

White Paper:

A Preliminary Assessment of the
Illinois Mathematics and Science Academy

By Jeffrey R. Paine

For Dr. Patty Byrnes
PAD 603—Advanced Seminar in
Spring Semester, 2006
May 11, 2006

Introduction

What to do with gifted and talented students? Although these exceptionally academically able students make up only slightly more than 6 percent school-age children (NCES, 2004) the debate over whether, and how, to provide services for this group has been continuing for at least the last four decades. This is an important issue because, some argue, the nation's political, social and economic future depends upon developing these students to their fullest potential. The nation's current educational system, the supporters argue, is stunting these students because it is not offering the creative and challenging education that is required to maximize development of their talents. Others argue that devoting scarce educational resources to students whose abilities are already far above the norm is misguided in a time when schools are not adequately preparing students to participate in our nation's social, political and economic life. Giving more to those who already have an advantage will simply reinforce elitism in our nation. Despite years of research and argument on both sides, there has been resolution to the debate.

This paper will look at one policy option that Illinois has implemented, the creation and operation of a specialized residential high school designed to challenge and develop some of the best students in the state. Information on this school—the Illinois Mathematics and Science Academy (IMSA)—will be assessed using some of the evaluation criteria advanced by Byrnes (2006) and others (such as Weimer and Vining, 2000), and compared with data from other public high schools in Illinois, as well as a number of similar state programs across the country. The focus will be on understanding the goals that the state is trying to achieve through IMSA, whether the school is achieving those goals, and whether the benefits of the school outweigh the costs. The questions of overall educational reform and of educational programming specifically for the gifted and talented, while interesting and relevant, will only briefly be addressed here.

Also only briefly addressed in the current work is the historical origins and development of the IMSA and similar programs.

General Description

The IMSA is a residential three-year high school, owned and operated by the Illinois State Board of Higher Education (IBHE). It is located in Aurora, Illinois, in the midst of what state officials have designated as the “high-tech” corridor west of Chicago, an area intended to encourage research and high-technology manufacturing organizations to locate and expand facilities within the state. The Illinois General Assembly created the school in 1985, with support of Gov. James R. Thompson and legislative leaders, including House Speaker Michael Madigan. The school opened in 1986, and honored its first graduates in 1989. The school offers a curriculum rich in mathematics and science intended for the scholastically highest performing students in the state.

Illinois was the fourth state to approve and third state to open such a school, following North Carolina in 1980 and Louisiana in 1983 (Oklahoma’s school opened in 1990). In the ensuing quarter century since the North Carolina school opened, about half of the states have considered proposals to open similar math/science-oriented programs, and 14 states have done so (Georgia has opened two; see table 1 below). The most recent was Missouri in 2000.

In August 2006, the Illinois Mathematics and Science Academy (IMSA) will begin its 20th year of operation with almost 650 of the best and brightest students in the state, continuing to carry out its original legislative mandate:

“IMSA was established in 1985 by the General Assembly for two purposes—to provide a uniquely challenging education for Illinois students talented in math and science, and to serve the school system of the state as a catalyst for the advancement of math and science education.

“IMSA’s mission is to transform mathematics and science teaching and learning by developing ethical leaders who know the joy of discovering and forging connections

Table 1. Selected characteristics of residential Specialized Secondary Schools for Mathematics and Science

School	Type	Open	Enroll	Grades	In-state Tuition	OOS Tuition	R&B	Fees	\$ Per-student	Budget
North Carolina	HS	1980	~600	11,12	Free	DNA	Free	Free	?	
Louisiana	HS	1983	400	11,12					?	
Illinois	HS	1986	620	10,11,12	Free	DNA	Free	\$1,500	\$33,650	\$21.2 mil
Texas	ECE	1988	378	11,12	Free	DNA	\$5,113	\$1,300	\$10,806	\$4 mil
Mississippi	ECE	1988	~270	11,12	Free	DNA	Free	minor	?	
South Carolina	HS	1988	~300	11,12	Free	DNA	\$1,000	minor	\$23,333	~\$7 mil
Oklahoma	HS	1990	134	11,12	Free	DNA	Free	Free	?	
Indiana	HS	1990	300	11,12					?	
Alabama	HS	1991	300	10*,11,12	Free	DNA	Free	\$1,000	?	
Arkansas	HS	1993	~270	11,12	Free	DNA		\$170-\$505	\$25,519	\$6.9 mil
Georgia (AAG)	ECE	1995	67	9*,10*,11,12	\$1,219	\$4,877	\$2,500	\$416	\$4,135-\$7,793	\$522,131
Maine	HS	1995	150	9,10,11,12	Free	\$21,500	\$4,500		\$26,000	\$3.9 mil
Georgia (GAMES)	ECE	1997	27	11,12	(\$5,365 total)	\$9,358 total			\$5,365-\$9,358	\$252,666
Iowa	ECE	1999	~23	12	(\$15,142 total)	\$26,528 total			\$15,142-\$26,528	\$610,000
Missouri	ECE	2000	102	11,12	Free (\$7,200 value)	DNA	\$6,200-\$6,500		\$15,686	\$1.6 mil

* A limited number of students from lower grades may be admitted based on academic and social achievement.

within and among mathematics, science, the arts, and the humanities by means of an exemplary laboratory environment characterized by research, innovative teaching and service.” (IMSA, 2005a)

According to the U.S. Department of Education, there were about 607,000 secondary public school students (defined as students enrolled in grades 9 through 12) enrolled in Illinois high schools during the 2003-2004 school year (NCES, 2006). The Illinois State Board of Education (ISBE) for the 2002-2003 school year reported that almost 64,300 (about 10.6 percent) Illinois secondary students had been identified as gifted/talented (ISBE, 2003). IMSA’s roughly 640 students therefore amount to about 0.11 percent of Illinois’ secondary students, and about 1.0 percent of the state’s gifted and talented secondary students.

Residential specialized schools such as IMSA represent just one of several educational options for gifted and talented students that exist on a continuum from no dedicated services at all at one extreme to the residential schools at the other. First, there is a smaller group of residential specialized schools similar to the math and science academies that have thematic foci in other areas, such as liberal arts, the humanities, the fine and performing arts, and so on. Next, there are more than a hundred other high school programs with a math, science, and/or technology theme, and at least that many more that have other thematic emphases. Most of these programs fall into one or more of the following operational categories. Some are run by individual school districts (e.g., Stuyvesant High School in New York) or consortia made up of districts within a region in one state (e.g., the California Academy of Mathematics and Science). Some programs provide half-day specialized instruction (e.g., the Central Virginia Governor’s School) for students who spend the other part of the day in their home schools, while others are full-day magnet schools with full high school curricula (e.g., Von Steuben Metropolitan Science Center in Chicago). Finally, and by far the most common, there are a variety of enrichment and

advanced placement classes within non-specialized high schools, including self-contained programs dedicated to a small cadre of gifted students. Many of the enrichment courses are offered after school, on weekends, and during the summer.

Almost all of these schools and programs were created within the last four decades. The earliest residential schools were created in the early 1960s (Earlyentrance.org, 2006), while magnet schools, for example, evolved during the 1960s and 1970s in response to the need for desegregation and other pressures (Waldrup, 2006). The first charter school (a privately operated public school) opened in Minnesota in 1991 (Detrich, Phillips and Durrett, 2002). According to the NCES, in 2003, the fraction of public school students attending a “chosen” school (meaning either a magnet or charter school) instead of their assigned school was 15 percent, up from 11 percent in 1993 (NCES, 2006). The fraction of students served by totally private schools in the U.S. has not changed significantly in the last several decades, despite much rhetoric about the advantages of private schooling. In 1970, 10.5 percent of students attended private schools, and the rate had fluctuated slightly while increasing to only about 11.5 percent by 2002. U.S. Department of Education predictions for 2013 show slight fluctuations and growth to perhaps 11.7 percent (Census Bureau, 2006). The fraction of schools, and even of programs within schools, aimed at gifted students, and specifically at those interested in mathematics and science, remains a fraction of the total.

Aside from some articles written primarily by faculty and staff at the specialized schools (Eggebrecht et al, 1996; Marshall and Hatcher, 1996) on various aspects of their programs, there has been little peer-reviewed research published on the residential secondary schools. What has been published is primarily interschool comparisons of characteristics and curricula (Green, 1993; Stephens 1998; Sethna et al, 2001; Boothe et al, 1999), admissions practices (Jarwan and

Feldhusen, 1993), student characteristics, especially socialization issues (Jones et al, 2002; Dixon, Cross and Adams, 2001), and educational and life outcomes of students (Hagedorn et al, 2002; Dorsel and Wages, 1993). These appear primarily in journals devoted to the field of gifted education, such as the *Journal of Gifted Secondary Education*. Green (1993), in his summary of the then-existing programs, cited the lack of peer-reviewed literature on the financing, budgeting and economics of these facilities. He noted that at that time, it might have been “too soon” since the first schools opened to get meaningful and stable budgetary and other figures. There has been essentially nothing published in the literature to remedy this shortfall in the past dozen years. Indeed, there seems to be little literature on any aspect of the economics of education for the gifted and talented. Nor has there been any published study on the schools’ goals and whether they have achieved those goals.

Findings

Approach to problem

The paucity of detailed studies on budgeting and operational factors in peer-reviewed journals, when combined with the lack of complete and uniform reporting from the schools on their operations in publicly available reports and documents makes this analysis a challenge. It is obviously an under-investigated field that will warrant future attention. Because of the lack of comprehensive and comparable data, this project is a case study/comparison that looks to a variety of sources to derive a sense of what the IMSA was created to achieve, whether or not it is achieving those objectives, and the cost of doing so. Some of the comparisons will illustrate potential alternatives to specialized residential schools such as the IMSA, because if these alternatives can provide similar results at lower costs, that suggests that IMSA might not be the

best way to spend state tax revenues. To evaluate the IMSA, existing data and estimates derived from comparison sources will be used. These data and estimates will be compared to evaluative criteria, such as those presented by Byrnes (2006) and Weimar and Vining (2000). These criteria are used to evaluate policies based on factors of economic efficiency, effectiveness, equity, political accountability and acceptability, and so on.

Comparison of individual programs

While IMSA can be compared with other residential programs, it can also be compared to the plethora of other math and science oriented programs that have grown up in Illinois over the past two decades, especially the dozen or more math, science and technology academies operated by the Chicago city school district, including at least two public charter schools. The Chicago city schools operate a number of other advanced placement programs, in some cases more than one in a school, including in math, science and technology (8), finance (4), career (formerly vocational-tech prep) (12), fine and performing arts (6), international baccalaureate (12), international language and careers (8), Junior Reserve Officer Training (30) and military (12), law and public safety (4), medical careers (2), and technology (6). There are also eight “selective enrollment” high schools for the city’s most academically advanced students, as well as a number of others styled as “college prep” schools for moderate-achieving students (Chicago School District, 2006). Some of the programs not only provide advanced placement and accelerated classes, but allow some students to move to higher grades ahead of their age-mates based on academic and social achievement. Thus, throughout the Chicago district, a broad range of talents, interests, and student capability levels are provided for in different schools.

Data sources on the IMSA

There are three primary sources of statistics and other information on the IMSA used in this project: 1) official reports, such as the Fiscal Year Performance Review, mandated by the Illinois Board of Higher Education (IBHE) under its *Illinois Commitment* policy; 2) promotional documents, such as the school's annual report and other informational materials designed to help recruit new students; and 3) information from second-hand sources, such as journal and popular press articles. This latter category is not used extensively in this report because so little of the material available is relevant to the question of school mission, objectives, achievement and cost. The IMSA declined to respond at all to specific requests for information for this project. All information presented here comes from sources in the first two categories that were available online at the school's web site, www.imsa.edu, or the IBHE. Comparison data from other residential schools was collected from online sources (mostly the schools' web sites, but also a number of articles, both peer-reviewed and general media) and the few institutions that responded to a request for information. Contextual information was collected from the U.S. Department of Education, the Illinois State Board of Education, the Census Bureau, and other federal and state agencies as cited. Again, this was supplemented by journal and popular media reports, including websites of various organizations with interests in gifted and alternative education.

Analysis

Mission statement, objectives, goals and measures

The original mission statement and statement on legislative intent appears on almost all annual reports and many other documents related to the school (IMSA 2004, IMSA 2005a). Quoted above, this provides two sets of objectives that could conceivably be measured. Specifically, the IMSA mission statement is to “transform mathematics and science teaching and

learning by developing ethical leaders.” This is to be done “by means of an exemplary laboratory environment characterized by research, innovative teaching and service.” The statement on General Assembly purposes states that IMSA is “to provide a uniquely challenging education for Illinois students talented in math and science,” and to “serve the school system of the state as a catalyst for the advancement of math and science education.” IMSA does not directly connect this mission statement and broad objectives to actual goals or measurable outcomes, however.

Instead, IMSA uses as its framework for setting measurable goals and outcomes a document called “The Illinois Commitment,” (IMSA 2005a). According to the IBHE, the Illinois Commitment is “the state’s strategic plan to guide higher education through the first decade of the millennium.” Originally developed in 1999 and revised in 2004, the Commitment “provides a framework that enhances accountability and communication efforts for higher education stakeholders,” (IBHE, 2004). The Commitment is “premised on the conviction that higher education provides the foundation for Illinois’ future by enhancing the social, economic, and civic well-being of the state and its residents.” This is accomplished by pursuing goals in six broad policy areas: economic growth, partnerships with primary and secondary education, affordability, access and diversity, high quality, and accountability and productivity. The IBHE provides direction for its various units (mainly colleges and universities) on the kind performance indicators and the manner in which they should be presented. As a unit of the IBHE, IMSA is required to construct its performance reports in accordance with the objectives and performance indicators established in the Commitment. The directions for completing this Performance Report are somewhat different for IMSA than the colleges and universities, as the operation and purpose of a high school differ from facilities of higher education.

Thus, there are five broad objectives derived from the mission statement and legislative intent, plus six set by the IBHE’s Illinois commitment. Of course, these may overlap: transformation of math and science education; development of ethical leaders; in an exemplary laboratory environment; providing a challenging education for talented students; serving the public school system as a catalyst; assisting the state’s goal of encouraging economic growth; forming partnerships with other education organizations, such as primary, secondary and post-secondary schools; affordability for those attending; ensuring access and diversity of individuals seeking and using higher education services; high quality in providing services; and accountability and productivity.

Statistics offered as measures of success

IMSA offers a number of different statistics as evidence of its level of accomplishment. Some of these are presented in its Performance Report, while others are highlighted in annual reports or other documents used in recruiting and other public relations activities. The following table compares the 11 identified goals with the indicators used by IMSA, as well as those suggested by this study.

Objective	IMSA Indicator	School Report Cards
Transformation	None provided	Data not reported
Develop ethical leaders	Mention in annual reports and elsewhere of speakers and courses in leadership and service	Data not reported
In Exemplary Lab -Research -Innovative teaching -Service	Annual reports highlight program and individual activities each year in fulfillment of this objective	Data not reported
Challenging education	Course offerings, grades Tests taken, composite scores	Course offerings Tests and composite scores
Education system catalyst	None provided	Data not reported
Economic growth	1) Grads declaring STEM major 2) Incentives to grads from Ill. colleges and universities	Data not reported
Partnerships	1) Schools and educators participating in systemic professional development 2) Use of IMSA on-line resources	Data found only on Chicago Card supplements

	<p>and tools by students and teachers</p> <p>3) Educators participating in professional dev. Programs</p> <p>4) students participating in long-term learning programs</p>	
Affordability	<p>1) Merit-based aid to grads from “selective colleges”</p> <p>2) Percent of grads receiving aid by college tier</p>	<p>Educational and total operating costs and costs per student (District level, plus individual school in Chicago); Scholarship information not included</p>
Access/Diversity	<p>1) percent of applicants and accepted students from under-represented ethnic groups</p> <p>2) completion rates by race/ethnic classification</p> <p>3) increase participation in advanced STEM courses by females, African-American and Latino students</p> <p>4) increase number and diversity of teacher participants</p> <p>5) increase number and diversity of student participants</p> <p>Annual reports include student breakdown by gender and race/ethnicity; Earlier reports included broad geographical breakdown of origin (i.e. “Chicagoland/Metropolitan area” and “Other areas of Illinois.”)</p>	<p>Student racial/ethnic breakdown by percent</p> <p>Teacher racial/ethnic breakdown by percent</p>
High Quality	<p>1) number of IMSA students engaged in formal inquiry, research, and leadership development</p> <p>2) diversity of IMSA employees</p> <p>3) increase number of faculty certified by National Board for Professional Teaching Standards</p> <p>4) improve quality of learning experiences (No measure given)</p> <p>5) increase traditional and non-traditional measures of success (test scores, etc.)</p>	<p>Teacher characteristics by percent</p> <p>Average class size, staff to student ratio, time devoted to core subjects, subject test scores</p> <p>Chicago schools supplement: external partnerships, specialty programs offered, courses offered</p>
Accountability/Productivity	<p>1) reallocate funds to strategic initiatives (no measure given)</p> <p>2) increase student, educator, parent satisfaction with IMSA (No measure given)</p> <p>3) increase efficiency and productivity of operations (no measure given)</p> <p>4) increase contracts/grants and donations (in addition to GRF appropriations)</p> <p>5) participant fees and contracts</p> <p>In annual report, includes revenue</p>	<p>Teacher, administrator salaries average</p> <p>Revenue by source and expenditure by funds</p> <p>NCLB Adequate yearly progress and improvement plan</p>

	by source and expenditure by item (i.e., personal services, equipment, commodities, etc.)	
--	---	--

Diversity of applicant pool and student body

IMSA apparently does not disclose the actual number of applications it receives each year; certainly, the number does not appear in any of its promotional literature and none of the official reports reviewed for this project. There is an estimate of at least 1,000 applications for the roughly 240 openings available each year (Wikipedia, 2006). South Carolina reports an applicant-to-admitted ratio of 4 to 1, for example (SCGS, 2002). At study by xxx (xxx) reports ??? in relation to alleged reverse discrimination at the North Carolina school. IMSA does report the percentage of applicants by membership in “underrepresented groups,” (which includes African Americans, Hispanics, and mixed-race individuals together) and the percentage students enrolled on the same basis. As a mission-specific indicator for Goal 4.1 under the Illinois Commitment, the school reports that in 2003-2005, the percentage of the applicant pool from underrepresented groups was 15, 16.4 and 16.3 percent, while the percent of admitted students from these groups were 14, 18, and 16.5 percent, respectively (IMSA, 2005a). Year in and year out, the gender ratio is approximately 50-50, with slight variation (IMSA, 2005c). In 2005, the student population of the academy was 44 percent white, 37 percent Asian, 7 percent African American, 5 percent Hispanic/Latino, 5 percent multiracial and 2 percent not reported (IMSA, 2005d). By comparison, the K-12 student population of Illinois is about 56.7 percent White, 3.7 percent Asian, 20.3 percent African-American, 18.3 percent Hispanic, and 0.7 percent multiracial (ISBE, 2005). Thus, Whites, African-Americans, and Hispanics are underserved by IMSA compared to their proportion in the student population (at about 77, 34, and 27 percent of their incidence), while Asians are over-represented by a factor of 10, and multiracial students by

a factor of 7. Interestingly, while IMSA (2005a) breaks down its teacher and student outreach populations by location in Chicago, the metropolitan suburbs, or “Greater Illinois,” nowhere in the available documents does it do this with the reported applicant pool or its admitted students. Instead, the metropolitan area is aggregated into “Chicagoland,” or “Metro Chicago Area” while the rest of the state remains separate (IMSA 2003, 2004, and 2005c).

Testing achievement

IMSA students take a variety of tests, and overall results appear in official reports and promotional materials for the school. Students take PSAT, SAT, ACT and Advanced Placement tests. Under Goal 5.5 of the performance report, the school average of these scores is reported (IMSA 2005a), while the mean scores are reported and compared to the Illinois and national college-bound senior means (IMSA 2005c). IMSA does not offer advanced placement courses, but students frequently take AP tests as an indicator. In 2005, 293 students took 461 AP tests, and 80 percent scored 3 (passing) or higher (IMSA 2005d).

National Merit Scholarship competition and other honors competition performance

One of the most prestigious awards for high school students to earn is the National Merit Scholarship. In 2005, some 50,607 Illinois students entered the competition: 1,763 were commended, and 696 were selected as semifinalists (National Merit Scholarship Corporation, 2006). The organization also conducts a National Achievement Scholarship program. The IMSA class of 2005 included 65 receiving National Merit commendations (about 3.7 percent), and 44 being National Merit finalists (about 6.3 percent). Three others were National Achievement finalists (IMSA, 2005d).

In other competitions, there were six Intel Science Talent Search semifinalists, of which three became finalists; and four Siemens Westinghouse regional semifinalists, of which one

became a finalist. In addition, several other students won awards in other regional competitions, or presented research projects at conferences (IMSA, 2005d).

Amount of scholarships and grants awarded to graduates

Although the IMSA touts the value of scholarships won by its students, and monitoring of grants and scholarships is part of the schools' performance reporting, the figures reported are incomplete at best. In 2004 and before, graduating students self-reported the value of all scholarships and grants offered, whether based on merit or need, and whether or not they were accepted. That is, if a student received acceptance from five universities, and four of the schools offered financial incentives to attend, the total value of the offers was reported, not just that from the accepted school. The school reports that not all graduates chose to report. Beginning in 2005, the students were asked to voluntarily self-report the number and amount of merit scholarships received only. The number of students reporting, and the amount reported, fell considerably from prior years (IMSA, 2005a). While information on graduate grants and scholarships might be enlightening, and even a significant indicator of school and student performance, reporting to the school apparently cannot be mandated. The published figures are therefore not reliable as a measure.

Colleges and universities attended

The IMSA reports that of the graduating class in May 2005, 207 of 208 students enrolled to attend 76 different four-year colleges and universities in the fall 2005 (IMSA, 2005d). Some 62 percent enrolled as mathematics, science or technology majors. Ten of the universities were in Illinois, 63 in other states, and three outside the United States. In all, just slightly over 50 percent of the graduating class enrolled at colleges and universities in Illinois. The largest fraction—71, or 34 percent—enrolled at the University of Illinois at Urbana-Champaign. The next highest are

Case Western Reserve University and Northwestern University, each with 11 graduates (5.3 percent). Fifty of the colleges enrolled only one graduate, while 14 enrolled two graduates from the class (IMSA, 2005d).

From the last three graduating classes (2003-2005), there were 24 colleges or universities with four or more graduates enrolled, matriculating 421 of the IMSA's 615 graduates (about 68 percent). Only nine schools enrolled 10 or more graduates. UIUC again was the leader, with 202 graduates (just under 33 percent) enrolled. Northwestern University was again in second place, with 28 graduates (4.6 percent), while the U of I –Chicago was in third, with 24 graduates (2.9 percent). The eight Illinois universities on this list enrolled 297, or just over 48 percent of the graduates. The top three out-of-state schools were Washington University (20; 3.3 percent), Case Western Reserve University (18; 2.9 percent), and the Massachusetts Institute of Technology (11; 1.8 percent) (IMSA, 2005d).

Students and teachers reached via outreach programs

IMSA has helped develop a number of outreach programs for students in other Illinois schools and for Illinois' teachers. These include but are not limited to (from IMSA 2005c; 2005a):

- * 21st Century Information Fluency Program, funded by a U.S. Department of Education grant that provided training on internet research techniques to 850 educators from 390 schools.
- * Problem-based Learning Network, which provides professional development for teachers through summer institutes, conference presentations, classroom mentoring, seminars, and an online network. This program also includes a summer program for sixth through ninth graders.

* Excellence 2000 is an after-school enrichment program for middle-school students interested in mathematics and science. Some 719 students were taught in 2005 in their home schools by teachers who received professional development via IMSA.

* Kids Institute includes several enrichment programs for 2nd through 8th graders that integrate science, mathematics and the humanities. The programs are designed and delivered by IMSA students under the direction and support of IMSA staff. In 2005, more than 4,900 children participated.

* Illinois Virtual High School (IVHS), which provides coursework and other resources to high school and some middle school students throughout the state via the internet. IMSA was a founding partner, and now manages and administers the program on behalf of the ISBE. During the 2004-2005 school year, about 2,260 Illinois students made use of the IVHS.

In 2005, more than 1,200 educators and more than 8,400 students took part in IMSA outreach programs (IMSA 2005a). The 1,200 teachers are about 0.6 percent of Illinois' teachers. The students represent about 0.4 percent of the Illinois student population. Among educators, just over 50 percent were from the suburban Chicago area, with 16 percent from Chicago, and almost 21 percent downstate. The balance were out-of-state. Almost 87 percent of educators participating were White, and almost 10 percent were African-American. They were from 156 districts, or just 17.5 percent of the state's 892 districts, and 273 (6.4 percent) of the state's schools.

For students, more than 47 percent were from Chicago, and almost 31 percent were from downstate. By race and ethnicity, 44 percent were white, almost 23 percent were Hispanic, almost 18 percent were African-American, and just over 10 percent were Asian. More than half were in grades K-5, and almost 38 percent were in grades 9-12. The number of participating

districts and schools was not reported for students. The IMSA (2005a) notes that “students who are not within a reasonable driving distance from the Academy have traditionally had limited opportunities for participation.” This suggests that most student participants were from the northeast quadrant of the state, probably within a roughly 100-mile radius of Aurora.

Interestingly, the percent of legislative districts with participants was reported as an indicator for both teachers and students. In any given year, it appears that only a legislative few districts are not represented. Also, the 2005 Performance Report includes data for the 2003 and 2004 school years. In many categories, the variables show considerable year-to-year differences. For example, while 47 percent of the students served in 2005 were from Chicago, 22 percent from the Chicago Suburbs, and 31 percent from Greater Illinois, in 2003, the percentages were reported as 12, 67 and 21 percent, respectively. By grade, 63 percent were K-5 students in 2003, but only 8 percent were in 2004, before rebounding to 53 percent in 2005. Almost a third were grade 6-8 students in 2003, nearly 80 percent were in 2004, before dropping to less than 20 percent in 2005. Less than 5 percent in 2003 were 9-12 students, but the percent increase to more than 12 percent and to almost 28 percent in the last two years. No explanation is given for this magnitude of variation.

IMSA Financing and budget

The IMSA is typical of the residential math and science schools, as it is funded through the IBHE, which has jurisdiction over the state’s colleges and universities, instead of the Illinois State Board of Education (ISBE), which has jurisdiction over primary and secondary education, including all public high schools in the state. Most other states with residential programs also opted for this arrangement, attaching their schools either to a state agency of higher education or directly to a state college or university. The IMSA budget of about \$21 million is therefore

nestled inside an agency budget of more than \$8.5 billion (IBHE, 2006). The proposed 2007 budget gives the ISBE about \$8.7 billion for its programs (ISBE, 2006); much of this is the channeling of federal and state education funds to local districts. Placing IMSA under the IBHE also seems to isolate the program from the existing institutional players and requirements in secondary education. For example, the IMSA does not have to file reports to the ISBE, and does not have an annual report card (ISBE, 2005).

The IMSA budget appears to have always been high compared to the other schools. A 1998 study (Stephens, 1998) note that the legislative budgets of the then 11 residential schools ranged from a low of about \$1.4 million for Maine to a high of about \$13.2 million for IMSA, and that most of the budgets were between \$3 million and \$7 million at that time. The IMSA figure means the cost per student covered by the General Assembly from General Revenue Funds at that time was about \$20,900. If the mean budget for the 11 programs was about \$5 million (speculative, as the study does not specify by school or total), then the mean total cost of educating each of the 3,366 students enrolled at the time of that study was about \$16,200. The median budget, however, was about \$7.25 million, making the median per-student budgeted cost about \$23,700 per year. This is likely below the actual spending per student, as some of the schools included in the study—such as the IMSA—also receive funding through grants and other sources.

In fiscal year 2004 (academic year 2003-2004), IMSA had operating resources totaling almost \$21.5 million (IMSA, 2005b). About \$14.2 million of that came from the state's General Revenue Fund, while about \$1.7 million came from fees and other revenues (including a \$1,500 per student fee). Another \$4.3 million was derived from governmental grants and contracts, and \$1.3 million from private grants and contracts. The 2003-2004 academic year total divided by

640 students (the reported enrollment that year), gives a total per student operating cost of about \$33,600. Total cost per student figures reported or estimated for other residential schools in table xx are as low as \$4,135 for the Advanced Academy of Georgia, to as high as about \$23,300 for the South Carolina Governor's School. IMSA is thus about 44 percent higher than the next highest, and about eight times higher than the lowest reported cost.

This is also considerably higher than the average cost of education per student in Illinois, which in the 2004-2005 school year was just under \$8,800 (ISBE, 2005). However, a better comparison might be the operating cost per student of high-school-only districts, rather than comparing with elementary only and unit districts, both of which include the cost of elementary education. During the 2002-2003 school year, the per-student operating costs ranged from a low of about \$6,500 to a high of about of about \$17,300, with the median of about \$9,600 a year (ISBE, 2003). The table also includes operating costs from a selection of other Illinois high schools, including a rich suburban Cook high-school only district (New Trier), Naperville Central High School, and Aurora East and Aurora West high schools, which are in separate districts. The IMSA is located in a campus next door to Aurora West High School. Another source of comparison is high schools in the Chicago Public School district. The CPS places a supplement at the end of their school report cards that gives each school's budget and per-student operating cost for the year. The selected Chicago high schools in table xx include five science magnet programs and one selective enrollment high school. The budgets range from a low of \$4,019 to a high of \$9,250 (Chicago Public Schools, 2005).

In order to estimate the fraction of the IMSA's resources spent on education on the one hand and room and board on the other, we can use several methods. First, we can assume that the outreach and research activities are covered primarily by contracts and grants from the federal

and state governments, and private organizations (totaling \$5.6 million in 2004). If this is the case (and it is not necessarily so), then the remaining \$15.9 million must cover both the cost of education and room and board for the students. This works out to just over \$24,800 per student. If we then assume that the per-student operating expenditure at IMSA is between the high and low limits of secondary district spending, then it is between about \$6,500 and \$17,300 (ISBE, 2003). From this, we can estimate that the cost of student room and board is in the range of \$18,300 on the high end (if the education costs are low) to \$7,500 on the low (if the education costs are high). At the mean expenditure of \$9,600, room and board for IMSA students would be about \$15,200. We can compare this range of estimates to the room and board charges reported by other residential schools, which range from a partial fee of \$1,000 charged by the South Carolina school, to a top of \$6,500 reported by the Missouri program. The room and board estimate for UIUC incoming freshmen is about \$7,000 (University of Illinois, 2005). If we assume this is the correct room and board cost, it would mean that the cost of educating a student at IMSA is about \$17,800 a year, making the IMSA among the most expensive public high schools in the state. However, this is more in line with out-of-state freshman tuition charged at UIUC, which was about \$19,380 (University of Illinois, 2005). Out-of-state tuition is usually understood to reflect the unsubsidized average cost of a student's education.

Unfortunately, the available information on IMSA spending is rather sparse. The figures are broken down by the broadest of line items, and not at all by programmatic activity. About 61 percent of the budget went for personal services, 25 percent for contractual services, and 5 percent for permanent improvements. The remaining 9 percent went for equipment, commodities, other expenses, telecommunications services, and travel.

Recommendations

Future research

Certainly in the case of the IMSA, and apparently for almost all of the residential schools, there appears to be a lack of complete and easily available data on applicants, admissions, budgeting, program costs and returns on investment. Schools in regular districts (traditional, magnet, and charter) are required by federal law, and in most cases, state law as well, to report certain data for inclusion in public “report cards” that present a fairly uniform set of data for schools and districts within each state, and across the states. For the most part, it appears that the residential schools are exempted from this process, and therefore the data found for this project is far from uniform. The immediate need is for a research effort to determine accurate, timely and uniform information on the operation of each of the residential schools, information that can be compared directly with the information reported on other public schools. In several instances in early-1990s literature on the schools, the writers noted that it was “too soon” since the first schools were founded to conduct such detailed fiscal and microeconomic analyses. Today, more than a decade later, such analyses should have long-since been undertaken and the results published and incorporated into the ongoing policy debates on school reform and gifted education. The present analysis, based on incomplete and non-uniform sources of information, is suggestive but by no means conclusive. It shows the need for more and better data, and from them, more complete analyses.

Policy alternatives

State and local officials have considerable responsibility for deciding and implementing policies that impact the educational needs of gifted and talented students, and of all students. The decisions are important because education is among the largest of government activities, in terms

of both total budget and government employment, but also because of education's significant positive externalities benefiting society. Educational reform and the educational needs of the gifted are part of the larger debate over educational quality and the ways, and reasons, to improve it. While elected officials and appointed agency directors do not always make decisions based on complete and fully analyzed data, in our representative democracy it is important that such information exists and is widely available to researchers, interest groups and the general public, as well as to government officials.

References

- Berry, F.S., and Berry, W.D. 1999. Innovation and diffusion models in policy research. In Sabatier, P.A. (ed), *Theories of the Policy Process: Theoretical Lenses on Public Policy*. Boulder, CO: Westview Press.
- Boothe, D., Senta, B.N., Stanley, J.C., Colgate, S.O. 1999. Special opportunities for exceptionally able high school students: a description of eight residential early-college-entrance programs. *Journal of Secondary Gifted Education*, 10(4): . Downloaded 3/25/06 from Academic Search Premier.
- Borman, K.M., and Associates. 2005. *Meaningful Urban Education Reform: Confronting the learning crisis in mathematics and science*. Albany, NY: State University of New York Press.
- Buchanan, N., and Woerner, B. 2002. Meeting the needs of gifted learners through innovative high school programs. *Roeper Review*, 24(4): . Downloaded 4/7/06 from ERIC—Professional Development Collection.
- Campbell, J.R., and Verna, M.A. 1998. Comparing separate class and pull-out programs for the gifted. Downloaded 4/7/06 from ERIC: ED420953.
- Chicago School District. 2006. School Information: Types. Accessed online on 4/12/06 at www.cps.k12.il.us/school_info/types.htm
- Chubb, J.E., and Moe, T.M. 1990. *Politics, Markets and America's Schools*. Washington, D.C.: The Brookings Institution.
- Detrich, R., Phillips, R., and Durrett, D. 2002. Critical Issue: Dynamic debate—determining the evolving impact of charter schools. Report from the North Central Regional Educational Laboratory. Accessed online 4/18/06 at www.ncrel.org/sdrs/areas/issues/envrnmnt/go/go800.htm
- Dorsel, T.N., Wages, C. 1993. Gifted, Residential education: outcomes are largely favorable, but there are some cautions. *Roeper Review*, 15(4): . Downloaded 3/27/06 from Academic Search Premier.
- Earlyentrance.org. 2006. Early entrance college programs in the USA; Comparison Chart. Accessed online on 4/7/06 at www.earlyentrance.org/home
- Eggebrecht, J., Dagenais, R., Dosch, D., Merczak, N.J., Park, M.N., Styer, S.C., and Workman, D. 1996. Exemplary Curriculums: Reconnecting the sciences. *Educational Leadership*, 53(8): 4-8.
- Franciosi, R.J. 2004. *The rise and fall of American public schools: the political economy of public education in the twentieth century*. Westport, CT: Praeger Publishers.
- Gallagher, J.J. 1997. Least restrictive environment and gifted students. *Peabody Journal of Education*, 72(3&4): 153-165.

- Gallagher, J.J. 2001. Personnel preparation and secondary education programs for gifted students. *Journal of Secondary Gifted Education*, 12(3): . Downloaded 3/27/06 from Academic Search Premier.
- Geniusdenied.com. 2006. Gifted Education Policies. HTML links for each state and the federal government, accessed online on 4/10/06 at www.geniusdenied.com/Policies/State/Policy.aspx?NavID=6_1
- Green, J.E. 1993. State academies for the academically gifted. Bloomington, IN: Phi Delta Kappa Educational Foundation. Downloaded from ERIC, ERIC document ED357596.
- Hagedorn, L.S., Tibbetts, K., Moon, H.S., Matsumoto, D.H.K., and Makuakane-Lundin, G. 2002?. The academic and occupational outcomes of residential high school student instruction. Downloaded on ? from ?.
- Illinois Board of Higher Education. 2004. *The Illinois Commitment: a policy framework for Illinois Higher Education (Revised 12/2004)*. Springfield, IL: Board of Higher Education. Accessed online on 4/07/06 at www.ibhe.state.il.us/Board/agendas/2004/December/IllinoisCommitment04.pdf
- Illinois Board of Higher Education. 2006. Fiscal Year 2007 Higher Education Budget Recommendations: Operations, Grants and Capital Improvements. Springfield, IL: Illinois Board of Higher Education. Accessed online on 4/07/06, at www.ibhe.state.il.us/Board/agendas/2006/February/item%209.pdf
- Illinois Mathematics and Science Academy. 2003. *2001-2002 Annual Report*. Aurora, IL: Illinois Mathematics and Science Academy.
- Illinois Mathematics and Science Academy. 2004. *2002-2003 Annual Report*. Aurora, IL: Illinois Mathematics and Science Academy.
- Illinois Mathematics and Science Academy. 2005a. *A Pioneering Educational Community: Fiscal Year 2005 Performance Report*. Aurora, IL: Office of Research and Evaluation, Illinois Mathematics and Science Academy.
- Illinois Mathematics and Science Academy. 2005b. *2003-2004 Annual Report*. Aurora, IL: Illinois Mathematics and Science Academy.
- Illinois Mathematics and Science Academy. 2005c. *2005-06 IMSA Quick Facts*. Aurora, IL: Illinois Mathematics and Science Academy.
- Illinois Mathematics and Science Academy. 2005d. *2006 Profile*. Aurora, IL: Illinois Mathematics and Science Academy.

- Illinois State Board of Education. 2003. *Quickstats: Elementary and Secondary education statistics*. Springfield, IL: Illinois State Board of Education. Accessed online on 4/14/06 at www.isbe.net/quickstats
- Illinois State Board of Education. 2005. *Illinois State Report Card—2005*. Accessed online on 4/14/06 at www.isbe.net/reportcard
- Illinois State Board of Education. 2006a. Proposed Budget—Fiscal Year 2007. Accessed online on 4/14/06 at www.isbe.net/budget/default.htm
- Illinois State Board of Education. 2006b. Report Card 2005. Database accessed online on 4/14/06 at <ftp://ftpirtcard.isbe.net/ReportCard2005/>. Illinois Mathematics and Science Academy does not appear in database.
- Jarwan, F.A., and Feldhusen, J.F. 1993. Residential Schools of Mathematics and Science for academically talented youth: an analysis of admission programs. Storrs, CT: The National Research Center on the Gifted and Talented, University of Connecticut. Accessed online 4/10/06 at www.gifted.uconn.edu/nrcgt/nrcgtjea.html
- Jones, B.M., Fleming, D.L., Henderson, J., and Henderson, C.E. 2002. Common denominators: assessing hesitancy to apply to a selective residential math and science academy. *Journal of Secondary Gifted Education*, 13(4): 164-172.
- Jost, Kenneth. 1997. Educating Gifted Students: Are U.S. schools neglecting the brightest youngsters? *CQ Researcher*, 7(12). Downloaded 3/28/06 from <http://library.cqpress.com/cqresearcher/document.php?id=cqresrre1997032800>.
- Lexis-Nexis. 2006. State Capital—Bill tracking by keyword. Search of database, all states, 1990-2006. Access online on 4/12/06 at web.lexis-nexis.com/stcapuniv/
- Lindeman, C.R. 2006. Personal Communication. Email 3/24/06.
- Lynch, R.G. 2004. *Exceptional returns: economic, fiscal and social benefits of investment in early childhood development*. Washington, D.C.: Economic Policy Institute.
- Lynch, S.J. 2000. *Equity and science education reform*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Mace, F.B. 1997. Fanning the spark of exceptional creativity. *Journal of Secondary Gifted Education*, 9(2): . Downloaded 4/14/06 from Academic Search Premier.
- Marshall, S.P., and Hatcher, C. 1996. Promoting career development through CADRE. *Educational Leadership*, 53(6): 42-46. Downloaded 4/7/06 from EBSCO Professional Development Collection.
- Maxwell, N.L., and Rubin, V. 2002. High school career academies and post-secondary outcomes. *Economics of Education Review*, 21: 137-152.

- National Center for Education Statistics, U.S. Department of Education. 2001. *Overview of public elementary and secondary schools and districts: school year 1999-2000*. (Table 9—Number of Title I, magnet and charter schools and percentage of students served, by state: school year 1999-2000. Washington, D.C.: National Center for Education Statistics. Downloaded on March 15, 2006, from <http://nces.ed.gov/pubs2001/overview/table09.asp>
- National Center for Education Statistics, U.S. Department of Education. 2001. *Characteristics of the 100 Largest public elementary and secondary school districts in the United States: 1999-2000*. (Table 14—number and percentage of public elementary and secondary schools and students in magnet and charter schools in the 100 largest districts in the United States: School year 1999-2000.). Washington, D.C.: National Center for Education Statistics. Downloaded from on March 15, 2006, from http://nces.ed.gov/pubs2001/100_largest/table14.asp
- National Center for Education Statistics, U.S. Department of Education. 2004. *Digest of Education Statistics—2004* (Table 38—Enrollment in public elementary and secondary schools, by level, grade, and state or jurisdiction, fall 2002; Table 54—Number and percent of children served under Individuals with Disabilities Education Act, Part B, by age group and state of jurisdiction: selected years, 1990-91 to 2003-04; and Table 55—Number of gifted and talented students in public elementary and secondary school, by sex and state, 2000). Washington, D.C.: National Center for Education Statistics. Downloaded from on March 15, 2006, from <http://nces.ed.gov/programs/digest/d04/tables>
- National Consortium for Specialized Secondary Schools of Mathematics, Science and Technology. 2006. Institutional Members. Accessed online on 2/15/06 at www.ncssmst.org/membership/institutions.htm
- National Merit Scholarship Corporation. 2006. National Merit Scholarship Program—2005. Accessed online 4/5/06 at www.nationalmerit.org.
- National Research Center on the Gifted and Talented, 2006. xxx. Accessed online on 4/8/06 at www.gifted.uconn.edu/nrcgt/nrcgtjea.html.
- Nelson, J.L., Palonsky, S.B., and Carlson, K. 2000. *Critical issues in education: dialogues and dialectics*. Boston, MA: McGraw-Hill Higher Education.
- Peddle, M.T. 2000. *Does government need to be involved in primary and secondary education? Evaluating policy options using market role assessment*. New York, NY: Garland Publishing.
- Psacharopoulos, G., and Patrinos, H.A. 2004. Returns to investment in education: a further update. *Education Economics*, 12(2): 111-134.
- Ravitch, D. 2001. American traditions of education. In Moe, T.M. (ed), *Primer on America's schools*. Stanford, CA: Hoover Institution Press.

- Schneider, A., and Ingram, H. 1993. Social Construction of target populations: implications for politics and policy. *The American Political Science Review*, 87(2): 334-347.
- Sentha, B.N., Wickstrom, C.D., Boothe, D., and Stanley, J.C. 2001. The Advanced Academy of Georgia: four years as a residential early-college-entrance program. *Journal of Secondary Gifted Education*, 13(1): . Downloaded 3/27/06 from Academic Search Premier.
- Shields, C. J. 1993. The Illinois Mathematics and Science Academy: an institution that groups students by talent, not economics. *Curriculum Review*, 32(9): . Downloaded 3/25/2006, from Academic Search Premier.
- Stephens, K.R. 1998. Residential math and science high schools: a closer look. *Journal of Secondary Gifted Education*, 10(2): . Downloaded 3/25/06 from Academic Search Premier.
- Stephens, K.R. 2000. Gifted education and the law. *Gifted Child Today Magazine*, 23(1): . Downloaded 4/7/06 from ERIC—Professional Development Collection.
- Taylor, L.L. 1999. Government's role in primary and secondary education. *Federal Reserve Bank of Dallas Economic Review*, first quarter 1999: 15-24.
- University of Illinois. 2005. *Get Ready 2005: An inside guide for new students and parents*. University of Illinois at Urbana-Champaign. Urbana, IL: University of Illinois at Urbana-Champaign.
- Vail, K. 2004. Remaking High School. *American School Board Journal*, 191(11): . Accessed online 4/14/06 at www.asbj.com/2004/11/1104coverstory.html
- Waldrip, D. 2006. About Magnet Schools of America: a brief history of magnet schools. Accessed online 4/10/06 at www.magnet.edu/mag_schools.htm
- Wikipedia, the free encyclopedia. 2006. Illinois Mathematics and Science Academy. Accessed online on 4/14/06 at http://en.wikipedia.org/wiki/Illinois_Mathematics_and_Science_Academy
- Winner, E., and Karolyi, C. von. 1998. Giftedness and egalitarianism in education: a zero sum? *National Association of Secondary School Principals Bulletin*, 82(595): 47-60.
- Zirkel, P.A. 2005. State laws for gifted education: an overview of the legislation and regulations. *Roeper Review*, 27(4): 228-232. Downloaded 3/27/06 from WilsonSelect.