td>72.3</td>
</tr>
<tr>
<td><strong>English Language Learners</strong></td>
<td>13.0</td>
<td>29.7</td>
</tr>
</tbody>
</table>

Table 1. School Demographics

The student sample for the analysis of this paper included the 7th grade cohort. The number of survey respondents in School A was 134 boys and 184 girls while school B included 98 boys and 89 girls, resulting in a 60% and 39% participation rate, respectively. In addition, 40 students from School A and 25 students from School B were included in the interview sample. Both schools are vastly overcrowded and thus, the
schools operate on a year-round schedule with four tracks of students. During each month three tracks are in session and the remaining track is on vacation, or “off-track.” Teachers and administrators often characterize this system as a smaller school within a school and perceive challenges with respect to promoting a cohesive school climate. School A has students in the gifted and talented education (GATE) program within each track; School B, however, has a much smaller number of GATE students and these students are accommodated within two tracks. According to school counselors about 30% of students at School A are at risk for retention, while more than two-thirds of the students at School B receive notices for being on the cusp of retention.

**FINDINGS**

The results of this study are reported in three major sections: the first a narrative of the researcher’s perceptions of the school environment; the second focusing on the attitudes and perceptions of the school personnel; and the third reporting the perspective of the students.

**Perceptions of the Researcher**

Most researchers would agree that the key to working effectively with schools is that all parties involved must have a shared goal. In other words, the participants in our study needed to see the value in the work we planned to undertake in their schools. While we (our research group) received strong support at the district level for participation in our study, in our experiences with numerous other districts, district support does not always translate to school level support. As a means for introducing our study and rallying the needed “buy-in,” at the beginning of the school year I arranged a meeting with our district liaison (the assistant superintendent of research and testing) and
the principals of our participating schools (two middle schools and two high schools). Fortunately, the middle school administrators (the principal of School A was unable to attend the meeting and thus sent an assistant principal in his place) expressed interest in the study objectives and indicated they would do what was necessary to comply with the needs of the project.

*School A*

During my first interaction with School A, I was informed by the assistant principal that Mr. Norman, the school’s principal would be taking over as the lead contact person. As such, I set up a meeting with Mr. Norman to explain more about our study, what his school’s involvement would entail and also to arrange a time to meet with the school’s science faculty. During this initial encounter I learned many things about his leadership style, the school environment and his goals for the school.

Mr. Norman has had more than 20 years of experience as a school administrator and has been the principal of School A since the 2001-2002 school year. As a former middle school science teacher for twelve years, he was very proud that his school was selected to participate in our study. As a person with a science background he understood the need to encourage girls and minorities to participate in science and he believed his school was a good model in this regard. As a stranger in a strange land (most of my research experiences has been in elementary schools), I perceived Mr. Norman to be a strong ally in my work with School A.

During our initial meeting Mr. Norman also shared with me that he believed his school was the best middle school in the district not only with respect to its students, but

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1 All names have been changed to protect participant anonymity.
with a committed group of teachers and support staff. He raved about how students of
School A routinely competed on district, county, state and national levels in science and
history fair competitions. Not only that, but recently the science department chair
spearheaded students’ participation in SimCity competitions, which gave students
opportunities to work with local engineers who supervised their designs of virtual cities.
Mr. Norman also discussed a large technology grant his school had recently received and
wanted to explore the possibility of students becoming more involved with the data
analysis of our study as a mechanism for creating more authentic learning opportunities.
We ended out meeting discussing his concerns about student academic performance as
measured by state testing. And despite being viewed as a successful school within the
district, they were continually pressured to increase test scores and focus the curriculum
largely on math and language arts. Interestingly, he noted his school efforts to ensure
that all students increase their skills, not simply those classified as underperforming as he
shared that it had become common practice for schools to focus only on lower
performing students to help increase test scores, often at the expense of students whose
performance had previously been on par. It was clear from my first interaction with Mr.
Norman that School A had very high expectations of all of its students.

Rather than meeting with the school science teachers, Mr. Norman believed that it
was important for the entire school to learn more about their involvement in our study
and as such, arranged for us to address the school faculty during one of their regular
faculty meetings. We ended our meeting with a tour of parts of the school and at every
opportunity Mr. Norman introduced me to fellow school personnel.
My first interaction with individual science teachers came when we were recruiting students for participation in our longitudinal study. Mr. Norman believed that we would have more success receiving permission forms from students if we met directly with students, rather than leaving the responsibility of introducing the study to the science teachers. Although our teachers initially viewed our presence with mixed interest, over the course of several visitations to their school and increased opportunities for interaction, I began to have a clearer understanding of Mr. Norman’s characterization of his school. Informal conversations with teachers revealed their belief that excelling in science was one of the factors that helped their school stand above the rest and that students of School A were not only high achievers, but they were competitors and they held them to a standard of excellence. When I shared with teachers (even non-science teachers) our presence in a rival school, they often responded, “we’re the best [middle] school in the district” and would cite examples of their students “sweeping” the awards at district competitions. Despite the overflow of praise, I did encounter science teachers willing to express their concerns over students’ lack of abilities with respect to reading and math. Finally, they believed that their students had much to contribute with to our study, particularly with respect to girls’ interest in science as the majority of their science fair winners were, in fact, girls.

School B

School B had also named a new contact person for our study. Mr. Yearly, one of two assistant principals, was also a former science teacher and expressed his utmost support and curiosity for our study. As I shared with him our presence in School A, he began to identify the increased challenges facing his school because of the differences in
the student population. He explained that although the school had met its performance goals for the past two years, they were still classified as an underperforming school and as such his science teachers were faced with working to incorporate more language arts and math into their science curriculum. Furthermore, the students at School B came from more underprivileged backgrounds and they were challenged by extensive disciplinary problems. He also noted that although, the two schools were quite different he believed the students of School B would have much to contribute to our understanding of girls and minorities interests in science.

My initial contact with the science faculty was through a formal meeting to discuss the purpose of our longitudinal project. This meeting was attended by all the science teachers (including those not immediately involved in the study, such as the sixth grade teachers), with the exception of one teacher who was required to attend a parent conference. I was very impressed with the professionalism of the group as they were eager to ask questions and comment on the nature of the study. The teachers shared their challenges in promoting science interest at their school and many expressed a desire to be interviewed to discuss their teaching experiences. Upon learning of School A’s involvement the department chair commented, “their students are very different from our students.” And a second teacher followed with, “they think they’re better than everyone else.” Future opportunities for interaction with the teachers revealed teachers’ struggles in creating an optimal learning environment in science because of all of the demands for incorporating math and language arts into the science curriculum. And they faced further pressures because the local high school argued that upon entering high school their students were not meeting the minimum standards for science achievement. It was rare
for teachers to comment on the positive aspects of science in their school, instead focusing on a deficit view. But despite the challenges this school faced, teachers and administrators maintained a positive stance relative to our presence in their school. And a proud moment came when I informed them that we had completed our student interview data collection without a single student absence, to which they replied, “Make sure you tell School A that!”

Perceptions of School Personnel

Perspectives of School Science Priorities

School counselors were interviewed to gain an understanding of the kind of access students had to learn about science and science-related careers outside of the science classroom as well as learn more about the emphasis on science within the school curriculum. In both schools counselors agreed that more could be done to promote student awareness about science related careers, but the budget did not allow for such luxuries to occur through the counseling services, although they had in the past. Counselors meet each year with students to discuss the importance of high achievement across all subjects but the passing of math and language arts is what is emphasized because of state mandates for minimum promotion requirements. Each counselor also believed that this sent a clear message that science was not a priority even though the high school exit exam tests students on the content learned in middle school science.

Challenges of School Science

During formal one-on-one interviews, the science department chairs were prompted with the following question: What are the biggest challenges your department faces with respect to meeting its curricular or extracurricular goals? Mr. Jones, the
department chair from School A discussed the continual changes in curricular expectations as being a major challenge for his school:

The standards are too broad. And there are too many. The state of California has gone from a scope and sequence to so many different philosophies so as soon as we hone in on one, the state test changes. And we used to teach a certain curriculum that now has changed because we have state standards. And so we have to adjust according to the tests and then the state adjusts to the tests and tells us. We had frameworks, those were thrown out and now we have standards. So that’s our biggest challenge. To have a system that is consistent that we can teach to.

However, Ms. Smith from School B expressed a variety of challenges that speak to the limitations of her school’s science environment:

I think the biggest one is what I already said, is that the lab’s just not available. It’s difficult to teach really good science without a lab. It really is. Even though some teachers will tell me, “No, it’s not. You just get the bucket and you got a sink and…” Yes, but if you want it really good, you need a lab. You have to have a lab. So I think that’s the biggest one. Maybe one of the other ones is, we have some people at our site teaching outside of their field and they’re in science and they maybe shouldn’t be here…

And lastly, she reveals her perception of the priority her school places on science relative to other subjects:

I’m not saying that my administrator doesn’t realize that science is here, social studies is here, but it’s, “Math, language arts, math, language arts.” The funds, all the funds, you know, they go to math and language arts.

*Science Access and Opportunities*

Students at School A are required to complete either a science fair or SimCity project as part of their science class. In fact, it was through conversations with the principal and other science teachers that I learned the price for not completing the science
fair project was steep, worth a total of 40% of the students’ grade. They went on to explain that in recent years parents had been complaining that it was simply too much for students to have to complete both a history fair project (which was also required) and a science fair project during roughly the same time span. Parents (and some science teachers) were pushing for the projects to be rotated every year. However, the principal of School A, Mr. Norman held firm in his decision to require students to complete both projects and initiated the 40% standard. The option to enter the project in the science fair competition, however, is the choice of the individual students. Students at School A also have the opportunity in the 6th grade to attend a three-day earth science camp. Roughly two-thirds of the students participate.

School B received similar pressures from parents to eliminate the science fair project requirement. In fact many teachers shared this sentiment because the local high school did not require such activities and during the beginning of the school year (Year 1 of our project) voted to leave the decision to engage in science fair projects up to the individual teacher. This resulted in roughly one third of the students completing science fair projects. The annual earth science trip also fizzled out during the school year due to lack of parent interest to support their child’s participation and challenges presented by the administration to raise funds to offset the cost of the trip.

Although responses to the question regarding opportunities students had to participate in science related activities outside of the classroom were quite revealing, it was not until I asked the question, What is the pride of the science department? that issues related to access and opportunities and their impact on the science climate became apparent. Ms. Smith expressed her frustration and concern:
No, no, no. I’m trying to wrack my brain. No. The only thing we do outside of classroom instruction is the science fair projects and there are a few teachers that side against that.

She further discussed the general perception of the school around the science fair:

It’s poor. It’s poor…it hasn’t always been poor but we’ve had the big science fair display before we go on to district [competition]. We have the big one. The parents come in.

The winners would be recognized…this year we didn’t even have one.

In contrast, Mr. Jones addressed these questions with a great sense of pride and spoke of the general climate in the school:

Oh, we always, we do well in Science Fair, now we do well in SimCity. So we do well in competition. Not just science, but History Day, Spelling, you name it. We have kids that always go to State…they [students] are recognized. Trophies, certificates, ribbons of participation, newspaper clippings. Trophies displayed in the front office, announcements made during the school announcements. It’s put in the principal’s letter that goes home once a month to the parents….I have one of my students who was a gold medal winner in our science fair. That’s going to be announced tomorrow. And she’s gonna walk on water. All of her friends are gonna want to get to know her. Kids, they recognize each other, they don’t put each other down if they’re not apathetic. Our teams, our sports, all of our academics, we have been known. You know we’re a distinguished school. So there’s a lot a pride. They take a lot of pride in our school. Being a winner. People, they do not like going up against [School A]. We have experts in our field, once you have winning teams and you know what people are looking for, plus we have teachers here, I’ve taught at this school since it opened, Mr. B’s been here since I think the second year that it opened. Ms. G, over History Day, we’ve gone to state and we’ve gone to Nationals.
He believes that the historical success of the school puts pressure on students to continue in the winning tradition but adds that their students are competitive and this competitive drive helps fuel their achievement:

> Our kids are competitive. If they got a second place, they come back. Last year some of the kids that I judged that were 6th grade, they came to me and said, “I’m gonna win next year.” I had one student whose parent came in here and I took them to regional competition and we went to the museum of science and industry. The parent said after her son saw SimCity last year, a light came on, that’s all he has been talking about all year long…I’m telling you, his parents, that’s all he talked about was SimCity competition and Future City competition and going [to compete]. And that is what motivated him to do better in school and in science.

Comments by fellow teachers and administrators only bolstered Mr. Jones’ claim as they shared stories of determined students who had started science fair projects as early as their summer break.

**Attitudes and Perceptions of Students**

*Student Survey Responses*

Fifteen survey items focusing on students’ interests in science and perceptions about the school science climate were used for these analyses. Mann-Whitney U tests were applied to these items and the results are summarized in Table 2. Interestingly, there were no differences in students’ science interest and their perception that science could be a future career choice. The attitudes and perceptions of school science and the science climate, however, revealed that student from School A held more positive views about their science class, their science teacher and their peers perceptions of science. Given the significant differences in results related to school climate, it was surprising that
there were no differences between students’ perceptions as to whether or not their teacher believed they could be a scientist.

Z Value

### Perceptions of Science in Relation to Self
- Science is interesting: 0.51
- I could be a scientist one day: 0.90
- My teacher thinks I could be a scientist one day: 0.74
- Science career interest scale: 6.62**

### Attitudes and Perceptions of School Science
- I enjoy learning science this year: 2.08*
- It is important to me to get good grades in science: 2.85**
- My teacher cares if I learn science: 4.26**
- My teacher has high expectations for me: 4.40**
- My teacher cares if I think science is interesting: 4.26**
- It is important to me that my science teacher likes me: 3.31**
- My close friends like science: 3.52**
- My close friends think science is cool: 4.52**
- Other students at my school like science: 3.28**
- Other students at my school think science is cool: 4.48**

### Science Participation
- Participation in a science fair: 5.75**

* * p < .05  
 ** * p < .01

Table 2. Comparative Survey Data of Science Attitudes and Perceptions

Thematic Analysis of Student Interviews

This section highlights the results of student interviews focusing on the topic of science support and encouragement at the school level. Students were prompted with the following questions: Do you think this school encourages students to be involved in science? If so, how? And, Do you think this school supports students who are interested in science? If so, how? Student responses with respect to how their school might
encourage or support science interest/involvement resulted in two major thematic elements.

Theme 1: Reflection on school science priorities and support

Generally speaking, students from both School A and B expressed similar views on the role their schools play in promoting and encouraging science interest. They equally cited support from teachers, interesting classroom activities, and even their school’s participation in the Caltech study as evidence of support. For example,

I think they really put attention to kids because they have teachers here for science and math that make both of them interesting and they make kids really want to learn. I haven’t been in a single science class that was boring…The teachers here are really nice to students, my teacher supposed to be working and instead he helps us out with our science research papers and stuff on his free period.

However, students from both schools perceived the school’s commitment to science as being less than the commitment to other subjects. A student from School B explains,

They’re kind of supportive, but they really push about math and language arts…The push about those because those are the one that we really need to learn to move on to the next grade…My teacher told me that. She told me that math and language arts are the two most important thing you need to pass to move on.

Students from School B also complain about substandard books while a student from School A gives rave reviews about the new books they received for science.

Finally, students from both schools suggest that a lack of science supplies as being indicative of a lack of support. Students from School B, however, were more likely to have stronger criticisms of their school relative to this issue as exemplified by a girl:
How supportive do I think they are? I would prolly say that they’re prolly not as supportive as they say they are because of they were so supportive then why aren’t we getting new books and stuff…So I mean if like they really cared then why aren’t we getting books that we need right now…They claim that they really care, but I mean if they cared so much then…I mean they might care but they don’t show efforts towards it.

Several students in both schools remained unsure about the support and/or encouragement their school had to offer and their general perception was that most students at school were not interested in science.

Theme 2: Access to science participation

Not surprisingly, students from School A were more likely to reflect positively about the school science fair and the access to science in school. Some described the science fair as “a big deal” and a time when there is buzz of excitement around the school. One student believed that the school’s success was something to be proud of:

I think it puts a good name for this school for people to do well because we have so many that make it and other schools don’t.

A second student comments on the perceptions students have of science fair winners:

They think their project was tight. If your project is nice, if it’s cool and you make a nice presentation, people are going to be looking at you like, oh, that was cool. They will literally mean that.

A third student, however, suggested that the importance students placed on the school science fair was determined by the “track” students belonged to, that students from one particular track were more competitive than others and as a result received more notoriety.
In contrast, two students from School B cited the lack of a science fair at their school as contributing to the schools limited encouragement even though the school science fair had taken place two months prior. A third student was keenly aware about the lack of science access:

They used to have science activities before I went here but they had to stop that stuff. I don’t know why, but they just stopped it.

However, he believed that access to participating in the Caltech study did encourage students to like science.

**DISCUSSION**

While some may perceive the comparison of these dissimilar schools as being largely unfair, this may be a prime example of how science can be a strong force in the school if the school is committed to maintaining a standard of excellence across the curriculum. Academically speaking, as measured by state test scores, School A is the highest performing school in the district. And of the seven middle schools in the district, School B is in the middle of the pack. By comparison to similar schools across the state, both schools rank above the median performance levels. School B confessed that formerly they were tough competition to School A, but the concern for performing well on state tests, combined with the changing school demographics, they felt forced focus on the content areas to which they were held accountable.

At the outset of this study, I honestly did not expect to find such marked differences between these two middle schools. While there are certainly schools within districts that vary quite considerably, I did not perceive this to be the case when I recruited these two schools for participation in our study. The design of our study required that we have one middle school that fed into each of our participating high
schools and when I initially contacted the district’s assistant superintendent, I relied on
his assessment that both schools had a strong science presence and we would profit
greatly from their participation. The latter is most certainly true. Leading back to my
original question, what are the qualities of School A that lead to such a positive science
climate? Three variables stood out in my mind to explain these differences: the
development of a climate of excellence rooted in strong leadership, the influence of the
classroom teacher and access to science opportunities. While each of these variables is
related to the others, they are distinct with respect to individual contribution.

A Climate of Excellence Guided by Strong Leadership

During my first visit to School A it was clear to me that they held to the values
Johnston (1995) defines as being necessary for building a successful school climate.
During a time when other schools are limiting students’ and focusing on math and
language arts, School A has been expanding the opportunities they provide their students.
The principal of School A refused to give into pressures from parents to ease
requirements around history day and the science fair. He believed all students should
have these experiences, not simply those who were highly able. He also welcomed an
engineering component in lieu of a science fair project by supporting the schools desire to
compete in the SimCity competitions. This brought in local engineers to guide student
work and ignited a new interest on behalf of the students. And in their first two years of
competing students were already a recognized force, taking home first and second place
awards in state competitions. The school sought and earned a large technology grant
because they envisioned it as an opportunity to create more authentic and meaningful
learning opportunities for its students. And finally, the principal of this school seemed to
view our work together as an opportunity, rather than one more requirement set forth by the district. He has been eager to learn the results of our study and even arranged for me to speak with the science teachers about our initial findings. He has also requested that I formally present the results to the entire student body so that they will be more informed about the science attitudes and experiences of their peers, relative to other schools within our study. He also routinely taps into my own expertise and resources, evidence that he uses his school’s participation in our study to their benefit.

As found with work by Lin and Crawley (1987) students at School A seemed to thrive on the competitive nature of the school. Conversations with students led me to believe they wanted to help maintain the prestigious status of the school, not just within the district, but on county and state levels as well. And those students who had general positive views about school were proud of the accomplishments of their peers rather than threatened by the additional recognition successful students might receive.

*The Influence of Teacher*

While student interest in science and their perceptions about their ability to pursue a science-related career are similar for both schools, the teachers at School A seemed to have a more positive influence on their students attitudes and perceptions of school science. Haladyna, Olsen and Shaughnessy (1982) have suggested that teachers are in the best position to help guide students’ interest toward science. Students from School A believed that their teachers cared more about them learning science, put in more efforts to make science interesting, had higher expectations of them and were more concerned about whether or not their science teacher liked them. These results may be the outcomes of several factors, not only a climate of success. For example, teachers at School A may
expertise in science teaching as School B reported a number of science teachers teaching out of their subject area. In fact, School B has four vacancies in the science department this year because they could not find qualified candidates to teach science.

Access

Students in School A simply have more access to science opportunities. While this lack of opportunity does not seem to impede students’ overall interest in science at School B, it may limit opportunities for students who have some interest and need an extra push. A quote from student at School A hits this point quite clearly when his teacher suggested he submit his project in the science fair competition:

My teacher did think my science project this year was good, so I thought I would, it was the first time I’ve ever really got a compliment on it or something like that.

While the power of this message is not certain, if it not for the requirement to complete a science fair project, this student may not have experienced such a positive experience relative to science.

Limitations

When conducting qualitative work, a researcher often become part of the culture she studies. And the extent to which she becomes immersed in that setting may greatly impact how she comes to know the culture and how the individuals within that culture come to know her. The relationships she develops with each individual can greatly impact the level of trust and in turn, what they are willing to share about their school, their classroom, their students and themselves. Of course, more “face time” allows for increased opportunity to build the trust and earn the respect needed to work effectively in schools. Admittedly, for a variety of reasons, I had more opportunities to interact with
students, teachers, administrators and support personnel at School A and I believe this may have privileged me in terms of learning more about life at School A.

Administrators at both schools had an “open door” policy with me and it was clear they were willing to do what was necessary for our project. In fact, Mr. Yearly from School B had even offered to drive to Caltech (more than 120 miles roundtrip) to drop off the additional permission forms that were straggling into his office! However, working closely with the principal of the school can be quite different from working with the assistant principal. Mr. Norman was more apt to have me working directly with teachers once we had taken care of issues like scheduling logistics and I was often forced to track down teachers between class periods to collect more permission forms or confirm scheduling logistics. Mr. Yearly, however, always served as the middleman, often going to teachers himself to collect required forms. While the second scenario is much more efficient with respect to my efforts, the former certainly gave me a stronger presence in the school. And my personal perception was that Mr. Norman took pride in the fact our Caltech presence was highly visible in the school. It became clear that I was not only known by the science teachers, but by the entire office staff, the majority of the counseling staff, the custodial staff and by a small percentage of non-science teachers simply by “hanging out” in the teacher’s lounge between class periods as I waited for opportunities to track down teachers involved in our study.

Additionally, because I worked so closely with the assistant principal at School B, I did not get a strong sense of the leadership at this school. All of my interactions with Ms. Fineman were professional and friendly. Each time I encountered her she would inquire about the progress of our study and whether or not the school was providing what
we needed to contribute to the success of the project. When Ms. Fineman handed over project responsibilities to Mr. Yearly my perception was that it was done because of his high interest in the project, his science background and his previous experience as the district science fair coordinator (which I did not learn directly from him, but from teachers at other schools) and not simply a means for shirking responsibility. As such, my limited knowledge of her priorities for the school was almost exclusively the result of conversations with teachers. And even teachers expressed these as being somewhat limited because she was newly appointed to the school.

**Future Directions**

There remains much to learn about these two schools. Not only is there more information to uncover specifically about girls and minorities or the impact of teacher quality, but school climates are ever-evolving and there will be much to add about the cultures of these schools. While both schools fell short of their academic performance targets, School A remains abuzz with the prospect of maintaining its elite status in the district. While the school walls are inundated with positive messages about the upcoming state tests, this issue rarely enters my conversations with science teachers, and in most cases it is when I introduce the topic. Teachers at School B, however, have a difficult time not talking about the state tests, which focus on math and language arts. They feel that science is being greatly marginalized and fear the district may cut science opportunities for 6th and 7th graders who fall short of academic expectations. Currently these students are forced to take enrichment courses in lieu of their elective class. At a time when we know California elementary schools are shortchanging students with
respect to science opportunities, it is alarming that this is now filtering to the middle
school population.

What is refreshing about School A is their lack of willingness to become
overwhelmed by the extensive demands of the state with respect to test scores and
continue to focus their priorities on creating high standards across the curriculum. And
not by simply including subjects like science, but having high expectations for success
with its girls, boys, ethnic minorities and students from underprivileged backgrounds—all
of whom have a strong presence in the fabric of this school.
REFERENCES


