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The IMSA© PROMISE: Diverse Perspectives Do Enrich Understanding!

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The Achievement Gap

For years we have grappled with the effects of the Achievement Gap, which has been defined by: (a) the National Assessment of Educational Progress (2011) as the "observed, persistent disparity of educational measures between the performance of groups of students, especially groups defined by socioeconomic status (SES), race/ethnicity and gender; (b) The National Education Association (2013) as differences between the scores of students with different backgrounds (ethnic, racial, gender, disability, and income) are evident on large-scale standardized tests, adding that test score gaps often lead to longer-term gaps, including high school and college completion and the kinds of jobs students secure as adults; and (c) The Great Schools Partnership (2013) as "any significant and persistent disparity in academic performance or educational attainment between different groups of students, such as white students and minorities or students from higher-income and lower-income households." The GSP further defines the achievement gap as having any significant and persistent disparity in academic performance or educational attainment between different groups of students, such as white students and minorities or students from higher-income and lower-income households.

Haycock (2001) indicated that "to increase the achievement levels of minority and low-income students, we need to focus on what really matters: high standards, a challenging curriculum, and good teachers." Limited research has been conducted on achievement gaps among students who perform at advanced levels; the existing research provides evidence that the educational system systemically short-changes certain populations of students capable of reaching high levels of academic performance. Research suggests that high-achieving Black students may be attending schools with less challenging learning experiences and fewer resources. After 5th grade, the gap between students with higher initial achievement increased quickly while the gap between those with lower initial achievement either increased marginally or shrank (Plucker, Burroughs & Song, 2010, p.2).

Middle School: STEM Education

In their work on closing the mathematics achievement gap in high-poverty middle schools, Balfanz and Byrnes (2006) indicated that the United States is falling behind other developed nations in mathematics achievement and that, "the students who are falling behind are from predominately high poverty and/or high-minority areas.…For many high-poverty students the middle grades are a period in which achievement gaps in mathematics become achievement chasms (143). The same may be said for science education.

In its position statement on science education for middle level students, The National Science Teachers Association (2013) recommended a strong emphasis be placed on middle-level science education, "the middle-school years, grades 5 through 9, are a time of tremendous physical, emotional, and cognitive change for students" (para.1). It also is

a pivotal time in their understanding of and enthusiasm for science. Research indicates students may never "find their way back to science" if educators don't capture their students' interest in and enthusiasm for science by grade 7." (NSTA, 2013)

We concur with the Position Statement of Multicultural Science Education by The National Science Teachers Association, "we believe all children can learn and be successful in science and our nation must cultivate and harvest the minds of all children and provide the resources to do so" (NSTA, 2000, para.1).

It is imperative that schools, "… provide science education programs that nurture all children academically, physically and in development of a positive self- concept; children from all cultures are to have equitable access to quality science education experiences that enhance success and provide the knowledge and opportunities required for them to become successful participants in our democratic society; and curricular content must incorporate the contributions of many cultures to our knowledge of science." (NSTA, 2000, para.1)

IMSA PROMISE

Background

The Illinois Mathematics and Science Academy (IMSA) serves diverse student populations through PROMISE (Providing Opportunities for Math and Science Enrichment) Program, a pipeline program featuring pre-enrichment activities in mathematics, science, and technology that are designed to discover and develop diverse STEM talent in underrepresented students—low-income, Blacks, and Latinos— in grades 5-9 from under-resourced school districts and socioeconomically disadvantaged communities. These populations are often characterized by high dropout rates, low levels of secondary education, and poor economic opportunities that combine to yield high crime rates and unstable living conditions (Barton & Coley, 2009).

Since 1995, IMSA PROMISE has served those gifted, disadvantaged and/or minority middle-school students challenged by the combination of economic inequities, academic program deficiencies, and social pressures that define them as "at risk" for future academic success as a direct outcome of their inclusion in these demographic groups.

We believe that introducing these programs early in a student's educational experience to be most effective. These students require access to programs that (a) encourage excellence as opposed to avoiding failure, (b) place a value on learning and education, and (c) create an engaging and relevant learning environment. IMSA PROMISE is designed to meet these three criteria, and is geared to stimulate interest and develop skills in STEM, and challenge and motivate participants toward high achievement. In addition, IMSA PROMISE assists students with overcoming academic deficiencies, and to prepare for advanced study in secondary school programs, whether or not they matriculate at IMSA. Generally, long-term systemic instruction is necessary for PROMISE students to become proficient in knowledge and skills that are the prerequisites to success in an academically-challenging high-school program.

Pipeline of Five Programs

IMSA PROMISE consists of five programs which provide "options for students to further develop their interests and talent, and prepare for advanced study in STEM" (Marshall, McGee, McLaren & Veal, 2011) and feature activities that are curriculum-based and develop skills in problem-solving, communication, collaboration, and making connections between the core subject areas of science, math, and literature. Students participating in the two-week residential summer camp (SEAMS) on the campus of the Illinois Mathematics and Science Academy are exposed to on-campus life and have the opportunity to meet current IMSA students and learn first-hand of the joys and challenges of attending a specialized secondary school in science, technology, engineering and mathematics (STEM).

Research indicates that students begin to identify with subjects as middle-school students and if their interest does not emerge by high school, the likelihood of them pursuing a STEM career is less than those who identify with math and science in middle school and study these subjects in high school (Singh, Granville, & Diak, 2002). Beginning in fifth grade, students with an interest and talent in science and mathematics are identified and referred to IMSA PROMISE, either through student self-identification or by parents or educators. The level of engagement and exposure to curriculum is enhanced within each of the five unique PROMISE programs that are offered annually, and which offer a slightly different method and manner to attract, motivate, and engage students:

Grades 5-8: one day excursion, Project School Visit (PSV). Provides hundreds of students annually with an excursion to IMSA's campus with a "day in the life of an IMSA student," in which they are able to interact with academically high achieving students from similar backgrounds and cultures, engage in inquiry based and problem-centered learning experiences, and perform science experiments in the laboratories.

Grades 5-8: semester program, Leading Students to Success (LS2S). Provides approximately 100 students during their critical decision-making years with an introduction to inquiry-based learning. This cross-age cooperative learning program features mentorships, tutoring, and Illinois Scholastic Aptitude Test (ISAT) preparation. Alumni PROMISE participants who are current IMSA students serve as program leaders.

Rising 9th graders: summer program, Summer Enrichment for Academics in Mathematics and Science (SEAMS). Provides 70 rising 9th graders with a two week summer residential camp experience on IMSA's campus. Students explore the core subjects of mathematics, science, and English around a central theme and are engaged in hands-on activities that are focused on real-world problems, such as energy and conservation.

Grade 9: Early Involvement Program (EIP). Provides 40-50 students with discovery-based and collaborative research activities and preparation for the Scholastic Assessment Test (SAT) during 10 Saturday sessions throughout the school year. Students develop skills in research, decision-making, and self-motivation skills; receive tutoring; and study mathematics, science, literature, and wellness.

Current IMSA students: PROMISE and Excel Extension Program (PEEP).
Provides a personalized approach to the retention of underrepresented (URP) and at-risk students who have not been exposed to as much mathematics and science, but have demonstrated potential and talent. Students who participated in the PROMISE and Excel programs are invited to become members of PEEP, which meets on Sunday evenings during the academic year. Most sessions include 30-minute interactions with IMSA URP alumni, and each involve two hours spent with IMSA faculty members—one hour of science; one hour of mathematics. Those who are struggling at IMSA are connected to alumni who faced similar challenges, but are now successful adults. Thus, PEEP serves to enhance the self-confidence of URP students, thereby minimizing the gifted-student achievement gap. At-risk IMSA students are provided with additional academic and emotional support to enable their academic success and retention. As upperclassmen, PROMISE and Excel alumni serve as tutors and mentors for sophomores, and this in turn provides opportunities for leadership and mentoring. PEEP increases the retention of these URP students.

Goals and Objectives
PROMISE is an integrated, cooperative learning pre-enrichment program that includes PSV, LS2S, SEAMS, EIP and PEEP with the following goals and objectives:

Short-term goals. Include: (a) provide enriching academic experiences that create academic growth and stimulate interest in STEM, expose students to subject content in mathematics, science, and language arts utilizing problem-centered, inquiry based, and collaborative, integrative methods; (b) facilitate interaction with and instruction from high school students who are interested and gifted and talented in science and math (IMSA students), who are also of the same culture and background; (c) provide a residential experience similar to IMSA's secondary school, demonstrating student life on campus; (d) enhance critical thinking skills and improve test-taking skills for the ISAT and in anticipation for taking the SAT; (e) assist students in overcoming deficiencies in academic preparation necessary to attend and succeed in any advanced secondary-school program and increase their competitiveness if they choose to apply to IMSA; (f) provide continuously challenging learning experiences in STEM through retaining students in IMSA pipeline; (g) provide leadership programs and support the retention of PROMISE students currently attending IMSA.

Long-term goals. Include: (a) increase the number of students from underrepresented populations who apply to and are accepted for admission into secondary STEM programs, such as IMSA; (b) increase the number of students, especially those from underrepresented populations, who pursue college majors and careers in STEM.

Outcomes. Research indicates that the goals and objectives of IMSA PROMISE are being met and the results are encouraging and impressive. The majority of the Black and Latino students currently enrolled at IMSA have participated in one or more of the PROMISE programs. IMSA student retention is 100% for those completing the five-program PROMISE pipeline; and IMSA has retained approximately 90% of students who completed at least one PROMISE program. Many alumni of these programs indicate that IMSA PROMISE increased not only their interest, but boosted their confidence in

science, technology and mathematics and this reflected in IMSA's most recent survey of PROMISE-SEAMS 2013:

What role did PROMISE – SEAMS play in developing your interest in the following (1= No Role, 4 = Neutral, 7 = Primary Role)?

	1	2	3	4	5	6	7	Total
Mathematics	3.13%	1.56%	3.13%	17.19%	17.19%	12.50%	45.31%	
	2	1	2	11	11	8	29	64
Science	4.69%	1.56%	1.56%	17.19%	18.75%	17.19%	39.06%	
	3	1	1	11	12	11	25	64
Technology	4.69%	4.69%	4.69%	25%	20.31%	12.50%	28.13%	
	3	3	3	16	13	8	18	64
Groupwork	1.59%	0%	3.17%	22.22%	17.46%	28.57%	26.98%	
	1	0	2	14	11	18	17	63

Since starting PROMISE – SEAMS, my confidence about each of the following has:

	Decreased	Stayed the Same	Increased	Total
Mathematics	3.17%	17.46%	79.37%	
	2	11	50	63
Science	1.59%	15.87%	82.54%	
	1	10	52	63
Technology	1.61%	37.10%	61.29%	
	1	23	38	62
Groupwork	1.59%	28.57%	69.84	
	1	18	44	63

In addition, many IMSA alumni who participated in the PROMISE programs and the pipeline were STEM majors in college and/or entered STEM career fields. IMSA attributes much of this retention to the PEEP program and the PROMISE alumni who are current IMSA students that provided leadership for the PROMISE programs.

Designing a PROMISE Pipeline: What We Suggest

Although unique to the Illinois Mathematics and Science Academy, PROMISE is a prototype of an adaptable educational program model. After nearly two decades of working with diverse Illinois student populations, we have learned much and offer the

following design features for developing similar successful programs that ignite and nurture the educational needs of underrepresented and underserved students:

- Begin the pipeline at 5th grade or earlier and encourage progression through the pipeline;
- Provide Saturday and summer enrichment activities that include educational and social field trips. If feasible, include an afterschool component;
- Work with community organizations, churches, schools, teachers, counselors and school administrators to identify and recruit potential participants;
- Recruit culturally competent faculty/staff (some of whom share a common background with the participants) to develop and implement curriculum;
- Encourage PROMISE alumni to stay connected with the program as mentors or tutors;
- Utilize an inquiry/problem-based teaching and learning approach;
- Include a mentorship component so that the participants stay connected to the pipeline;
- Hold retreats in which parents, teachers and students are participants;
- Provide internship and research opportunities for older students;
- Seek diverse funding sources.

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