

How a Technology Grant from the National Academy Foundation Has Begun To Make a Difference for Minority Students in an Urban High School

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Abstract: Minority students, particularly those in urban schools, are confronted with numerous obstacles to academic success and career outlook: low self-esteem and motivation, inferior achievement in mathematics and science, lack of support and role models. The Academy model of the National Academy Foundation has the potential to address a number of these issues. This paper presents the results of a descriptive research study that evaluated the Academy of Information Technology program at Gorton High School in Yonkers, NY. Data collected from a variety of sources revealed numerous advantages of the program as well as certain problems. Despite some of the difficulties in implementing the program, there is substantial evidence to suggest that the AOIT program has begun to make a difference in the lives of these students.

Introduction

The educational community has focused considerable attention on improving the outlook for minority and disadvantaged students. Closing the achievement gap, improving retention, increasing motivation, and providing career opportunities are only some of the issues that have been addressed by educators, politicians, and philanthropists alike. One of the most publicized areas of concern is the low enrollment of minority students in mathematics, science, and technology programs in colleges and universities. Lack of interest in these areas can be traced to elementary school (SubbaRao 1993). Research by Reichert and Absher, (as cited in Marable 1999) summarizes some of the prominent conditions faced by minority students: “. . . inadequate academic preparation, substandard educational resources, mismatched social and academic expectations, lack of encouragement, psychological intimidation, unstable familial and financial circumstances, inadequate peer support, and lack of role modeling and mentoring.” A number of programs have been developed to counter these deficiencies. The Gateway to Higher Education program offers minority high school students rigorous preparation for careers in areas such as engineering and technology. It is based on the assumption that a key factor in college success is entering high school with adequate preparation in mathematics and reading. Surveys of program graduates indicate a high percentage pursuing careers in areas such as computer science and planning to continue their education at the master’s and doctoral levels (Iler and Slater 1998). The goal of Joint Educational Facilities Inc. (JEF) computer science program is to expose minority and disadvantaged students to the basics of computer science as well as advanced topics such as artificial intelligence and super computers and to encourage them to continue their education. The hope is that this program will increase the enrollment of minorities in mathematics, science and engineering programs in colleges and universities (Roach 2005).

The impact of computers on our society is an important factor on the future of our youth. The Department of Labor Bureau of Statistics predicts many computer fields to have a much faster than average growth in the next 6 years (e.g., Software Engineering 45%, Systems Analysts, Database Administrators, and Computer Scientists 42%). The need to educate students to meet the demands of an increasingly technological society cannot be over estimated. Some economists believe that if students are not equipped with the required knowledge and skills to take advantage of these opportunities, they risk falling to the bottom of the employment pool (Olson 2006). Computers have contributed to the imbalance in the occupational structure, with the majority of jobs at the very top (professionals with specialized knowledge and extensive technology skills) or at very bottom (unskilled working poor such as janitors, cafeteria workers, security guards) of the pay scale. The good news is that access to computers has increased for minorities; the bad news is that the gap has widened. The US Department of Commerce report in 2000, “Falling Through the Net: Toward Digital Inclusion,” shows that more minorities have access to computers. Yet, the gap between the “have’s” and “have not’s” is not being bridged.

How computers are used appears to be a more significant indication of their value than mere access. Minority students tend to use computers more for low level skills such as drill and practice, games, and recreational activities; however, the key to effective use may be linked to the influence of adult supervision. Students from more affluent homes are more likely to be exposed to the research and enrichment benefits of computers than their poorer peers, whose parents typically lack the time and education to assist their children (Attewell 2001). Equity in use is of paramount importance in bridging this divide. A research study of a national sample of 752 public, Catholic and private school students on the impact of technology use on achievement reported significant differences between the achievement of students in high and low socio-economic status (Du, et al 2004). Findings revealed that computer use at home was less for disadvantaged students and was a stronger factor in achievement than computer use at school. In addition, computer use did not benefit disadvantaged students as much as their more affluent peers and their academic achievement was not highly predictable by computer use.

The National Academy Foundation and The Academy of Information Technology

In a move to better educate and prepare our youth for the demands of a technological society, the National Academy Foundation (NAF) and the Center for Occupational Research and Development (CORD) established the Academy of Information Technology (AOIT) in 2000. The National Academy Foundation, a non-profit organization, has a twenty year history in sustaining a network of academies to enhance the career development of high school students. Academies are small learning communities dedicated to a specific career, encouraging their members to focus on what they want to do with their lives. The collaboration between business and education is the cornerstone of NAF's strategy and success. The academy model has been very successful with over 90% of academy graduates continuing their education beyond high school (Weill n.d.).

To determine the effect of the NAF academies on students' educational and career plans, a recent research study (Orr, Hughes, & Karp 2003) surveyed almost 200 graduating academy seniors and compared them to an equivalent group of non-academy graduates. Results indicate positive experiences for the academy students but no improvement in academic achievement when compared to the control group. In addition, academy students found their course work more interesting and more relevant to college and career planning. In their transition to college and careers, the academy influenced their planning for and acceptance into college. Students reported a positive outlook on their choice of careers and, more importantly, most alumni were in career-track positions five and ten years after graduation. Other research findings report that some of the benefits to students include improved engagement, achievement, increase in career awareness, greater retention and a sense of community among academy members (Orr 2005).

NAF initiated a pilot group of twelve Academies of Information Technology in 2000. Among the objectives of AOIT are to offer students a strong academic grounding to prepare them for a career in technology or a technology-related field, to encourage them to stay in school by establishing personal goals that are attainable, to expose them to a broad range of career possibilities, to prepare them to continue their education, and to lay the groundwork for lifelong learning. Gorton High School in Yonkers, NY was awarded a \$10,000 grant to be one of the twelve pilot academies in 2000. As with many urban high schools, Gorton has a large population of minority students (about 80%), many of whom are immigrants or children of immigrants. In addition, over 86% of the students are at the poverty level. A computer magnet school for over twenty years, Gorton was well positioned to offer its Academy students an enriched curriculum beyond that of the computer magnet. They had much of the hardware, software and teacher expertise in place. Core area teachers worked with Teachers College, Columbia University and the Center for Technology and School Reform on integrating technology. The award was a major accomplishment for the Yonkers Public Schools and for Gorton High School in particular. The educational and business communities enthusiastically welcomed the news and joined to lend their support and encouragement for this important undertaking. A Director was named to develop and oversee the program and an Advisory Board was established to provide guidance and assistance in managing and monitoring the activities of the Academy.

Research Questions

The program has been in place for six years and three classes have graduated. It seems an appropriate time to reflect on the experience and ask a few pertinent questions. Is the Academy at Gorton meeting NAF's goals? How are Academy students performing academically? How do students feel about being members of the Academy? Do teachers feel prepared to teach the new curriculum? How does the administration view the AOIT program? In general, has this grant opportunity made a difference at Gorton High School?

Methods

The researcher is a member of the AOIT Advisory Board and, as such, possessed a background of the program and how it had progressed since its inception. This knowledge greatly facilitated the research process. An application was made to the district to secure permission to enter the school and conduct the research. The study took place during the 2005-2006 school year. Data was collected in a variety of methods. The Department chair provided copies of the AOIT curriculum to assess the rigor of the academic program. The researcher observed each of the AOIT classes (grades 10, 11, and 12) several times and interviewed all teachers both formally and informally to gain an understanding of the classroom environment, student engagement and interaction between students and teachers and among students. A survey was administered to the AOIT students to determine their computer usage, their attitude towards computers and computer classes, and how they view computers in their future. Some of the questions on the survey were drawn from work done by Gupta and Houtz (Goupta & Houtz 2000). A random sample of students in the computer magnet program but not in the AOIT program was selected as a control group. These students were also given the survey to ascertain any differences between the attitudes of the two groups. The control group was also used to compare the computer grades and the overall GPAs of the two groups to determine if the AOIT students were performing better than their peers who were not in the program. At the end of the school year, a survey was administered to the graduating seniors primarily to reveal their plans after graduation. Interviews were held with selected seniors to explore more deeply their reflections on the program and any suggestions they may have for improvement. An alumni survey was emailed to the 2004 and 2005 graduates to determine if students were enrolled in college or were in the workforce and to get their impressions of how the program affected their lives. Those who did not respond were telephoned and asked the questions in an interview. At the end of the research, the school principal was interviewed to gain an understanding of how the program was viewed from the perspective of the school administration and what the plans were for continuing to support the AOIT at Gorton High School.

Results

Results of each of the research questions are as follows:

I. Is the Academy at Gorton meeting NAF's AOIT goals?

A. To offer students a strong academic background:

The AOIT program at Gorton has used curriculum guidelines established by NAF to implement the program in the classroom. As the program has progressed, certain modifications have been made based on recommendations from the Curriculum Committee of the Advisory Board in consultation with the director and teachers in the program. The current program is as follows:

1. 10th grade: **Introduction to the Internet.** This course presents the basics of web page design where students learn HTML to develop web pages.
2. 11th Grade: **Advanced Web Tools.** Topics in this second course on the web include Cascading Style Sheets, Common Gateway Interface using Perl and DHTML, and web scripting with JavaScript. These Internet technologies are essential for students to gain more in depth knowledge of how to create dynamic and exciting web pages.
3. 11th Grade: **AP Computer Science.** This course prepares students to take the AP exam in Computer Science in Java and forms the introduction to most college majors in Computer Science. It is an important course because it gives students some understanding of the kind of work required in a Computer Science major.
4. 12th Grade: **System Support and Maintenance/Digital Networks.** Each component of this course is covered in half a semester with a double period each day. In System Support and Maintenance, students learn about hardware and software installation, repair and troubleshooting. Students are exposed to hands-on activities. In Digital Networks, students learn data transmission concepts.

5. 12th Grade: **Database Management/Digital Media.** Each component of this course is covered in half a semester with a double period each day. In Database Management, students learn the basic concepts of relational databases including querying with SQL. The Digital Media component gives students experience with a variety of media, such as audio, video, graphics, text and animation. A culminating project combines the media into single product.

Classroom observations indicate that teachers prepare engaging lessons and that, for the most part, students are on task and engaged in the learning process. The teachers regularly use SmartBoards or PowerPoint presentations to deliver the lessons. Each student has access to a computer, greatly facilitating learning. Teachers regularly assist students at the computer and there is significant interaction among students, particularly in the programming class. Among the disadvantages of student access is that they sometimes use the computer for other activities such as web surfing, email and game playing.

The teachers currently working in the AOIT program have various levels of knowledge and expertise in computing. All have some formal training either at the Masters level or from teacher training courses. Teachers spend considerable time learning software on their own. There is a degree of cooperation among the teachers in which they assist each other and share information. The teachers are aware of student aspirations to continue their education in college and work hard to offer a strong and current curriculum to the AOIT students.

B. To prepare them for a career in technology or a technology-related field:

AOIT students completed a survey that asked several questions related to careers in technology. Perhaps the most significant finding suggesting that the program prepared student for a career in technology was that over 95% of the students said that they learned facts about technology careers that they did not know before. Almost 89% of the students reported that they definitely or probably would use computer skills in their future work and over 97% thought that computer skills would be important in college. The most important skill cited as important for a computer career was programming. This response indicates that students have a good idea of what may be required if they pursue a career in technology. Sixty-three percent of the students claimed that they were very or somewhat interested in a career directly related to computers. The most popular areas of interest (in order of choice) were graphics, computer engineering, web development, programming, and computer repair. Over 73% of the students cited money as the principle reason for interest in a career in technology, with only 20% interested because they enjoy computers. Over 54% of the students would like an internship in technology, even without pay, suggesting a high degree of interest in learning first hand what a career in technology might involve.

C. To encourage them to stay in school by establishing personal goals that are attainable:

Interviews with teachers and students point to the strong relationship that exists between them. Because of the small class sizes, teachers are able to get to know the students well and provide needed mentoring. This sense of caring and belonging has an influence on keeping students motivated and interested in completing their high school degree.

D. To expose them to a broad range of career possibilities:

In previous years students in the AOIT program had been taken on field trips to local businesses to help them understand the range of career possibilities in technology. They had visited companies such as IBM, Verizon and Consumer Reports. Students were also offered internships in the summer between 11th and 12th grade. These field trips and internships were sponsored by the Advisory Board. During the year of this research, the Advisory Board did not meet. Consequently, there were no field trips and no internships. Several alumni encouraged the program to continue the internship experience.

E. To prepare them to continue their education:

At the end of the school year, seniors in the AOIT program were asked to complete a survey that asked about their plans after graduation. Of the 18 graduating seniors, 14 students completed the survey. All of them indicated that they planned to attend college in the fall. Of the fourteen, five students intended to major in a computer related field. Surveys were also given to the two classes of AOIT alumni, a total of 59 students. Twenty-six students (44%) responded either via email or telephone. Twenty-three students are currently enrolled in college (18 in 4-year institutions and 5 in a community college). Eight of them are enrolled in a computer program. Thirteen reported that being a member of the AOIT program helped them in their current situation. Even those not majoring in a computer-related field credited the program with honing computer skills required in college. These statistics are a very strong indication that the program not only encourages but also prepares students to continue their education.

F. To lay the groundwork for lifelong learning:

The AOIT program has not been in existence long enough to realize this goal. However, given that over 92% of the alumni who responded to the survey are currently pursuing their education is compelling evidence that the program is on the right track in laying the groundwork for lifelong learning. Some of the responses from graduating seniors and alumni indicate that, as they reflect on their experience in the program, they see its value for their future. One senior in particular wrote, “[The program gives you the opportunity to] learn things you could use for the rest of your life, even if you don’t major in computers.” An alumnus reported that the program “helped me with my work ethic because it was a demanding program so now I demand more of myself.”

II. How are Academy students performing academically in their high school classes?

Grades from January and June were examined for AOIT classes and June overall high school averages. The mean computer grade for 10th grade Introduction to the Internet was 82, for 11th grade AP Computer Science 75.5, for 11th grade Advanced Web Tools 89, for 12th grade System Support and Maintenance/Digital Networks 83, and for 12th grade Database Management/Digital Media 80. Only three students had a failing computer grade in January, none in June and only one student had an overall failing average at the end of the school year. This grade report indicates that despite the rigorous curriculum, students in the AOIT program are doing very well.

III. How do students feel about being members of the Academy?

AOIT students completed a survey that asked many questions about how they feel about being in the Computer Magnet and being members of the Academy. Over 90% claimed they were happy they joined the Computer Magnet at Gorton. The most popular reasons students offered for joining were a deep interest in and great enjoyment of computers (over 61%). Information on student attitudes was gathered from various sources: student surveys, graduating senior surveys, graduating senior interviews, alumni surveys, class observations and teacher interviews.

Perception of Academy:

Class observations clearly indicate that students are proud to be members of AOIT. Data gathered from senior interviews suggests that they have access to knowledge and skills that is not available to other students in the Computer Magnet program. Several students think that others have a high opinion of AOIT students. Over half of the students interviewed thought that students outside the program were jealous of the advantages afforded to AOIT students. They believe that they have more fun with computers and have greater access to their teachers than the other students. Almost half the students interviewed feel somewhat slighted because they believe that other magnets get more attention and think the school does not give sufficient support to the program.

Group dynamics:

Over 93% of the students surveyed reported that they enjoyed working with other students in the program and over 77% reported feeling a strong connection to other students in the program. Observations of AOIT classes confirm that students willingly assist each other and exhibit a high degree of camaraderie to the extent of IM’ing their friends about their school work. Several alumni cited the close friends they made while in the program. All teachers interviewed commented on the close relationships among students in the Academy and the advantage for students to work with others of like ability and motivation. Teachers see a bond among students who are similarly motivated and have the opportunity to work together. Watching students grow over the course of the program is a source of great satisfaction for teachers. The concept of a close knit family is an accurate analogy of the students and teachers in the AOIT program.

Advantages:

The student survey asked what students liked best about the program. The most popular response (over 45%) was that they learned new and interesting things. Several students also reported that they enjoyed the classmates (17%), that the program was challenging (13%) and fun (10%). When asked their overall impressions of the program, over 30% said they learned new things that may help in the future, 15% said it was a rewarding experience, almost 11% said it was challenging and 13% said it was fun and enjoyable. AOIT alumni were also asked what they liked best about the program. Their responses emphasized the excellence of the curriculum, the knowledgeable teachers and the small classes that allowed them to get to know their fellow students well. When seniors were asked if they would recommend the program to other students, all students replied positively. The most frequently mentioned reasons were the wealth of knowledge presented and the great fun they had learning with the teaching staff and their fellow classmates. Alumni cited similar reasons for recommending the program: knowledge learned, individual attention of teachers and close knit group of students.

Disadvantages:

The student survey asked what students liked least about the program. Encouragingly, over 28% reported that there was nothing they did not like. Over 18% claimed they did not like the hard work the program entailed and about 11% found the program boring. Over 35% of those responding said the program could be improved with more fun activities and over 22% believed that the equipment needs to be upgraded. Several of the seniors interviewed also mentioned the need for more hardware and software for the program. The alumni survey found that over 38% of those responding claimed that there was nothing they did not like. Some of the problems mentioned were not enough qualified teachers and the amount of work involved. Improvements suggested by alumni centered on more field trips and internship opportunities for students.

IV. What are students' attitudes about themselves and their abilities?

AOIT students consider themselves competent at the computer; almost 85% of the students surveyed reported their ability to use computers as excellent or very good. Over 78% expect a grade of B or better in their current computer class. Half of the students report that their computer skills are self-taught. Over 70% of the students took 2 or more computer classes in middle school, so they entered high school with a good foundation. Over 90% find computer classes interesting and fewer than 9% of the students find their computer classes difficult. Most of the seniors interviewed claimed that their classes were as challenging as they expected.

V. Do teachers feel prepared to teach the new curriculum?

All of the current AOIT teachers have had some formal training in computer technology but to varying degrees. Most have had professional development courses and are self-taught. The program has lost several teachers since the AOIT program began and it is difficult to find and keep qualified teachers. Not all teachers are able to teach the full complement of AOIT courses, leaving the program in potential jeopardy. NAF does provide some training for teachers but not all of them have been able to take advantage of this opportunity. Interviews with the teachers did not indicate a sense of being overwhelmed by the curriculum but this situation could change unless the district is able to find more technologically capable teachers.

VI. How does the administration view the AOIT program?

When the current principal came to Gorton 4 years ago, the program, though young, was thriving. The Yonkers School District was proud that Gorton had received the NAF grant and was committed to sustaining the program. The AOIT program brought many advantages to the students of Gorton. Features such as a rigorous curriculum and a jump start on a career path in technology improved the level of learning and made it a very attractive program for parents and students. The program clearly raised the visibility of the school. During the last 2-3 years, difficulties in the district and the school saw the program lose momentum. The Advisory Board was discontinued and with it opportunities for field trips, shadowing days and internships were lost for the students. Students, while still enthusiastic, felt somewhat disheartened. Because the administration has such high hopes for the AOIT program, plans are underway to revive the program. The Advisory Board has been reinstated and a new directorship has been appointed. Two new teachers with extensive experience in computing have been hired to give the teaching staff much needed assistance. Goals for the future include a revised curriculum to better provide course prerequisites, increased enrollment, and a closer relationship with students and parents. The administration is hopeful that these initiatives will get the program back on track so that it can achieve its potential.

Discussion

The AOIT program at Gorton High School is 6 years old. In that period of time, the curriculum has undergone a number of changes designed to better meet the needs of the students. Several teachers of varying backgrounds and abilities have come and gone. The Advisory Board that assisted in organizing field trips, arranging for internships, soliciting scholarships and supporting student activities has not met in over 2 years. Yet, the students have managed to learn, to grow and to excel. Data gathered in this study strongly indicates that most of the NAF goals have been met. In addition, students are satisfied with the AOIT program and are very happy to be members. They do well in their classes and have specific goals for their future. Alumni report the many advantages of the program and realize by comparison with others the benefits they derived from being in the Academy. Teachers are enthusiastic about their classes and see the potential that this program could have for the students in the future.

The program has come a long way in a short time but to build on its success and to continue to serve the best interests of the students, we make the following recommendations. 1) It is critical to provide for continuing professional development of teachers. In the fast-paced world of computer technology, it is vital that teachers continue their education to be able to incorporate the latest developments in their classes. 2) The internship program

must be revitalized. It is a key component of the NAF model and is absolutely essential in giving students the knowledge and experience they need to make vital career decisions. It is an invaluable link between the classroom and the workplace. 3) Arrange for field trips and shadowing experiences for younger students. These events are important in exposing students from the beginning to the various career opportunities that are available. 4) Consider establishing a mentoring program so that younger students can relate to upperclassmen and learn from them. The social character of the program is strong, but this initiative could strengthen the ties among students in all classes. 5) Invite AOIT alumni to come and speak to current students, both formally and informally. A number of the alumni can be effective models and inspiration; take advantage of their positive influence. Students pay attention and relate well to those who have recently gone before them. 6) Assure students that they matter at Gorton and that the AOIT program is important to the school. Recent changes may have left the mistaken impression that the school does not care about them.

Conclusion

We return to the overarching question of this evaluation: Has this grant opportunity made a difference at Gorton High School? We find that the Academy model addresses many of the difficulties minorities face in achieving success. 1) It replaces mere drill and practice with rigorous computer courses that prepare them for college and technology related careers. 2) Dedicated teachers provide them with much needed mentoring. 3) Focus on career preparation offers them a goal and motivation to stay in school. 4) The social fabric of the Academy gives them a sense of camaraderie and belonging that improves self esteem. The results of this study are supported by previous research on the Academy model that confirms the benefits to students. Thus, despite its shortcomings and growing pains, there is sufficient evidence to suggest that the AOIT program has begun to make a difference in the lives of these students. The challenge will be to build on past success to enhance the experience of future students.

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