

**“Helping Hands” Science, Math, Technology, and Service Learning  
Innovations in Teacher and Principal Training (pre K-12)**

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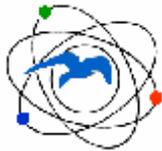
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*Innovative teacher and student education to create the next generation of STEM ready students*

**Math Science Nucleus**



**Fremont Unified School District**



**City of Fremont**



**“Helping Hands” Science, Math, Technology, and Service Learning  
Innovations in Teacher and Principal Training (pre K-12)**

**INTRODUCTION**

This proposal addresses **Absolute Priority 1**, which identifies proven coaching and modeling techniques to support teachers and principals in science and math in California and North Carolina. It prepares the materials for nation-wide dissemination. The competitive preference **Priority 5** includes Early Learning Outcomes by improving pre-school teachers’ ability to teach science through literacy and play. **Priority 6** will impact secondary students by allowing them to see how service learning can increase their science and life career skills. Special emphasis will target Juvenile offenders in court schools. **Priority 7** will address students with autism to customize materials so they can participate in science and math. Limited English Proficient Students will also learn about content in their native language as well as learn English with each new science experience. **Priority 8** will work with rural schools in different setting to test different implementation models. In Madera County (farmland, low income central California) we will target schools working with a new local fossil museum and classroom coaching. In North Carolina we will work with Iredell County schools by coaching at schools. All of these programs will expand to other schools in California and North Carolina. An implementation model will emerge that would be able to service all schools to increase their student achievement in science (especially all elementary) and math (especially pre Algebra).

### A. Need for the Project and Quality of the Project Design

Highly qualified teachers and administrators are key to student success. In order to pique the interest of students in STEM fields, teachers must be able to actively engage students in content rich lessons using hands-on materials while allowing them to think critically and apply their knowledge. FUSD is very successful in outstanding professional development with great results (Appendix H-1). FUSD's Beginning Teachers Support and Assessment program, literacy and math training, as well as their ongoing training to equip teachers to teach English Learners are just a few of Fremont's ongoing professional development efforts that have paid big dividends. Fremont is a high performing school district with around 32,000 students of very diverse ethnic and socio-economic backgrounds.

FUSD's ongoing training for principals is a model in Alameda County. Administrators are provided ongoing, robust professional development. Our monthly Principals' meetings are used only for staff development. Every single administrator in FUSD has gone through two years of training in conducting "walk throughs". They are expected to be in classrooms to observe, mentor and coach teachers on a daily basis. With each new adoption, our administrators are expected to be fully trained in the new materials just as their teachers are required. In addition, with any new program or curriculum, administrators learn what to look for in lessons and how to support their teachers in the implementation phase. The last three years, Fremont administrators have focused their work in their Professional Learning Communities (PLC) in depth on five equitable practices; rigor, access, checking for understanding, differentiation of

instruction, and engagement. Professional development in science now needs to be added to the recent improved practices for math and literacy.

### **The Pre K- 6 Need in Science**

There is a strong need to prepare our students for STEM careers to keep our country strong (Rising above the Gathering Storm, 2007). Unfortunately, testing required by the legislation of No Child Left Behind has mostly focused on improving math and English skills in the United States. The interesting and inspiring content of science has been neglected. Fremont Unified School District in the last twenty years has provided science specialists in the K-6 schools. This district recently eliminated these specialists because of budgetary matters. Many teachers in this district have not taught hands-on science and have only focused on theory.

The need to add science units for our Early Learners can also help us bridge the gap between low income students and affluent students so they are prepared as they enter our K-6 schools. Many pre-K teachers in the Fremont State Pre School are like many other instructors at the pre-K level, deficient in concrete science examples that are directed to the science standards for K-3.

### **The 7-12 Need**

Science teachers at the 7-12 level are single subject credential and at least have the content level to teach science. However, in the Community Court Schools for incarcerated youth and many continuation schools, this is not the case. Many of them are multi subject credentialed without a science background. These students have the chance to become productive citizens, but they get little fun, hands-on approaches, that teaches them critical thinking. This small percentage of students should not be

disregarded and can actually benefit from more hands-on science especially tied into subjects that help them with careers. In addition, any student who returns to our high schools after incarceration is even farther behind and finds it extremely difficult if not impossible to catch up.

Service Learning has shown that it increases academics and community responsibility. Service learning in groups for 7-9<sup>th</sup> graders helps to move students from group learning to individual learners in the later years in high schools. Especially for low income students this is a difficult conversion to becoming an individual. There is a need for modeling and coaching for teachers and providing direction for principals to provide constructive criticism. Small learning communities within schools have shown to be very successful in this process.

There must be a strong connection the school system, the service organization, and students so the expectations are realistic. Many times the need of the community is not met because the students do not know how to help. Training of teachers and the ability of principals to help develop local community relationships is needed. The integrating of science including environmental and disaster training can not only help teachers be more effective, but will create a population of young adults with critical thinking skills and an appreciation for the environment.

### **Dissemination**

FUSD model includes partners that can help with projects both new and evolving. FUSD has always had a changing demography as it changed from rural to urban within 50 years. **Although** the program that works for another school district may look different, the methodology of finding that solution is the same.

Dissemination models will be tested the first 2 years especially in low income rural areas (Madera County, California, North Carolina), Juvenile Court and Continuation Schools in Alameda County. We will look at which materials excite the teachers and motivate them to do more with their students. We are proposing that innovation has to be internalized through teachers and principals who see the results first. These “disciples” then bring their school or district to try a pilot, and when a school is interested we will make a contract with administrators to allow MSN Trainers to model lessons with materials that would remain at the site. These schools would agree to compare science and math scores with previous years.

### **PROJECT DESIGN**

The **project design** is in two phases: the first 2 years help complete the “packaging” of successful practices in FUSD while testing some of the dissemination models on select content; and the last 3 years tests the dissemination and training models of teachers in other schools found to be most effective.

The first phase we will expand, integrate, and institutionalize modeling and coaching with FUSD teachers in the two current programs in math and science (Helping Hands Science and Dana Raimondi Math Program) (K-8) which has shown positive student achievement. We would customize the lessons to help the Community Court School teachers use science to help students in Alameda County. We will continue to use the facilities already located in the Fremont Learning Corridor for field trip modeling. These facilities include Tule Ponds at Tyson Lagoon Wetland Center (MSN and Alameda County Flood Control and Water Conservation District), Stivers Lagoon Environmental

Center (COF), Children's Natural History Museum (MSN), Hopkins Planetarium (FUSD), Sabercat Historic Park (COF), and Native American Museum (FUSD).

Packaging the materials for professional development in the scale up portion of this proposal will be refined in the first phase (i.e. translation of storybooks to languages common in low income areas). The modules used with service learning in 7-12 will bring in partners like the American Red Cross to coordinate training of FUSD trainers. We will use the newly opened Fossil Discovery Center (<http://www.maderamammoths.org/>) managed by San Joaquin Paleontological Society using Madera County schools (rural area in mid California) and Mooresville, North Carolina (rural) to test some of our packaging and internet delivery methods. We will also look at emerging technologies from high tech companies and try to influence the design of teacher friendly hardware. Packaging is one of our strategies for long term sustainability.

We will use the Fremont Chamber of Commerce to coordinate professionals and community members who want to act as "coaches" to help assist teachers. This will be a model for duplication. They will be trained on the modules and staff will coordinate their working with the schools. This would be modeled after MSN's very successful Partners in Science Program ([http://msnucleus.org/membership/guide/making\\_partners.html](http://msnucleus.org/membership/guide/making_partners.html)).

The second phase will see COF and MSN complete an 8200 sq ft building that would house a model classroom with materials to train teachers. This would give us a total of 20,000 square feet for total training at this one site. Displays will be built into the classroom that would celebrate earthquakes and fossils, that would attract not only school classes during the week, but the general public during the weekend. Many of the exhibits will be from the Ice Age fossil materials at the present Children's Natural History

Museum (<http://msnucleus.org/gordon/index.htm>). Internet technology embedded in flat panel displays will allow broadcasting and creation of online courses.

Funds will be provided for schools that participate in the second phase. California Department of Education Science and Math unit will help us determine which low income schools and how to design a way to collect data. A regional teacher training center would be ready in the 3<sup>rd</sup> year as part of the expansion of the Fremont Learning Corridor. The building will be used as a teacher and principal training center for science and mathematics used by Fremont Unified School District as well as MSN. This would allow access to all the school districts in the San Francisco Bay and Delta Region and the ability to offer innovative long distance training. The packaging will include hands-on materials for professional training (principal and teacher), which are used with students; electronic support materials that allow teachers to learn the content with their students; and new technologies that can transfer classrooms to be successful users of internet technology.

### **Getting Materials ready for Scale Up (first 2 years)**

Adoptions of many science textbooks throughout this country have done little to increase performance of students, especially in the low-income schools. It is well known that STEM subjects are best learned through inquiry and the use hands-on materials. Long-term retention and the ability to solve problems can be motivated by well designed materials; however, this must be coupled with robust professional development for teachers and principals are critical in assuring the delivery of the materials. Both are essential to improving STEM subjects in schools.

Materials used in this grant request for K-6 were developed by the Math Science Nucleus over the last 30 years. Pre-K materials were developed for a program at SciWorks in Raleigh, North Carolina (Science Trunks). Although it has the data (especially low income schools) and was acknowledged by the Department of Education as a program that works for K-6 in 1991, MSN never marketed the materials nor wanted to sell its copyright. The written lesson plans, animated storybooks and slideshows are available free of charge on (<http://msnucleus.org/membership/index.html>) for teachers and students to use. Hands-on materials are available for sale to sustain the program. All of the modules that can be used are on MSN's online catalog (<http://msnucleus.org> and click on Catalog). What is needed, is professional development for teachers to help them not only learn content but be able to deliver instruction in science to pre kindergarten students.

Materials used for service learning science modules in the secondary have been developed over the last 13 years, but need to be packaged for wider use than Fremont. MSN saw a need for service learning opportunities with the City of Fremont (COF). They slowly developed a way to not only train youth in FUSD, but to use students to help maintain and expand wildlife corridors. Unique in this concept is using service learning and community service (for 7<sup>th</sup> -12<sup>th</sup> graders) to restore, learn, and maintain areas. High school interns are also used to monitor scientific problems such as pollution, restoration benchmarks, and earth movement. This helps to authenticate learning in the classroom, to teach civic responsibility, and strengthen our local community while providing possible career choices. The younger students (K-6<sup>th</sup> grades) benefit through field trips

that enhance their learning in the classroom. All of these programs evolved from the I.Science MaTe Reference Curriculum.

In the outline below we would take modules (one lesson plan) and units (multiple modules that can be used in play and lessons) designed by the Math Science Nucleus. The materials help the teacher learn different principles of hands-on activity management and content. They would use an electronic slideshow to get the children engaged; then a lab that guides the students to make a conclusion; and then a storybook sums up the lessons. In the secondary, animated slideshows would be used. Some modules will be developed for disaster planning. We will also include the community in helping to continuing coaching and modeling from the MSN successful Partners in Science Program model.

### **I. Pre-school**

**Materials:** 6 units (2 per trimester) – each unit will have materials that can be used for multiple learning situations; will increase critical thinking skills. Many of the products are usually not found in low income homes (tentative units: fossils, gears, magnets, bubbles, animal models, minerals/rocks) (formerly part of our Science Trunk Series - MSN)

**Teacher Training:** Teachers from Fremont State Preschool (Full day workshops to introduce the project, **teach content**, and plan for the year; 2 modeling sessions per teacher, continuous support from FUSD and MSN). Manual will be online.

**Community Training:** MSN and Fremont Chamber of Commerce will identify and train helpers (parents, scientists, or community members so that they are able to model in

classrooms). Manual will be online especially to help other Chamber members interested in the program.

## **II. Elementary**

**Materials:** 12 hands-on science and math modules per grade (4 per trimester) during the school year (Helping Hands Science – (<http://msnucleus.org> click on Helping Hands FUSD); 20 modules for afterschool science and math for title 1 schools; 8 modules for summer school for Title 1 schools. These would be hands-on and adapted from I. Science MaTe Reference Curriculum and will include electronic storybooks and slideshows and workbooks. Certain materials will be adapted for special needs students. Special materials for Native American modules on how understanding nature can create materials for shelter, transportation, and food (MSN and FUSD), translations will be continued on electronic storybooks.

**Teacher Training:** District Elementary Science Coaches will receive two full days of training directly with the Math and Science Nucleus. They will be in schools and classrooms 90% of their time and 10% in ongoing professional development with MSN. The Math Coaches will receive two full days of training with the Alameda County Office of Education Math Department and be in schools, supporting classroom teachers by modeling, coaching, and mentoring 90% of their time and 10% in ongoing professional development with ACOE. Manual will be online on how to use the materials. Edited video clips of presentations will also be put online for teachers to use as “coaching” tools.

**Teacher Training in Madera County:** Working with Discovery Fossil Museum of Madera County, Madera County Office of Education, and San Joaquin Valley Paleontology Foundation, we will be test the methodology of coaching and modeling by

training key personnel to continue doing classes at the museum with follow up at schools in rural central California. Modules will be more earth science based for the first 2 years. Internet coaching of trainers at the Museum will determine how much training would be necessary for our scale up grant.

**Teacher Training in North Carolina:** Math Science Nucleus trainers will go into schools and coach at site with between 6-12 modules per grade. Staff will be based in Mooresville for the first 2 years. We will look at ways in which we can impact as many rural, low income schools by providing teachers the tools to complete the lessons. Internet coaching strategies as used for Madera County will also be used.

**Development of Materials with Red Cross** for state wide scale-up in CPR and hazard preparedness training for teachers and principals. More scientific and engineering in nature, that would comply with science state standards. Since the American Red Cross does training throughout the country this will help institutionalize the training in schools (i.e. Plate Tectonics includes a module on hazards)

**Community Training:** MSN will identify and train helpers (parents, scientists, or community members) with guidance from all partners. Recruitment for lower income schools will be emphasized for professional community. Manual will be available online.

### **III. Junior High**

**1. Materials:** 2 hands-on modules each in math, biology, earth science, physics, and chemistry) to teach effective service learning in science and math i.e. hands-on modules in service learning including one on earthquake preparedness (earth science) and how to prepare students to perform service learning at environmental center (biology)

**2. Teacher Training:** 1 day of in-service, modeling for schools with high low income enrollment. MSN and American Red Cross train the FUSD coach.

#### **IV. High School**

##### **1. Court Community Schools and Continuation School**

**Materials:** 10-20 hands-on modules of key principles that student s probably missed (biology, elements, etc) tied into state science framework. Preliminary discussions with teachers revealed that they needed materials and training on general science activities that would especially be helpful in human biology and critical thinking skills.

**2. Training:** Modeling with teachers by MSN staff.

**Service Learning in STEM related fields** - MSN works with FUSD Service Learning Coordinator for specific activities that can help the classroom teacher guide service learning in the community using COF and Alameda County Flood Control and Water Conservation District land for restoration; modify some of American Red Cross training to include more science and ways in which they can help with service learning (emphasis on earthquakes for California schools)

**Student program.** FUSD youth serve as community leaders, teaching disaster preparedness and CPR aid to peers, teachers, administrators, parents and community members. Institute a train-the-trainer program for FUSD high school students and empower them to teach live-saving skills to community members. Students will get paid to help train other students or community members.

**Materials:** 2 modules per biology, chemistry, geology, physics, and integrated science (developed and provided by MSN with assistance from partners) for single subject credential (3-5 modules for service learning)

## **V. Pre Service**

**1. Materials:** California State University, East Bay will incorporate the elementary modules into science methods class for multi subject credential. Service learning modules will also be incorporated in single subject classes. Materials will be provided for university use.

**2. Web training modules** – hosted on MSN site and available for university online courses; include materials that could act as a training tool (i.e. students pay for materials as part of coursework instead of book).

The second phase will use the best modules used for training during the first two years with FUSD teachers and make them available for attracting school districts that are willing to be part of the scale up portion. We would advertise the procedure and as part of this grant provide monies to schools who participate. We would target the low income schools and country court schools through the region (San Francisco Bay and Delta, Madera County in California). The long distance models such as those from Madera County, California and North Carolina will help us disseminate the materials for those school districts that need professional development in lower income schools. The details of scale up are discussed in Section E.

### **B. Strength of Research, Significance of Effect, and Magnitude of Effect**

There is strong evidence that this proposal can provide solutions to many school districts throughout the country, providing teacher and principal training that directly benefits not only the teacher, but student success. The magnitude of its effect is not limited to the funds received from the proposal, but if the project verifies increased student performance in science and math, we will be able to advertise and market with

the products to bring it to a wide audience. This section will look at evidence from FUSD that shows their methodology in training teachers and principals work. Several studies of the materials designed by the Math Science Nucleus will also demonstrate why the Department of Education in 1991 put the curriculum on a list of projects around the country that works. Evidence of the effectiveness of preparedness training by American Red Cross will also be presented. Service learning and its impact on students, especially at risk children will reflect 13 years of joint collaboration with schools in FUSD, Math Science Nucleus, Alameda County, and City of Fremont.

### **Fremont Unified School District**

Obtaining feedback from those who attend training and professional development opportunities and receive support is a very important part of ongoing program in Fremont Unified School District. The primary purpose of evaluating training and support is to identify both needs and strategies for improvement for short and long term planning to enhance student achievement. The school district and Sinclair Research Group developed a “Professional Development Feedback System” to expand and strengthen data collection and use.

Questions on the “Professional Development Feedback Form” were developed that aligned to (1) *The California Standards for the Teaching Profession*, (2) *The National Staff Development Council Standards for Adult Learners*, and (3) *The Guskey Levels of Professional Development Evaluation*. The form itself is kept simple; participants are asked to respond to no more than 10 questions. The form gives opportunities for comprehensive quantifiable data as well as qualitative reflection.

Data is collected from each attendee at each event and sent immediately to Sinclair Research Group. Data is then compiled, analyzed and, within one week of receipt of data, a two page report is provided for each session. This allows the presenters/program to make immediate formative improvements in content and process.

As well as formative feedback, the data over time (yearly and biennially) is analyzed and compared. This summative data highlights any lower rated sessions and works toward improving those areas.

From data provided in Appendix H-1 it can be seen that mean ratings for professional development improved remarkably from the inception of the professional development system in August 2007 to the end of the second year in June, 2009. During the 07-08 academic year nearly half of the professional development events were rated under 8 out of 10. During the 08-09 academic year, just one (3-ST.6) was rated below 8 out of 10. In the 08-09 academic year approximately 2/3 of the overall ratings for professional development offerings were rated at 9 out of 10.

Clearly the evidence demonstrates that training and professional development in the Fremont Unified School District is thoroughly evaluated in a formative and summative way, is effective and is continuously improving.

### **Beginning Teacher Support and Assessment (BTSA)**

The program design of the Fremont BTSA Induction Program provides systematic opportunities for the application and demonstration of the pedagogical knowledge and skills acquired in a beginning teacher's preliminary credential program. Highly-qualified veteran teachers (support providers) work with new teachers to formulate action plans through a State-approved formative assessment procedure called

*Formative Assessment for California Teachers (FACT)*. Research supporting formative assessment for beginning teachers indicates that more teachers remain in teaching through the efforts of early professional development support and assistance. Therefore, the Fremont BTSA Induction Program requires each participating teacher to complete FACT. Together, the veteran and new teacher apply the principles, concepts, and pedagogical practices for teaching all students, including the establishment of well-managed classrooms, the advancement of technology, and the understanding of the complexity of equity and diversity in the cultural context of the class, school, district, and community.

Upon receiving their preliminary credential, all new teachers in California are required to complete a State approved Induction Program in the first five years of their teaching in order to earn their clear credential.

Fremont has a state approved Induction Program that has proven extremely effective with over 95% retention rate. If awarded the I3 grant, all new teachers in the Induction Program will go through full day training with the Math Science Nucleus to become knowledgeable about the services provided through the Science Corridor and service learning.

Clearly the evidence shows that professional development in the Fremont Unified School District BTSA program is improving from year to year, and is well received and appreciated.

### **Training of Teachers tied with Student Achievement in Low Income Schools**

Grimmer Elementary is a Title 1 K-6 school with a population of about 400 students. The school went into Program Improvement in 2003. Part of the improvement

plan was to provide the teachers with professional development which would increase the quality of instruction, resulting in improved student achievement. (Appendix H-2) As a result the school API is now 800 (considered high performing by the state) and has been selected as a Distinguished School in 2010.

The CST (California Standards Test) Growth reports show significant growth in the percentage of students at each grade level scoring at proficient or advanced over the five year report period.

2<sup>nd</sup> grade – 32% - 45% ; 3<sup>rd</sup> grade - 24% - 40%; 4<sup>th</sup> grade – 45% - 55%; 5<sup>th</sup> grade – 30% - 68%; 6<sup>th</sup> grade - 30% - 38%

Between 2006 – 2007 100% of Grimmer teachers participated in the 40+ 80 hour SB 472 Institute Professional Development model. About 75% of the teachers have been part of the LITE Team Professional Development model (described in Section C).

### **Math Professional Development**

Intel Corporation has supported Fremont for ten years through a yearly grant in professional development. Through grants from Intel, we have trained hundreds of teachers and will continue to train them through Developing Mathematical Ideas that help the teacher gain content knowledge and pedagogy. This has helped our students gain a much deeper conceptual knowledge in mathematics. This has been an ongoing effort which has resulted in the district's high performance in mathematics as demonstrated by the CST (California Standards Test).

## Math Science Nucleus

### Material Design – Why it Works

Integrating Science, Math, and Technology (I. Science MaTe) materials were based on research designed by scientists and educators over 8 years. They looked at low to middle income school districts and chronicle the development of scientific thought in children. Young children learn to **discover** and **describe** their scientific encounters. As a child matures he/she learns to **compare** past with new experiences. In upper primary grades students begin to integrate math skills to **quantify** their data. Once children develop these skills they can then **interpret** results and logically create their own experiments. Unlike most programs this research project by scientists wanted to develop a program that made the connections for children, **year after year as a spiral curriculum that added content every year.** The teachers learn science along with their children if they go through the activities that are suggested. As they go through their specific grade they can customize activities to their needs and the equipment provided by the school. There are many teaching strategies that can make teachers feel more confident to teach science.

The I. Science MaTe Reference Curriculum is one of the most innovative, comprehensive, rigorous, and fun science programs that have emerged in the United States. It brings students and teachers into the future so students will understand science and how it is part of their lives. The I. Science MaTe program **was recognized in 1991 as an exemplary program that works by ERIC (Dept. of Education)** based on data from a 10 year analysis of the program (Appendix H-3). I. Science MaTe made supplemental adoption list in California in 1990's. It was also on the adoption list of

North Carolina and several other states. All of the school districts that adopted the program in the late 1980's-90 have showed increases in overall scores.

The initial idea of the Integrating Science, Math, and Technology Program began in 1981. The Minority Participation in the Earth Science (MPES) Program of the U.S. Geological Survey (USGS), Menlo Park, California, began collecting data on reasons why the ethnic backgrounds of geologists were not diverse.

Since the interest was getting students in low income areas exposed to scientific principles, we realized that we needed to develop a program that reached elementary children. We surveyed students on their attitude toward science in general. The research concluded that children's attitudes toward science were molded early in their educational career. Our data was collected during 1,000+ visits to San Francisco Bay Area schools in approximately 20 school districts by conducting presentations to students with the teachers available. The grades ranged from kindergarten to sixth grade and included low and high income student populations.

During the visits, several conclusions could be made. (1) Economic status of the school site seemed to be a critical factor in determining the overall level of science background. (2) Teachers on a whole did not have an adequate background to perform science experiments and discussions. (3) Materials nor professional development were available for teachers, especially in the low income schools. (4) Administrators were unaware of the need for a well balanced science curriculum. (5) Curriculum guides in science issued by the school district were inadequate.

In an effort to help educators find a solution, the Math Science Nuclues (MSN) was founded. They first surveyed the majority of educational science materials available

for elementary grades. The materials usually lacked a good foundation in the earth sciences. In many instances, the information was incorrect or out of date. We found it very disturbing that the topics children liked most were not explored in greater detail. With this data MSN decided to design a school science program to guide teachers in developing a more rigorous hands-on program. The development of the I. Science MaTe Curriculum was also designed for formal educational systems to meet the minimum state standards in science. Hands-on modules and storybooks became a way to attract students.

Hundreds of people throughout the country helped in the development of this project. There have been many stages in this project from developing philosophy, writing lessons, researching science, teaching the students, comparing implementation modes, refining units and determining how to assess children. All of the materials are online including the research and how to customize to a district (<http://msnucleus.org/membership/k-6.html>).

### **Integrating Math with Science – Emerging Research**

As the Algebra initiative began in California, requiring all 8<sup>th</sup> graders to pass Algebra I by 8<sup>th</sup> grade, it brought to the forefront the need for intervention in elementary grades. More than half the students in 8<sup>th</sup> grade are still not passing Algebra in 8<sup>th</sup> grade and delaying it until 9<sup>th</sup> and 10<sup>th</sup> grade has not proven effective. In the past few years, with support from Intel, Fremont has been able to train hundreds of teachers in pedagogy and content in order to ensure students have a deep knowledge of mathematical concepts. This movement resulted in Fremont Unified School District's decision to adopt Everyday Math in K-5. This has been a paradigm shift and the need for ongoing, robust

professional development and coaching is even greater if we are to take full advantage of this great program.

MSN has been developing a series of lessons in math skills to help students in 6<sup>th</sup> grade. Several companies contributed to the development and a community resident (Dana Raimondi) is now funding this yearly program. The units reveal how numbers were invented. It also explains the reason for formulas and the mystery of math through history. Coaches modeled these lessons in 6<sup>th</sup> grade at five Title I schools with great results. We saw up to an 18 point gain in California State Test scores in math during the initial study of 5 low income schools in the 2008-2009 school year and are awaiting the results for 2009-2010 (Appendix H-4).

These modules would be made available to all schools and will be put on the list of modules available for dissemination. We hope to continue testing these materials and developing additional modules in order to scale up.

### **Research on Service Learning (Environmental) at the Secondary School Level**

MSN received several grants in the 1990's to develop service learning programs with Irvington High School. in FUSD. They created the "Change" program where freshmen worked in groups of 4 students and in small family clusters. All students had to propose an environmental change in the community. Although the idea was great, social studies, English, and science departments working together with these same students, it created a huge concern for the service organizations. Most cities are not equipped for so many long term volunteers. MSN developed more science related programs where the students worked on specific problems in the community. MSN decided to seek permits and tools so students could actually do a good job. MSN also worked with at risk

students in the same high school and developed a way in which they could do projects under supervision on school time.

In 2001, MSN was asked by Alameda County to manage an area that was for stormwater retention but they wanted to share it with schools. We developed a program where high school students maintained and developed projects while elementary students learned about the environment through field trips. MSN and Alameda County Flood Control and Water Conservation District worked out a long term plan that is a model for many counties to use public funds to assist educators. See

(<http://msnucleus.org/watersheds/index.html> for more areas of collaboration).

We completed restoration of 3 large areas, completed over 3000 student projects, 130 Eagle Scout projects, and over 100,000 children have been impacted. Our progress was so successful that Alameda County decided to fund these restoration projects.

Qualitative data reveal that students are eager for service learning projects but teachers are unprepared to lead students to the agencies that best help their students. Service learning increases interest and motivation for learning (Kielsmeier, 2010)<sup>1</sup>.

<sup>1</sup>There is a small but tangible gain in achievement in math, science, reading, and history.

The most robust effects of service learning have been found in personal and social development. We are convinced through observation and data gathered that in addition to personal and social development, that high school students have impacted the natural habitat of Fremont through the many ongoing restoration projects in a major way.

### **Research on CPR and Preparedness Training – Secondary Schools**

Fremont Unified School District will be participating with Alameda County Health Care Services Agency (HCSA) to build community capacity in bystander

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<sup>1</sup> Kielsmeier, 2010, Build a Bridge Between Service and Learning, [Phi Delta Kappan](#); Vol. 91:5, p8-15

cardiopulmonary resuscitation (CPR). HCSA will be providing training, support and materials **at no cost to school districts**. The CPR7 project will work at 3 of the junior high schools with all seventh graders. Ultimately, the project will benefit those community members who receive potentially life-saving bystander CPR from individuals trained in this skill through CPR7. In addition, our youth will also gain considerable benefits by participating in community service and developing both meaningful real-life skills and leadership skills (Appendix H-5). We would like to collect independent data from this program and see how this can be integrated into service learning in either Earth Sciences or Biology, as service learning units.

The Red Cross will assist us in using their expertise in CPR and Earthquake Preparedness training and incorporate into service learning modules that we can train teachers to use in their classes. Research from the Red Cross (Appendix H-6) points out that individual preparedness levels among Bay Area residents have increased 16% across the course of the American Red Cross Prepare Bay Area Initiative which began in 2006. The Red Cross is seen as the most trusted source of information regarding emergencies in the community. Approximately one-third of respondents have personally been involved in an emergency, and these respondents have taken more precautions to prepare for future emergencies than those who have never experienced a major disaster. The majority of respondents have taken at least one actionable step toward preparing for emergency while nearly one-third have taken at least two. The number of respondents who have not taken any steps has decreased from 21% in 2008 to 16% currently. Receiving training in the areas of first aid, CPR or disaster preparedness is the biggest step taken to prepare for an emergency.

The most frequently mentioned reasons respondents give for not being more prepared for a terrorist act or natural disaster include never having thought about doing anything, and not wanting to think about it. Almost half of respondents feel the Bay Area is just as prepared for disaster as it was four years ago, yet 31% feel it has improved. Residents feel that preparing individuals and then schools for potential disasters would provide the most benefit to emergency preparedness in the Bay Area.

### C. Experience of the Eligible Applicant

#### **Fremont Unified School District**

##### **Teacher Training and Student Activities for Pre School Students**

Fremont has a very successful State Pre-school Program (free of charge) for around 400 qualified students. In addition, there are several fee based pre-school classes offered through FUSD. An important step in encouraging STEM is to start such initiatives as early as possible in children's education. The format of the pre-school program lends itself very well to providing hands on science lessons. This does require intensive teacher training. We plan on replicating the same robust professional development opportunities that have proven effective with our K-12 and Adult School teachers. Ongoing modeling and coaching is critical in helping pre-school teachers become skilled at teaching science, especially since many pre-school teachers do not possess a teaching credential.

##### **Professional Development Delivery Models**

Fremont has used several effective professional models in the last few years. These models share several things in common: 1) training is ongoing, 2) modeling is imbedded in the training, 3) district coaches or teachers who have been fully trained as

trainers support the teachers with implementation throughout the year. Here are three of these models:

### **LITE (Literacy Intensive Teacher Training)**

- One grade level at one site is chosen to host the training
- Literacy Coach demonstrates language arts lesson in one classroom  
4days – 2 ½ hour/ day
- Other grade level teachers have 4 ( ½ day) release to observe demonstration lessons.
- All grade level teachers meet with coach before and after demonstration to preview and debrief the lesson. (Q & A)
- All observers are given detailed lesson plans and observation checklists to focus their attention on targeted strategies.
- A second literacy coach sits with observers and “whispers” commentary regarding instruction being observed.  
Coach observes teachers the following week and gives feedback on lesson.
- Coach is available for additional support lesson planning, demonstration, team teaching, and reflection.

### **GLAD (Guided Language Acquisition Program Models)**

- GLAD Trainers are hired to train teachers.
- Teachers sign up for 6 day training by signing a contract committing to this ongoing training.
- They attend a two day training with a pair of trainers learning the theory and watch demonstrations done by the trainers outside of class.

- Four to six weeks later, they are required to attend a four day modeling session, where a group of teachers sit in the back of a real classroom and observing one of the trainers teaching the students in the classroom using GLAD strategies while another trainer “whispers” to the teachers on what is happening and answering their questions. This occurs in the morning for four days, and in the afternoon, they are required to work in group to plan lessons using GLAD strategies.
- Principals have been required to participate in a one day session of GLAD for Administrators. Starting next school year, principals are required to attend the full training.
- Other grade level teachers have 4 ( ½ day) release to observe demonstration lessons.
- All grade level teachers meet with coach before and after demonstration to preview and debrief the lesson. (Q & A)
- All observers are given detailed lesson plans and observation checklists to focus their attention on targeted strategies.
- A second literacy coach sits with observers and “whispers” commentary regarding instruction being observed. Coach observes teachers the following week and gives feedback on lesson.
- Coach is available for additional support lesson planning, demonstration, team teaching, and reflection.

### **DMI (Developing Mathematical Ideas)**

Through funds from private industries, such as Intel and Silicon Valley Leadership Group, selected teachers (through an intensive interview process) attend a two week (80 hour) trainer of trainers session from experts in the field in Massachusetts

learning content and pedagogy as well how to teach other teachers how to teach various big ideas in mathematics through five modules. This two-week training is required for trainers for each module; therefore, trainers return for training in Massachusetts once a year during the summer if they wish to train in more than one module. Each trainer is required to teach at least 20 teachers upon return. Classroom teachers sign up and participate in a 40 hour session for each module during the year.

The 40 hour session is spread out throughout the year so that after each 4 hour session, teachers are able to implement the ideas and bring back their reflections and questions to class to discuss. Each participant is provided a stipend and a document camera that they have seen modeled during the training in order to encourage use technology in their classroom to enhance learning.

Principals are also required to train in the 40 hour administrative training of DMI, which is called Lenses on Learning, helping them learn to support teachers who have been trained in DMI in classrooms through observation and “walk throughs.”

### **New Teacher Training- BTSA/Induction**

The BTSA Induction Program provides teachers with an intensive two-year logically sequenced program of preparation consisting of formative assessment, individual support from a qualified support provider, professional development, observations of other highly experienced and outstanding teachers, and other appropriate support as indicated by the teacher’s *Individual Induction Plan*.

After each workshop Fremont Unified School District BTSA Program carefully examines the evaluator’s report of ratings for that workshop in order to immediately respond to the needs of participants in a formative way. However, each year they also

examine the summative data, particularly for any low scoring professional development workshop, and work toward improving in those areas.

### **Principal Training**

Principals, Vice Principals, and Assistant Principals are all required to attend training on all new curriculum adoptions. In addition, the last few years, they have been required to train in Lenses on Learning (to support teachers trained in Developing Mathematical Ideas), GLAD (Guided Language Acquisition Program), BTSA (Beginning Teachers Support and Assessment), and SB 472 models, and in Conducting Walk Throughs to Support Learning.

Principal training includes the following:

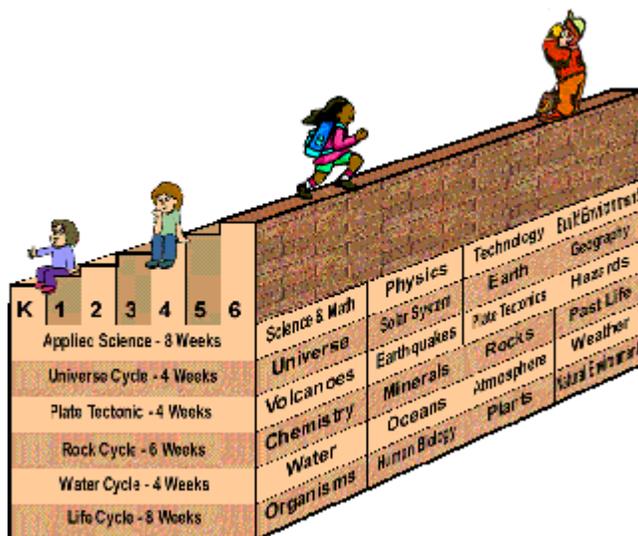
- Full or partial training that teachers receive.
- Training on how to support teachers' implementation, such as observation logs and practice.
- Reflection of observations throughout the year during Principals' Meetings.
- Pairing up principals to do "walk throughs" in classrooms at each other's schools. These walk throughs are 3-5 minute observations in classroom with a focus on observing evidence of implementation on an ongoing basis. Principals are expected to do walk throughs in all classrooms and give feedback (usually a couple of sentences on one of the following: rigor, access, engagement, checking for understanding, or differentiation of instruction) every week.
- These walk throughs are not for the purpose of evaluation but they are to help the teacher and the principal to work together to improve instruction.

## Math Science Nucleus

The expertise of the Math Science Nucleus has varied since 1982. Founded by a group of research scientists in the San Francisco Bay area concerned the pool of science professionals did not include all Americans especially woman and minorities. Strategies have evolved with completion of projects and economic opportunities.

### Curriculum and Materials Development and Research

Over the past thirty years the Math/Science Nucleus, a California based non-profit research and education institute, has developed a flexible science curriculum that uses hands-on material, traditional worksheets, and electronic storybooks. The



Integrating Science, Math, and Science (I. Science MaTe) reference curriculum has been successfully used in school districts in the United States to increase overall test scores. Teachers are guided using multimedia slideshows on the internet on how to teach the lesson plans successfully as well as helping them customize the material to their situation. The innovative essence of the I.Science MaTe curriculum provides students the means for basic critical thinking that can be applied to problem solving in real life situations. If children learn early how to solve problems with knowledge, technology, and science, they will be equipped to help the nation as they become businessman, teachers, artists, and well-informed consumers.

The entire K-6 curriculum is available free online, and the Earth Science (secondary). We have not completed the online version of the secondary Physical Science, Biology, and Human Biology and the Math Integration components. However, all of the teacher training lessons are complete.

### **Technology in Teacher Training (1989-2001)**

Once the I. Science MaTe materials were online and available to all educators, we began to get requests to merge the materials with electronic materials. We worked with Xerox Palo Alto Research Facility and several start up companies to see how technology could help. We produced several whitepapers on technology in the classroom (<http://msnucleus.org/research/index.html>).

Teachers needed extensive training and the technology should be embedded in their professional training on subject matter. The materials that were designed should enhance a teacher's ability to provide new materials and should not just be a "video" tape. Children learn more from adults than through electronics if designed correctly.

We developed storybooks that we had copyrighted so we can provide them free. We also developed ways in which they could be translated easily into different languages. Animated slideshows were also created to provide teachers with video, pictures, and sound to enhance their teaching with students.



### **Service Learning and Community Service**

<http://msnucleus.org/watersheds/index.html>

The Math Science Nucleus has been involved in several large restoration projects using high school students. We also have created several "Living Labs" where creeks are incorporated in their classroom experience. The Math Science

Nucleus also manages Tule Ponds at Tyson Lagoon Wetland Center, a 17 acre site owned by Alameda County Flood Control and Water Conservation District (ACFCWCD).

Students experience an urban wetland by observing native vegetation and how they attract native animals. This facility is where we keep all of our tools and materials for the other projects. The following link chronicles all the programs, projects, and events.

MSN currently receives about \$100,000.00 per year from ACFCWCD to maintain the facility including providing educational field trips.

**Children's Natural History Museum** <http://msnucleus.org/gordon/index.htm>

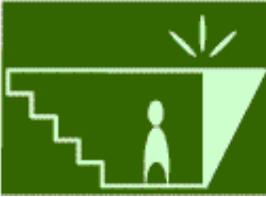
This unique collection of specimens that began in the 1940's from the little town of Irvington, in a gravel quarry long forgotten by current residents which is now covered by a freeway. This began as the personal collection of **Wes Gordon**, a teacher from Hayward, who led young boys to uncover one of the most important geologic finds in the Bay Area; so important and entire era in geologic history is named after the little town that it was discovered, the **Irvingtonian era**. Wes Gordon and his group of “**Boy Paleontologists**” uncovered fossils for over 10 years in the **Bell Quarry**; what they found was one of the best ice age fossil finds of large **mammoths, saber toothed cats, mastodons, wolves, giant sloths, short faced cave bears, camelops, western horses** and many other creatures. They uncovered tens of thousands of fossils, which many are on display in the museum. The museum is maintained by membership, grants, field trips, and classes.



**Hayward Fault Trench Exhibit** <http://www.msnucleus.org/haywardfault/index.htm>

In Fremont's Central Park there was a rare chance for the public to see the

Hayward Fault 15' below ground. Visitors to the Earthquake Exhibit were able to picture the narrow crack that allows two massive pieces of earth to slide by one another. Hearing about earthquakes in the news or feeling one will be a new experience! And picturing an 8-mile-deep fault breaking under your feet will make that earthquake kit seem much more of a necessity! The site of this trench is in front of the proposed Science Center.



**Teacher Training in Eritrea, Africa** <http://www.msnuceus.org/international/index.html>

We had a pilot teacher training programs in Eritea, Africa and had successfully developed customized materials. MSN was part of a World Bank team to assess Eritrea's educational system and how to train teachers after a 30 year war. We worked with the teacher colleges to train former freedom fighters to now become teachers. The documentation of this program is on our website and examples of how easy it is to translate into another language.

**Math Program** (<http://msnuceus.org/raimondi/raimondi.html>)

Dana Raimondi Math Program provides low income students in Fremont, California access to math programs that will allow students to excel. Her yearly donation of funds will be used to work with Fremont Unified School District, California to develop a way in which students can succeed in passing Algebra. This is especially timely with the state of California's initiative that students take and pass Algebra I by 8th grade. The lesson plans including curriculum and animated slideshows are on the MSN website for all to use. This fund also helps us to use some of the materials we designed with two other grants: TPL Inc and Seagate Technology.

**Helping Hands Science (FUSD)** <http://msnuceus.org/FUSD/grades.htm>

In 2009 FUSD has asked the assistance of the Math Science Nucleus to select 2 hands-on lessons per trimester per grade that teachers can use in either their school science lab or in their classroom. The written materials can be found by clicking on the appropriate link, which will provide guidelines on how to use the material. Schools that have selected to be part of this program have received materials that can be used by the appropriate grade level. Everything is boxed and ready to use. The materials were chosen to go along with the Adopted Science Text.

#### D. Quality of the Project Evaluation

### **THEORY**

The evaluation system planned for this innovation is ongoing and rigorous, and will collect qualitative and quantitative data from all stakeholders for the purposes of assessing innovation effectiveness and end user impact. Running through this evaluation work is the Walter Shewhart Theory of Quality Control (1930) and his “Plan Do Study Act” cycle. W. Edwards Deming adopted this model for his “Plan Do Check Act” wheel within a wheel cycle (1986) to which was added the concepts of mastery learning (Bloom 1968), formative and summative assessment (Hastings and Maddox 1971, Scriven 1967, Imai 1986), and minimalist theory - “the least theory that practice requires” (Trochim, 1998). This theoretical framework has been transformed into a formative program assessment cycle for the evaluation of program effectiveness: Formative Program Assessment (program evaluation) is defined as "A system of program evaluation that uses the continuous improvement cycle of ‘Plan, Implement, Reflect, Improve and compares results to criteria (Abel 1994, 2008)."

The day-to-day work of program evaluation has its basis in the logic model of Inputs (What we invest - what we do to collect data, whom we collect it from, etc.), Outputs (the actual data collected and the results of the analysis) and Outcomes (Predicted or discovered changes that move us every increasingly toward the goals of the innovation) (McLaughlin and Jordon 1999). This then leads to various "if/then" statements leading to a theory. For this innovation, the inputs are time, funding, and partnerships. Outputs are curriculum, training, mentoring, and facilities improvement. The results of these investments are an increase in effective teaching and increased academic achievement.

## **METHODOLOGY**

Sinclair Research Group proposes to undertake an extensive study of the implementation and impact of this I3 Grant. It seems appropriate that this evaluation address two main goals: the degree to which the proposals are implemented (Process Evaluation) and the impact of the implementation of the proposals (Impact Evaluation) as described below.

**Process Evaluation** - The focus of the Process Evaluation is on the implementation of the system for obtaining feedback from the training, the implementation of the training itself, and the implementation of the facilities improvements.

1. **Materials (Year 1 and 2)** – We will examine and describe the materials developed/used and extent that they are being used in training and by participants. We will also suggest areas for materials improvement.

2. **Training (Years 1 and 2)** - We will examine and describe how training is rolled out in various programs and assess the attainment of the objectives of the training

modules. We will target how the various trainings are structured, examine participant understanding of the theoretical and practical frames of the modules, and obtain ongoing feedback on training effectiveness (according to the Guskey Levels of Professional Development Evaluation and the National Staff Development Council Standards for Professional Learning) from every person experiencing any of the trainings. In this way we will be able to formatively evaluate each training session and quickly make modifications that will make implementation more effective. Each training and module will be evaluated for the extent that the goals of the modules and the needs of the participants are being met.

3. Support (Years 1 and 2) - We will examine and describe the ways the various programs are implementing the support, the ways in which the curricular materials are being used in that support, the extent that the support system is being implemented as planned, the degree to which those being supported are fully experiencing that support, and which module activities and support experiences participants find most helpful.

4. Facilities Improvements (Years 3-5)- Clearly a Process Evaluation is appropriate during the “Scale Up” years. We will evaluate the extent that building renovations and updating was implemented (completed) as planned.

To clarify, the goals of the Process Evaluation are:

1. To assess the extent that the training and support offered was successfully implemented as proposed and what, if any, improvements should be made in that implementation.
1. The ways in which differing programs implemented the various aspects of the innovation

2. The extent that the innovation was implemented as planned,
3. The extent that the articulated objectives of the training modules were met,
4. The level of mentor understanding of the theoretical and practical frames of the system,
5. The level of mentor skill in supporting teachers as they experienced the module activities, and
6. The degree to which participants are fully experiencing the various aspects of the system.
7. The degree that site renovations and expansion have been implemented as planned.

**Impact Evaluation.** The main focus of the Impact Evaluation is to examine the impact of the training, support and use of the curricular materials system on participants. This again necessitates ongoing examination of the training and experiences of all service learning participants, pre-service participants, teachers, volunteers/helpers, mentors, and principals, both for formative improvement within and across years and summative impact.

1. Materials (Year 2-5) – All materials used will be evaluated on their relative impact with a focus on ease of use, support for participant role, and increase teaching effectiveness. Data will be collected each year that would lead to formative suggestions for materials improvement. Impact data will focus on the quality of and engagement with materials.

2. Training (Years 2-5) – All training will be evaluated for impact. Data will be collected from each participant, at each training regarding impact (according to the

Guskey Levels of Professional Development Evaluation and the National Staff Development Council Standards for Professional Learning) from every person experiencing any of the training throughout the four year period. All training feedback will be aggregated and compared over time allowing for both formative and summative improvement and observation regarding training impact.

3. Support (Years 2-5) – Data will be collected from each participant of all programs (both end users and facilitators) regarding the impact of the support they are receiving. This will be particularly focused on the use of the materials within and the level of engagement with the supportive relationship, and the impact of the support on practice.

4. Facilities (Year 5) – During the last year the use of the new structures and renovations will be evaluated for their impact on both support for teaching and increased teaching expertise. This will be achieved through qualitative measures – observations, structured interviews, and document reviews. Surveys will also be used.

5. Increased Academic Achievement (Year 5) – During the last year of this evaluation, we will examine how the transition to expanded science curricula and facilities have impacted student academic achievement. This will be achieved by analyzing student standardized tests.

The Impact Evaluation goals are to examine the impact of the innovation on:

1. teaching expertise,
2. the teaching of math and science
3. the use of critical thinking skills,
4. the use with special needs students and

5. overall increased academic achievement.

This evaluation relies on multiple quantitative and qualitative measures. Quantitative and qualitative “paper and Pencil” and online surveys will be administered. Additional qualitative data will be collected through structured interviews. The studies involve both population and sample groups. Statistical techniques that are appropriate to each of these designs will be applied. Sample groups will be chosen using proportional random sampling by project. Samples will be chosen and requests for participation sent to individuals until the sample size will assure a 95% confidence level with a margin of error of  $\pm 5$ .

### **PROGRAM EVALUATION DELIVERABLES**

Each year, six reports will be issued as follows:

Report 1abcde – Updated goals, objectives and study tasks – Two months after grant approval and each year in November

Report 2abcde– Questions for the evaluation of training and materials – Two months after grant approval

NOTE: After each training or workshop, all feedback forms will be sent to Sinclair Research Group. All feedback forms will be analyzed and an overall report for that particular workshop will be sent back to the Grant Director – Within one week of receipt of data

Report 3abcde - Evaluation of materials – July 2011 – 2015 (Each year)

Report 4abcde – Evaluation of training – July 2011 - 2015 (Each year)

Report 5abc– Questions for Year End Survey for all role groups – February 2013-2015 (Each Year)

Report 6abc– Year Survey Results – August 2013-2015 (Each year)

Report 7 – Facilities Implementation Report – August 2014

Report 8 – Facilities Impact Report – August 2015

Report 9 – Student Academic Achievement Report – August 2015

Report 10 – Summative Project Report - September 2015

(TOTAL – 20 Reports)

### E. Strategy and Capacity to Bring to Scale

#### **SCALE UP (last 3 years)**

Phase 1 would give us clues about the most effective way of delivery of STEM in schools. In Phase II the Fremont Learning Center will open to increase capacity dramatically in the San Francisco Bay area. The Fremont Learning Corridor Concept Plan (Appendix H-7) outlines the scope, depth, and commitment of the City of Fremont (COF), Math Science Nucleus (MSN), and Fremont Unified School District (FUSD).

**The Fremont Learning Corridor** will provide instruction for teachers, and administrators on how to integrate science, math, and technology into curriculum to improve performance in STEM (Science, Technology, Engineering, and Math) subjects.

The 3 unique features found in Fremont, California (exposures of the Hayward Fault, urban waterways, and Ice Age fossils) acts as a multiuse area (schools and public) to excite the imagination of children and teachers. The present facilities create dynamic classrooms and outdoor laboratory for field trips, service learning, and workshops for FUSD and other school districts.





*Area of walking Tour including Tyson Lagoon on the left, present site of Earthquake Exhibit and Stivers Lagoon on the right.*

Completing this training center would increase capacity for training teachers that doubles as a place to generate funds through field trips and other activities for the San Francisco Bay area. Unlike museums, the facility is laid out to work with one class and one teacher at a time to make sure teachers are equipped to continue the lessons. Sometimes teacher workshops do not provide the materials that would allow the teacher to actually learn how to instruct the material. All the other facilities mentioned in this grant will still be adding layers of coaching to teachers to insure they understand the methodology of hands on teaching.

This area can be easily reached by public transportation and can train generations of teachers and administrators while serving the school districts in the San Francisco Bay area.

This grant will target low performing schools in lower-socioeconomic areas. However materials and training will be available for a fee for other schools that do not

qualify (see Section E). We will select districts or schools that will commit to certain responsibilities, especially to monitor student achievement scores. Selection will be based on the ability to track student performance of the teachers trained. Our contact at the California Department of Education will help identify these schools that will be part of our study from the 3<sup>rd</sup> to 5<sup>th</sup> years. Data accumulated in Phase I will allow us to determine if we should engage smaller museums and nature areas (i.e., Discovery Fossil Museum of Madera County) or just independent coaches (i.e., North Carolina model).

Throughout the state we will begin identifying schools that want to look into the coaching and modeling techniques. Since the packaging of the materials with electronic storybooks and slideshow will include online video libraries, we will be able to service more people at a lower cost. As part of the research design of this proposal we will be able to see if the online professional development can be a cheaper alternative to higher student achievement. Since the difficult work of developing the materials has been mainly complete, monies will allow us to package the materials more effectively and efficiently.

Schools chosen to be part of this study will have to apply for the slot. They will be in the project for the duration of the grant. So a school that enlists in year 2 will allow us to look at student performance in certain grades in science and math for 4 years. Some of the schools may start with only grade and with each year increase the coaching and modules at their school. The materials will be given to the school after the grant including any electronic equipment (computers, LCD, or other technology). A contract of their responsibilities and MSN will be negotiated prior to beginning coaching. By the

end of the grant we will be able to see how coaching and mentoring of teachers at their school and local center contributes to test scores.

Appendix H-8 shows the projected number of students that will be reached by this project each year. There will be a mix of electronic coaching and person-person coaching to reach these students. The modules will vary from 3-12 hands on activities per grade or subject level.

We also will include strategies to help a school use materials they already have to deliver fun and exciting lessons with the I.Science MaTe materials. The rural portions (Madera County and North Carolina) will also take on more responsibility and expand into different schools. North Carolina ( Mooresville area) will also look at the high school service learning training portion. Madera County Office of Education will also look into expansion into other content areas in science, and may include the math portion. We will start initiation of a cost sharing of school districts to develop the process of self sustainability.

STEM modules will be a part of the new teacher training and we will look into expanding the role of California State Universities to inform professors on different campuses through the smaller modules that are being used for pre-service teachers at California State University, East Bay. CSUEB will offer course credit through Continuing and International Education at the California State University, East Bay teacher training program.

The eligible applicants have the capacity to complete the grant and to increase the numbers of students and teachers. FUSD has an annual budget of \$275 million and COF is a city close to ¼ million people. MSN's budget is ¼ million per year, and they

have the capacity to grow especially to duplicate materials in different settings. When MSN's materials made adoption in the 1990's they were able to send materials throughout the country. Their work sourcing materials and packaging have been effective for over 20 years. Working in Africa shows the diversity of settings. Cost sharing, volunteers, and inkind help from industry is one of the strengths that enabled MSN to excel.

The estimated cost of the project is \$49,300,000.00 (this proposal) with about \$12,465,000 of in kind from COF, FUSD, and MSN (see Appendix E for details). Initial start up would be \$6,350,000.00 and the operating cost per student per year is: first year (\$154.00), second year (\$9.75), third year (\$67.44), fourth year (\$20.00), and fifth year (\$12.30). The estimate of the proposed project to reach 100,000 students would be year 2; 500,000 by year 3.5 years and 1,000,000 students by year 5. The average cost per year per student is \$28.83 for all students.

There will be a variety of mechanisms we will use to disseminate information on the project for replication including Internet marketing, television interviews on the FUSD TV, conferences, and articles. The technology staff will develop email newsletter. We will also look at develop broadcast training models to get as many teachers involved.

## **F. Sustainability**

### **Fremont Unified School District**

Sustainability of an educational program of this caliber depends on three things: well trained staff, content knowledge, and materials.

Through modeling and coaching during the five years of the grant, all FUSD teachers in elementary school will be trained in teaching science. The ongoing staff

development imbedded in this grant has clearly shown excellent results in Fremont the past few years. Since all new teachers have to participate in the BTSA (Beginning New Teachers Support and Assessment) program in FUSD, they will receive this coaching and modeling for the first two years of their teaching after the grant.

Since the materials provided for the classes are non consumables there will be little replacement. Materials are contained within boxes clearly labeled and housed at each school site in the science lab. A yearly inventory of materials at each of the elementary schools will provide an excellent opportunity for the high school students as a culminating activity each year. High school students will be trained on how to inventory the boxes at each school site, make a list of any materials needing to be replaced, and replace them so that the kits are ready for classrooms before the next school year starts.

Fremont Unified School District will be adopting its first Service Learning Board Policy that is based on the national service learning standards by June 2010. This BP requires that every student is involved in at least one quality service learning project during the elementary grades, one during Jr. high school, and one during high school. In addition, all students in Fremont are required to finish 40 hours of service as a requirement for high school graduation

### **Math Science Nucleus**

Although MSN is a non-profit organization, its philosophy has always been to develop a financially stable model that provides funds through quality programming, field trips, and sales of products. Grants are usually applied for that can assist in producing products that we can include in our business model. This grant provides a vehicle to market and disseminate a program that increases performance of our nation's

students in science and math. This proposal will create funds through the following:

1. Training program materials that can be purchased. Percentage will go back into new development (especially electronic materials)
2. Museum Shop at MSN will move over to Fremont Learning Center. Each training center would be able to make their own materials and distribute to generate their own funds. The location of this shop would have the potential of 1 million visitors per year.
3. Internet Classroom will start up – sales of materials for training
4. Field trips to the Fremont Learning Center
5. Sales of materials to other schools who are interested in results could be up to \$1 million annually (which would go into keeping the materials free online)

### **City of Fremont**

COF will maintain the building and have option of using the facility for summer and weekend use. In their MOU they will provide full access to the facility to the Math Science Nucleus and the Fremont Unified School District for training and free field trips for all FUSD students. MSN in turn will provide low cost field trips to schools throughout the San Francisco Bay area. They would be able to charge user fees from the naturalist program (earthquake and fossil tours).

The classroom will also be used to schedule Tiny Tot programs which can generate about \$500,000.00 per year. On weekends the classroom will be used in museum tours.

### **G. Quality of the Management Plan and Personnel.**

The management team has been working together between 10 to 30 years trying to improve science and math education for all children, with an emphasis on strategies to

include underserved.

The **Assistant Superintendent of Instruction** and **Director of Federal and State Projects** will directly oversee the grant. They have already spent hundreds of hours working with the City of Fremont and Math and Science Nucleus to come up with the best possible plan for “Helping Hands” to ensure it meets the needs of the students in Fremont, especially those who are in underserved subgroups, such as African American, Hispanic, Socio-economically White students, as well as those in Special Education and pre-school. The Assistant Superintendent and the Director of Federal and State Projects will directly supervise the **Program Manager**. They will meet at least once a week the first year and once a month and additionally as often as needed in subsequent years to ensure adherence to the grant proposal.

The **Project Director, Dr. Joyce R. Blueford**, a geologist, will oversee the activities and direction of the project and work directly with FUSD Project Manager as well as all the other key personnel. As the major author of the I.Science MaTe Reference Curriculum she brings a history of bringing scientists and educators together to provide students with experiences that only make them love and understand science. As a research scientist she organized over 50 international meetings including field work in Siberia and Sakhalin, Russia and worked with the Academy of Sciences, Moscow She also organized educational help to Eritrea, Africa after the Minister of Education requested her help. This project would be another challenge to reach more American children. As a Parks Commissioner for Fremont, she is well aware of the workings of the City of Fremont and how they can assist school districts around the area.

**Annabell Holland**, Manager of Parks and Recreation has been a leader in

providing the public with quality recreational classes that include many science and leadership skills for elementary to secondary schools. She oversees over a total of \$42 million dollar budget to keep the over 40 parks in Fremont maintained.

**Debbie Davidson** is the Vice President of the Math Science Nucleus Board. She has worked in California and North Carolina promoting science in schools. In the 1990's she had over 50 schools that worked on the project. **Dr. David Stronck** has been a professor at California State University, East Bay for over 40 years. He has extensive background in pre-service teachers and has been a Board Member of the Math Science Nucleus for over 15 years. He will be helping to coordinate the service learning component for the secondary schools. **Dr. Michele Korb**, is new to the group, but as an assistant professor in Elementary Science Education she will bring a new perspective of incorporated the materials. She has already used the materials and found that her students are guided into learning hands-on science the way the electronic and hands-on material work together. **Nate Ivy**, is a Fremont teacher currently working as a teacher on loan to Alameda County in Service Learning. He is the County's Coordinator for CalServe, a Service Learning grant. As a new teacher he went through several programs at the Math Science Nucleus and has always felt that they helped him through the early years of teaching. He will interact with the Red Cross to get their materials and the needs of the schools meet.

Dr. Lois Abel and her staff at the Sinclair Research group will be our independent evaluator. **Dr. Lois Abel** is perhaps best known to California educators for her work with the BTSA program as a Consortium Director, State Program Evaluator, and State Trainer for the New Directors Academy. She was one of the first Cluster

Consultants and trainers for the California Formative Assessment & Support System for Teachers (CFASST). Dr. Abel developed two evaluation designs: Formative Program Assessment (FPA) and the Goals Assessment Model (GAM) which are now widely used evaluation theories. She is also the author of *Mastering All the Teaching Standards (MATS)*, an innovative classroom management training program.

Other people that will be involved in the project include **Dr. David Schwartz**, an eminent seismologist from the U.S. Geological Survey. **Dr. Robert Curtis**, Science Consultant at Alameda County Office of Education will help us work with Community Court Schools. **Jim Greco**, Science and Math Consultant, California Department of Education will help us identify schools to be included in statewide dissemination to low income schools. The American Red Cross Managers, **Alyssa May** and **Emily White** will work directly with the identification of materials and professional development. **Larry Martin** and **Dr. Robert Dundas** will work with us from San Joaquin Valley Paleontological Society and **Cynthia Dolph**, Assistant Superintendent from Madera County Office of Education will work with us from Madera County.

Internet communications and other technologies will allow management team to be in constant contact. Trainers and coaches will be responsible for the day-to-day operation. They will track the teachers to see how they can help them do better lessons. The principals will be part of the team as they learn what to look for in a good science and math hands-on lessons. Communications on all levels is important. An annual meeting to assess progress will be conducted including Fremont Unified School District, the Chamber of Commerce, Math and Science Nucleus, City of Fremont's Recreation Department, California State University East Bay, Sinclair Research, Red Cross, the

Native American Studies, as well as other partners.

Timeline and tasks (Appendix H-9) will be constantly amended to make sure that the goal of increasing students' performance on standardized tests is the goal. Some teachers will require more coaching at some schools, or teachers will change grade level. Our timeline will be flexible to accommodate teachers. Please remember that we will keep track of the teachers we would have coached in previous years, and if some of them need some "refresher" courses, our timeline will be flexible enough to aid that teacher.

This is a complicated proposal with many levels of objectives and tasks. However, we feel confident that with all of our partners and our experience this will allow an innovative product and process to finally have widespread impact. The potential impact of this project is immense, making the City of Fremont a place for people to visit and learn. We truly believe that the ongoing coaching support, materials, field trips, opportunities for service learning, and a training center that will benefit students, teachers, and principals for years to come, while creating hundreds of jobs make this grant proposal unique. The commitment from our business partners, such as Intel and Lam, has been instrumental in our success as a District and we will work diligently to continue and expand this collaborative effort.