INTERCULTURAL DEVELOPMENT RESEARCH ASSOCIATION

IDRA Newsletter

IDRA FOCUS:
SELF-RENEWING SCHOOLS… MATH AND SCIENCE

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Can Everyone Master Mathematics?

Inside this Issue:

by Jack Dieckmann, M.A., and Aurelio M. Montemayor, M.Ed.

Twenty secondary math and science teachers from a large urban school district in Texas were recently asked: Why don't English language learners succeed in school? Their answers included: students feel isolated because of language, students get mixed up with gangs, and students do not value education.

The teachers then divided their answers into two groups: those that place the responsibility for succeeding in school on the student, and those that place the responsibility on the school itself. All 27 of the reasons given placed the responsibility on the students rather than on the adults charged with educating them.

In further conversations, the teachers agreed that there is a significant number of institutional barriers to learning for students. This article compares *student-attributed* and *school-attributed* explanations for the persistent failure of many students to develop mathematical thinking and offers alternatives for success.

Practices Affect the Outcome

One key question is: Why do inherently bright students (including native-born, recent immigrant and English language learners, etc.) continue to lose interest and give up on mathematics?

Typical student-attributed explanations include: these students cannot persist in sustained abstraction; these students are disengaged from the subject; these students do not understand the language of math; and these students do not get help or encouragement at home.

These kinds of explanations minimize the power that teachers have. But educators can directly affect how they perceive students as mathematical thinkers. Teachers can carry out the curriculum creatively with expanded methodology and engage all students in higher-order-thinking conversations. Successful teachers acknowledge student contributions and explore connections. They check for understanding and draw on students' natural mathematics to connect it with formal math. And they connect mathematics to students' reality.

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Instead, the predominant practices involve rote learning of patterns rather than seeking reasons and explanations; requiring students to "just follow along" with procedures that seem arbitrary and do not engage their critical thinking; ignoring student attempts to make connections across ideas; and prescribing to the theory of "no pain, no math gain."

We have failed the majority of our students for many generations, thereby preventing most of them from deepening as mathematical thinkers and reaping the rewards that follow. But, it does not have to stay this way.

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Ingredients for Success

There are small but growing groups of math teachers whose practices vary from those listed above. Their successful classroom experiences reflect the following (Dieckmann, 2003).

- Students' natural curiosity is a powerful hook for experimentation and discovery.
- Establishing mathematics as fundamentally relevant reduces students' perception of math as arbitrary and, ultimately, unknowable.
- Students create and explain various chains of mathematical reasoning.
- Interactive and dynamic lessons entail the serious consideration of all student responses and explanations.
- Students find learning rewarding and energizing and are self-motivated to continue exploring.

Additionally, English language learners deepen as mathematical thinkers when:

- Content, language and metacognition are integral to instruction (Echevarría, Short and Voght, 2003).
- Clearly understood visuals and universal shapes are used to explore concepts, irrespective of language ability.
- Group conversations exploring math concepts develop both Basic Informal Communication Skills (BICS) and Cognitive Academic Language Proficiency (CALP) (Cummins, 1986).

Natural Math

Students have resources and experiences that are useful in learning mathematics. We start with the premise that all children are natural mathematical thinkers, from infancy. Various researchers support this phenomenon in mathematics education and psychology (Lakoff and Nuñez, 2001; Harel and Confrey, 1994).

Children notice shapes and pat-

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In This Issue...

***The Intercultural Development Research Association** (IDRA)* is a non-profit organization with a 501(c)(3) tax exempt status. The purpose of the organization is to disseminate information concerning equality of educational opportunity.

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Creating Passages for Young Minority Girls

by Bradley Scott, Ph.D.

The gender gap – what is it? After all these years of gender equity in schools, does the gap still exist? Can it be closed? The answers to these questions are both simple and complex.

For instance, there are still gender gaps between girls and boys in various aspects of achievement and other performance outcomes in schools. In some areas, girls once performed consistently lower than boys on standardized math and science tests, while recently that is no longer the case.

But, in middle and high school, when science, math and computer courses are elective courses, girls tend to take fewer of them than do boys (National Science Foundation, 2003). Such courses as science, technology, engineering, and mathematics have commonly become labeled as "STEM."

The gap not only persists, it is changing. M.K. Gavin found that there is a new gender gap in technology (Gavin, 2000). Although the gender gap in advanced placement technology and computer science test performance has narrowed significantly, the percentage of women taking the exam is consistently low.

Yet, the Association of Medical Colleges found that for the first time ever, women made up the majority of medical school applicants in 2003, while there has been a sharp decline in males applying to medical schools (NEA, 2004).

So the gap is closing in some areas but still exists in others. There is an explanation offered in some circles for why this is so.

Closing the Gap

The Congressional Commission on Women and Minorities in Sciences, Engineering and Technological Development has noted that images of female scientists and engineers are still rare. Women make up only 19 percent of workers in science, engineering, and technology. The 10 fastest-growing occupations are in these very areas where women are under-represented.

S. Rosser and J. Montgomery's research found: "The continuing low numbers of women in many science, engineering, and mathematics fields provide other particular challenges and opportunities… These low numbers mean that a woman often serves as the first or one of few women… Women may have no senior women colleagues to act as role models, serve as mentors for them, and provide them access to networks of necessary professional information" (2000).

S. Malcolm is of a similar opinion regarding girls, in general, and minority girls, in particular. Minority girls are

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doubly challenged to be represented in STEM. As an African American scientist, she noted: "I came to understand that concern for social justice [where girls, particularly minority girls are concerned] could be expressed by mentoring freshman women, reassuring them that is was OK to do something nontraditional, by refusing to settle for anything less than excellence so as not to reinforce low expectations, and by confronting bigotry and narrow-mindedness from those who saw deficiency in difference" (Malcolm, 2000).

Creating Passages

A growing number of people believe that the gender gap can be eliminated. The National Association of Elementary School Principals has commented that the achievement gap can be eliminated with the right supports, resources and efforts on the part of all education stakeholders. It goes on to state, "Educators must bring the same attention to girls' achievement in sciences, engineering, and technology that they successfully brought to math" (NAESP, 1999).

Gavin suggests that schools also invite, involve and educate parents as a way of supporting girls in math. For those that support parents, he recommends assisting them to do the following (Gavin, 2000).

- Create at-home activities that involve hands-on problem solving.
- Engage in daily math routines, such as grocery shopping and balancing check books.
- Collaborate with teachers in flexible and creative ways to make sure girls are challenged and energized about mathematics.
- Visit museums of science and explore the contribution of mathematics to the sciences and other disciplines.
- Encourage girls to participate in math clubs and competitions.
- Explore varied careers in mathematics fields.
- Provide female role models.

> **"Educators must bring the same attention to girls' achievement in sciences, engineering, and technology that they successfully brought to math."**
> **– National Association of Elementary School Principals**

Darke and Clewell noted from their research that girls and boys show marked differences in levels of participation in extracurricular science activities. Boys participate more often in activities like science projects and hobbies. The researchers state, "This lack of informal science experience may negatively affect future learning outcomes in science for girls" (Darke and Clewell, 2000).

They recommend the use of innovative settings – like museums and parks, health care facilities, research facilities, laboratories, industrial and commercial sites, community centers, and online communities – to attract and engage girls in STEM.

Interventions such as mentoring and role modeling, summer science camps, internships, and cyberspace support also can be used to draw girls to STEM.

The Intercultural Development Research Association found in its work that minority girls express a powerful need to see and interact with minority female role models (Scott, 2001; Suda et al., 2000). The IDRA South Central Collaborative for Equity used this information to create a supplemental middle school science curriculum *Minority Women in Science: Forging the Way* (see Page 7). The curriculum uses the stories of minority female scientists as a basis for teachers and students to examine the personal and systemic challenges these women had to face to become scientists, mathematicians and engineers.

Following the guidance on what works from research, the curriculum provides students with hands-on in-classroom and outside of classroom experiences in the STEM disciplines represented by the women in the curriculum.

The goal of the curriculum is to create STEM passages for minority girls and other students while addressing a critical issue raised by the National Science Foundation: "Socially projected stereotypes about who should be scientists and engineers pose artificial limits on the participation of talented students. Gender is only one of the characteristics that shape personal and group identity. Other characteristics such as race, ethnicity, economic status, religion, and disability also bear on whether students are encouraged, neglected, or discouraged from developing certain skills and ambitions. Our educational system must seek to develop talent and interest in science, mathematics, and technology in all children" (2003).

The real challenge to be faced on every front is to build STEM passages to prepare all learners to step up to the growing demands of these hyper-growth disciplines and professions. Research, training, professional development, focused application of resources, and thoughtful collaborative interaction among the critical stakeholders will be the vehicles to deliver us to the goal.

Resources

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Gavin, M.K. *What Parents Need to Know about… Encouraging Talented Girls in Mathematics. Practitioners' Guide* (Storrs, Conn.: National Research Center on the

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"Minority Women in Science: Forging the Way"

Marianita Chee's Story

My family consists of my two children, ages 4 and 7, and my husband. My husband and I work for the same company, he works as a rolling stock mechanic at La Plata mine, and I am a mining engineer at Navajo mine. My dad is 86 years old and lives in Window Rock, Arizona, on the Navajo reservation. My mom died when I was 6 years old, so my dad raised those of us who were still at home. Most of us went to boarding school, but my dad was the one we came home to for vacations and holidays. I have seven sisters who are all older than me and four brothers, two of whom are older and two are younger.

"There is still that perception that men are better at engineering and math than women. So no matter how much schooling women have had or what kind of degree we have, we still have to work twice as hard... I am a determined person, and once I want to do something there is very little that anyone can do to make me change my mind."
– Marianita Chee

Since my dad was the primary person in my life, I can honestly say he was a great supporter of my going into engineering. Although he has had no formal education and does not understand English, he made sure I had whatever book I ever wanted when I was really young. He also constantly told me that I needed to learn the ways of the Anglo people and that I needed to learn them well enough to put them to my use. I am sure he gave the same advice to all my brothers and sisters so that whenever I needed any help along the way, my family was always supportive and willing to help me.

When I tried to get a job while in high school, I was asked if I knew how to type, work a cash register or anything else. That was when I realized I needed to obtain some kinds of skills in order to get a job. I decided I wanted to become a coal miner like my dad. Since my high school counselor always told me the easiest and fastest way to get a job was to get a degree, I decided to apply this thought toward getting a job in a coal mine. That is how I came to be an engineer.

I went to elementary school on the Navajo reservation in Arizona where we lived. After my mom died, we were sent to live at a boarding school nearby in Fort Defiance, Arizona. When that school closed, we were sent to live at another boarding school, this one in Albuquerque, New Mexico. So, from the fourth grade through high school, I went to the public boarding schools in Albuquerque. After high school graduation, I went to the New Mexico Institute of Mining and Technology in Socorro, New Mexico, and got my bachelor of science degree in mining engineering.

I was so un-informed while in high school that I did not think any college would want me. My high school counselor convinced me I was college material. She was also the one who was my sounding board when things happened to me that I felt I could not handle. Since I did not realize until late in my high school career that I needed to go to college, I was not prepared to go into engineering. My first year of college I had to take all the basic classes (math, chemistry, physics) to get myself prepared for the engineering classes. To me the whole five years of college were fairly difficult, and I was very lucky to have smart friends who were willing to help me.

I think my junior high and high school teachers could have done a better job in getting me prepared. I had some very good teachers, but I also got bored in some of my classes. I was given the impression during most of my school years that I would not be able to go to college because I was an Indian,

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and "Indians do not go to college." The other thing I did not realize was that there are scholarships out there for people like me (minorities). In fact, I was so naive that I thought I would personally have to pay for all of my college education.

While you are in elementary, junior high and high school, make it your goal to go to college. Do not worry too much about what it is you are going to major in, think about what you like to do (for example, do you like to talk to people, do you like to work alone, do you like math, do you like to write). Answer these questions about yourself and then find out what kind of jobs there are that would fit your style. Find people who do the type of work or have the type of career that interests you. Talk to these people and find out what they actually do while on the job and what they had to do to get their jobs (for example, college education, trade school). Most people are really willing to help, so never be afraid to ask for help or advice.

I do long-range planning for a large surface coal mining operation in northern New Mexico. The Navajo mine currently has three large draglines in operation for stripping dirt off the coal. BHP (the company I work for) recently bought a used dragline, and we are in the process of having it put together here on the mine site. Therefore, my current project is to find the most economical method of mining for the two machines that will be in operation once this dragline is up and running. Finding the most economical mining method requires looking at our reserves for all the mining areas on our lease. We then figure out what would be the best way to mine these areas to maintain the amount and grade of coal required from us for the power plant. After the best mining option is selected, we do detailed designs and plans on how the draglines will uncover each coal seam. We then determine the amount of time it would take to mine and to haul the coal out of each pit. From this figure, we can plan what the years ahead will look like for quality and quantity of coal for each year. We can simulate what the earth will look like after we finish mining, in order to plan for reclamation. We even determine what our staffing levels should be for the life of the mine. Almost all of this work is done on computers using various mine-modeling programs.

What I love most about my job is being able to design something and then see it actually created out in the field. I guess it is like seeing it done in your mind, then on the computer and then actually watching the equipment moving the dirt.

Some barriers I have encountered in the work place are that people, both men and women, do not seem to take me as seriously as they would one of my male counterparts. If the project involves more than one engineer, people always seem to think it is the other guy who did most of the work or came up with all the ideas. Since my father always told me it was not right to talk highly of yourself, it is very difficult for me to claim recognition for myself. To get up and say "I did that part of the project" is still very hard. In my heart and in my mind I know that I was the one responsible for the idea or the

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Mining Minerals in the Classroom

consumption: the process or act of using a mineral that has been mined.

inorganic: the quality of being composed of material other than plant or animal, belonging to the inanimate world.

lode: an ore deposit. It usually refers to a seam or vein of ore that will be mined as a unit.

mine: a spot or pit in the earth from which minerals can be taken.

mineral: an inorganic substance that is neither animal nor vegetable. Also a solid crystalline element or compound that results from an inorganic process of nature.

ore: the source from which a mineral can be taken (extracted). The mineral can be either metallic (gold) or non-metallic (sulfur).

reclamation: restoring a mine to beneficial use, facilitating the recovery of land that has been mined.

resource: a source of support or supply that can be used to serve a purpose.

seam: a bed of valuable mineral (especially coal), regardless of thickness.

vein: a mineral deposit that has definite boundaries that distinguish it from the surrounding rock. It usually appears as a thin layer that resembles a vein.

yield: the amount or quantity of mineral that was or can be mined.

from "Minority Women in Science: Forging the Way – Student Workbook," Intercultural Development Research Association

Marianita Chee's Story – continued from Page 6

work, so the glory is not the most important thing to me. We all have our own consciences to live with. What matters most to me is to know I did the job and to feel good about my work.

The Navajo Nation in general has been supportive of my pursuit of science. I started college when the Navajo Nation was very vocal about the need for Navajo students to earn college degrees. The Navajo Nation still says we need the people with the degrees, but, in my opinion, it is no longer one of the highest priorities for the tribe. It needs to be higher on the list of priorities for the Navajo Nation, and more efforts need to be made to prepare Navajos for college and to keep them in college. This is essential for our personal survival and for the survival of our tribe.

There is still that perception that men are better at engineering and math than women. So no matter how much schooling women have had or what kind of degree we have, we still have to work twice as hard to get on even ground with the average Anglo male. This is especially true if you are a minority woman in a predominately male field. I am a determined person, and once I want to do something there is very little that anyone can do to make me change my mind. I have overcome most obstacles by telling myself, "This is what I want to do, so I'm going to do it."

Whatever it is you want to accomplish, you will be able to do it with persistence and hard work. Do not hold back, do not be shy, do not be timid, do not set limits for yourself and do not let others tell you what they think your limits are. Prepare yourself so that you can use your knowledge to help yourself and your people.

I was the first mining engineer for the Navajo Nation. I have always tried to keep this as low-key as possible because being the first was not my goal when I started out. In fact, I have been many "firsts" along the way, and I felt it was more of a hindrance than a help for quite a while. I think the fact that I opened a door or two for many of my people is a greater accomplishment than being first. I have met some people who have told me they heard me speak many years ago and it gave them the push they needed for going into science or even going to college. These are the people that make me feel good about getting my degree and make me feel like I have done something to help them.

This story was reprinted from "Minority Women in Science: Forging the Way – Student Workbook" published by IDRA (see below).

Minority Women in Science

Forging the Way

by Keiko E. Suda, Oanh H. Maroney, M.A., Bradley Scott, M.A., and María Aurora Yáñez, M.A.

A great student-centered tool to support equity in math and science education!

We must ensure that minority girls are not left behind as progress is made toward narrowing gender and racial gaps in math and science education. This is an innovative resource that can be used with all students – girls and boys – to help break down gender stereotypes about scientists.

Inside, you will find:

- **Profiles of seven minority women scientists** who have surmounted barriers to forge the way for themselves and future scientists. ***See samples on Page 5.***
- **Science lessons** for the classroom that cover such topics as acid/base chemistry, earth science, wildlife and environmental science, and biology.
- **Life skills lessons** for the classroom that cover topics such as getting college information from the school counselor, identifying a support system, reaching goals, knowing self-worth, having community pride, overcoming stereotypes, and linking hobbies with career choices.

"Being a scientist can open doors to opportunities that you may never have dreamt of or even considered."

– Patricia Hall, M.S., one of the scientists featured in *Minority Women in Science: Forging the Way*

Student Workbook $6.50 • Teacher's Guide $25.00

(Student Workbook ISBN 1-878550-67-5; 2000; 32 pgs; paperback; $6.50) (Teacher's Guide ISBN 1-878550-68-3; 2000; 94 pgs; paperback; $25) Developed and distributed by the Intercultural Development Research Association. 5835 Callaghan Road, Suite 350, San Antonio, Texas 78228 • Phone 210-444-1710 • Fax 210-444-1714 • contact@idra.org • www.idra.org. Shipping and handling is 10 percent of the total price of the order. Orders must be prepaid. Purchase orders for orders totaling more than $30 are accepted.

IDRA Partners with the National Dropout Prevention Center for Students with Disabilities

For almost 20 years, the Intercultural Development Research Association has worked with schools to improve their holding power through effective dropout prevention efforts. This year, IDRA continues this work through a new partnership with Clemson University, the Educational Development Corporation and the newly established National Dropout Prevention Center for Students with Disabilities (NDPC-SD).

The NDPC-SD is housed in Clemson University's National Dropout Prevention Center/Network and is funded by the U.S. Department of Education, Office of Special Education Programs.

The goal of NDPC-SD is to provide support to state and local education agencies as they work to keep students with disabilities in school. This support includes guidance and technical assistance in designing, implementing, and evaluating effective dropout prevention programs for students with disabilities.

Through this partnership, IDRA shares its considerable experience in dropout prevention by identifying and disseminating effective model resources, such as IDRA's Coca-Cola Valued Youth Program. IDRA is also ensuring that such information is linguistically- and culturally-appropriate, and meaningful, particularly for Hispanic parents. IDRA will also be providing technical assistance to state education agencies and others.

Building on its extensive experience in designing, developing, producing and disseminating effective models that result in changes in practice at the classroom level, IDRA is creating a process for identifying proven models that will include:

- Developing criteria for identifying exemplary, proven (research- and evidence-based) models at the national level;
- Inventorying existing models in collaboration with clearinghouses including the What Works Clearinghouse and the What's Working Synthesis Center;
- Using the established criteria, selecting proven models, ensuring that the models have evidence of effectiveness for students with disabilities;
- Keeping the model's critical elements intact, adapting materials as needed for special populations, such as English language learners.

Once identified, effective models will be disseminated using the most effective dissemination tools available, including the new NDPC-SD web site and the What Works Clearinghouse. Promising practices also will be identified using the rigorous set of criteria established by the Clearinghouse and the U.S. Department of Education in order to provide a full array of possibilities for schools. Other collaborators include the Promoting What Works Synthesis Center and the National Center on Secondary Education and Transition (NCSET).

NCSET recently published a manual for policymakers, administrators, and educators that provides 11 exemplary dropout prevention models and characteristics of those models. IDRA's Coca-Cola Valued Youth Program is one of the 11 program models featured.

For more information on the NDPC-SD, contact IDRA at 210-444-1710 or visit the new NDPC-SD web site at http://www.dropoutprevention.org.

For more information on IDRA's Coca-Cola Valued Youth Program, contact IDRA or visit the IDRA web site at http://www.idra.org.

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Innovations in Intervention Settings

by Katherine Darke and Beatriz Chu Clewell

By the time they reach school, boys and girls have had quite different out-of-school science experiences, and this disparity persists through high school. There are marked differences between male and female levels of participation in extracurricular science activities, with males participating more often in activities such as working on science projects or hobbies.

This lack of informal science experience may negatively affect future learning outcomes in science for girls.

Informal science learning is promoted by activities that occur outside the school setting, are not developed primarily for school use, and require voluntary as opposed to mandatory participation as part of an accredited school experience.

Out-of-school intervention programs offer opportunities for informal science learning in a host of innovative settings that help bridge the gap between girls' everyday lives and science.

Traditional vs. Innovative Settings

With increasing frequency, experimental interventions to make science, technology, engineering, and math (STEM) accessible to girls demonstrate that innovative, nontraditional settings may be key to achieving goals in STEM and gender equity.

"Setting" refers both to the physical location of the intervention (e.g., a museum, zoo, or commercial pharmaceutical laboratory) and to the context in which the intervention is delivered (e.g., through the Girl Scouts or 4-H or neighborhood community center).

A recent review of projects funded by a multimillion dollar government program revealed a range of innovative settings in STEM programming for girls. These nontraditional settings yield new opportunities to capture girls' interest in STEM and STEM careers and, equally important, to engage community resources in STEM and gender equity issues in innovative ways.

Traditional Settings

- Classrooms in schools

Innovative Settings

- Museums and parks
- Health care facilities
- Television and radio stations
- Research facilities
- Government and university laboratories
- Industrial and commercial sites
- Community groups
- Community centers
- Online

Traditional interventions in the classroom include STEM courses (usually at the high school or university level), gender-fair STEM curricula, and gender equity training for educators. These components are integrated into the regular curriculum or school setting with varying degrees of success. The populations engaged in traditional settings are generally limited to educators and students.

Informal and nontraditional settings provide new contexts and opportunities for girls. Specifically, they engage new audiences in community dialogue about STEM and gender equity; involve multigenerational approaches; draw on new material resources; and provide the framework to deliver proven strategies to encourage girls to pursue STEM interests.

Expanding Audiences and Resources

Programs in innovative settings offer opportunities to reach populations other than those reached by classroom-based interventions. These programs may engage whole new audiences – for example, paraprofessional staff at a neighborhood community center or scientists at a government or

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commercial research facility – who have not previously thought about STEM and gender equity.

Outside the traditional one-grade classroom, multiple layers of service recipients and deliverers can be incorporated in innovative settings. For example, older students can be engaged in a learning process that includes leading activities for younger children, transforming the experience into a multigenerational exercise.

In addition, programs in nontraditional settings bring new resources (funds, facilities, technology, human capital) to the gender equity arena. Capitalizing on extant material and personnel resources – assets that are frequently beyond the average school or school district's resources – broadens the scope of STEM experiences available to girls.

Outside resources are particularly valuable in the most underfunded urban and rural districts, where girls have few authentic classroom-based STEM experiences because of lack of materials and equipment.

Intervention Strategies

Innovative settings permit the implementation of proven strategies to engage girls in STEM more effectively than those used in the classroom. Some intervention strategies are particularly suited to innovative settings, particularly mentoring and role modeling, summer camp experiences, internships, and electronic communication.

Mentoring and Role Modeling. This strategy links STEM professionals with girls who have limited knowledge of the availability and relevance of STEM study and career opportunities. Interacting with scientists and engineers from local industry, universities, or research facilities; physicians; nurses; veterinarians; radio and television technicians; and others in technical professions permits girls to see STEM professionals active in the community. Interventions that take place in the work place, such as career-shadowing field trips, are particularly suited to this purpose.

Summer Camp. The opportunity to spend a week or more in a setting that encourages girls to pursue their STEM interests in the company of like-minded peers can be invaluable for girls who do not receive positive support in the traditional school setting. Summer camps sponsored by universities, community groups, museums, or research facilities offer an intensive exposure to STEM concepts and skills, often in more depth than school curricula provide. Personal growth (enhanced self-confidence and STEM self-efficacy) as well as academic accomplishment often result from such summer camp experiences.

Internships. Research in teaching and learning demonstrates that for many students the best way to learn is to do. Engaging girls in the research process through meaningful internships in local industry or universities broadens their horizons, gives them opportunities to learn new skills and demonstrate their proficiencies, provides role model contact with STEM professionals, and sparks personal and academic growth. Early internship experiences may shape the education and career plans of girls as early as middle school, encouraging them to form long-term career goals.

Cyberspace as a New Setting. As technology proliferates, so do opportunities to engage girls in meaningful STEM experiences online. The electronic realm of cyberspace has become a "setting" for STEM interventions in recent years. Several recent interventions centered on helping girls make connections with female STEM professionals via e-mail or the Internet. Although electronic mentoring, or "telementoring," lacks the immediacy of face-to-face relationships between mentors and mentees, the benefits to girls in communities where female role models in STEM are unavailable are very real.

Conclusions

Traditional in-school interventions often benefit participants, but their scope and impact are limited by the structure and resources of the school or school system. In addition to augmenting the number and types of science experiences girls receive, informal science programs in innovative settings offer girls access to "real world" STEM environments, broaden their perspectives, and provide opportunities for more authentic STEM experiences.

Beyond direct benefits to target populations, innovative settings also provide opportunities to engage STEM professionals and others in STEM and gender equity issues. Finally, creativity in intervention settings provides opportunities to draw on new human and material resources beyond those available within schools.

Resources

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terns through play and daily activities. In playing basketball, for instance, they learn that the farther away they are from the basket, the more force they will have to use to make the shot. They have an intuitive understanding of the relationship among distance, force, and jumping height, as they relate to the likelihood of shooting the ball into the basket.

This and other common activities embody a core concept in mathematics: functions. Here is a short list of other instances where the functions concept shows up in children's everyday lives:

- The darker it gets outside (x), the closer it is to bedtime (y).
- The hungrier I am (x), the bigger serving of food I want (y).
- The more I like a certain food (x), the more I want of it (y). The converse is also true. (Think vegetables!)
- The quicker I finish my chores or homework (x), the sooner I can go play outside or watch TV (y).
- The more mud I track in on the kitchen floor (x), the more upset my mother may be (y).
- The volume of my voice (x) needs to change depending on how far away (y) I am from someone.
- If I wake up late for school (time), I must walk at a quicker pace (rate) to get to school (distance) before the bell rings.
- Even though a beach ball is bigger than a basketball (in circumference), the basketball is heavier (weight) and it takes more strength to catch it than the beach ball.
- The bigger the box (x), the better (y) the gift. (Better predictive variables soon get discovered such as shape, weight, and the kind of noise made when shaken.)

Math teachers can connect these functional relationships to school mathematics. Eventually, teachers can focus words, manipulatives, pictures, tables, and graphs to equations. Mining such mathematics experiences, teachers help students see how mathematical ideas from arithmetic, algebra, geometry and probability permeate daily living.

The math classroom becomes an exciting laboratory where experiences

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Highlights of Recent IDRA Activities

In June-July, IDRA worked with **10,054** teachers, administrators, parents, and higher education personnel through **54** training and technical assistance activities and **168** program sites in **nine** states plus Mexico and Brazil. Topics included:

- ✦ Migrant Needs Assessment
- ✦ Social Equity and Educational Leadership
- ✦ Parent Leadership in Education – Students Bridging Technology for Parents
- ✦ Curriculum Development

Participating agencies and school districts included:

- ✧ AVANCE, Inc., Texas
- ✧ Corpus Christi Independent School District, Texas
- ✧ Detroit Public Schools, Michigan
- ✧ Emporia University, Kansas
- ✧ Southern Minority Leadership Conference, Mississippi

Activity Snapshot

After receiving a number of sexual harassment complaints, administrators in a Louisiana school district requested staff training from the IDRA *South Central Collaborative for Equity* (SCCE) on the requirements of the law regarding sexual harassment in schools. The SCCE is the equity assistance center funded by the U.S. Department of Education to serve schools in Arkansas, Louisiana, New Mexico, Oklahoma and Texas. IDRA provided training in sexual harassment prevention to 120 principals and central office staff. As a result, administrators in the district developed campus level plans to ensure that students are protected from discrimination and adult-student sexual harassment. The plans are being implemented districtwide to prevent sexual harassment.

Regularly, IDRA staff provides services to:

- ✦ public school teachers
- ✦ parents
- ✦ administrators
- ✦ other decision makers in public education

Services include:

- ✧ training and technical assistance
- ✧ evaluation
- ✧ serving as expert witnesses in policy settings and court cases
- ✧ publishing research and professional papers, books, videos and curricula

For information on IDRA services for your school district or other group, contact IDRA at 210-444-1710.

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are studied more closely and where students learn more formalized math language and symbolic systems used to communicate their ideas.

Shifting the Question

If we hope to develop students as mathematical thinkers, we must abandon the prevailing deficit view that many students cannot master math. Schools can rethink how math is learned and taught to the benefit of all students. In doing so, teachers can be renewed in the professional satisfaction that comes from succeeding with all students.

The question for schools changes from "Why do *they* not learn math?" to "How do *we* teach math?" This leads us to re-tune our school radar to capitalize on the treasure of experiences that students bring to make the curriculum come alive. By doing so, schools can make good on their promise to educate all children.

Resources

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Harel, G., and J. Confrey, editors. *Development of Multiplicative Reasoning in the Learning of Mathematics* (Albany, N.Y.: State University of New York Press, 1994).

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Math Instruction Resources

Books

Natural Learning and Mathematics
by Joy Edmunds and Rex Stoessiger (Portsmouth, N.H.: Reed Elsevier, Inc., 1995)

Making Sense: Teaching and Learning Mathematics with Understanding
by James Hiebert, Elizabeth Fennema, and Thomas P. Carpenter
(Portsmouth, N.H.: Heinemann, 1997)

Knowing and Teaching Elementary Mathematics: Teachers' Understanding of Fundamental Mathematics in China and the United States
by Liping Ma (Mahwah, N.J.: Lawrence Erlbaum Associates, 1999)

Web Sites

AIMS Education Foundation http://www.aimsedu.org/

Articles on Family Math http://www.math.com/parents/family.html

FigureThis! http://www.figurethis.org/

Lawrence Hall of Science – Teacher Resources
http://www.lawrencehallofscience.org/Publications/

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