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ABSTRACT

A majority of the school districts that desegregate use magnet schools as part of their effort. Magnet schools offer enriched academic or vocational programs to attract committed students whose neighborhood schools do not offer the coursework and activities they seek. This paper is concerned with science magnet schools. This study was designed to determine if the implementation of a magnet school would generate more positive attitudes in the magnet school's students. The study group included 358 fourth-, fifth-, and sixth-graders, 177 in the elementary science-magnet and 181 in a neighboring school which served a similar student population. The measuring instrument was derived from the National Assessment of Educational Progress. It was reported that students enrolled in an elementary science-magnet school were more likely to identify science as their favorite or second favorite subject than their counterparts enrolled in a comparison school. The magnet school students wanted more science in school and were less likely to think that scientists were rich. The comparison school students felt that they would be able to help solve the problems of pollution, food shortages and disease and were more likely to use science in making decisions than their magnet school counterparts. The measuring instrument is appended. (MVL)

Elementary Science-Magnet School Student Attitudes Toward Science As Measured By Selected National Assessment Of Educational Progress Items

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Elementary Science-Magnet School Student Attitudes Toward Science As Measured by Selected National Assessment Of Educational Progress Items

A majority of the school districts which must desegregate use magnet schools as part of their effort. Magnet schools offer enriched academic or vocational programs to attract committed students whose neighborhood schools do not offer the coursework and activities they seek. Most magnet schools operate at the high school level and use their district boundaries as attendance areas. Some high school magnets, however, will enroll students who live in other school districts. Recently, school administrators have constructed magnet components in elementary schools. These magnets differ from those at the secondary level in two ways. First, the elementary magnets try to attract students who live in their attendance areas and are enrolled in local parochial and private schools. Second, the elementary magnets usually continue to serve their neighborhoods.

The School District of Philadelphia won a grant which provided funds to establish five elementary magnet schools. Each school selected a magnet topic, computer science, environmental science, French, early childhood and science, in order to attract white students who lived in their attendance areas but were enrolled in local parochial and private schools. A successful recruiting effort would allow these schools to maintain their desegregated status.

We were interested in the science magnet school. Here, four teachers, one coordinator and three classroom teachers, were added to the faculty. Materials and supplies were ordered and staff development activities were planned. Therefore, the components for a program which integrated science into the school's educational program through its grades was ready.

We found support for our investigation in the literature. Walberg et al. (1985) linked scientific literacy and economic productivity. The researchers were concerned with declines in students' science and mathematics achievement. These declines reached the point where scores were below those posted by students in other industrialized countries. "Consequently, concerted efforts need to be made, first, to identify through educational research those factors which lead to improved scientific literacy and, second, to change schools to optimize the factors which will enhance the science performance of students" (p. 1). We were interested in student attitudes toward science and collected data which addressed both points made by Walberg et al.

We turned to the National Assessment of Educational Progress (NAEP) for our instrumentation. The NAEP conducted science assessments in 1969-70, 1976-77 and 1985-86. In 1981-82, the National Science Foundation financed an assessment. Each assessment included exercises designed to measure student attitudes toward science. The exercises used in the First Assessment were repeated in the Second and Third Assessments and a selection was released in 1978 (NAEP, 1978B). The second Assessment included seventy-two attitude exercises. Thirty-four were designed for nine year-old students, eight exclusively and twenty-six, for older students as well. Twelve exercises were included in the released set. These exercises served as our measuring instrument.

Our study group included 358 fourth, fifth and sixth grade students, 177 in the elementary science-magnet and 181 in a neighboring school which served a similar student population. We found that the students enrolled in the magnet school were more positive toward science and we will suggest changes schools can make in order to implement similar programs.

Review of the Literature

Our literature review will trace the origin and development of magnet schools with respect to the desegregation initiative. We will emphasize elementary school magnets in our discussion. The next section of our review will address attitudes and their measurement. Finally, we will deal with the NAEP and their work with attitude measurement.

Magnet Schools

Magnet schools have served as important components of desegregation programs since school districts were ordered to desegregate. Designed to attract students from all racial groups in order to reach predetermined ratios of minority to majority students, magnets are characterized by novel programs, strong student and faculty morale and comprehensive parental involvement components. Generally, secondary schools have been designated as magnets and use their district's boundaries as their attendance area. This approach has fostered desegregation and in an attempt to extend the strategy, school administrators have created elementary school magnets. In most instances, the elementary magnets draw from their designated attendance areas, trying to enroll students who are attending local parochial and private schools while continuing to serve as neighborhood schools. Elementary magnets are relatively new to American education and ought to be examined by administrators in districts where desegregation is under way.

The Federal Government fostered magnet schools through a 1976 amendment to the Emergency School Assistance Act. Here, grants were authorized for the creation of magnet schools in those districts which had to desegregate. Looked on as a vehicle which could discourage middle class flight from the cities, magnets were supposed to offer courses of study and teaching methods not generally provided in the host district (Federal Register, May 16, 1980).

MAGI described the magnet concept as "novel and appealing" and supported this contention by reporting that over one thousand magnets were operating in 138 school districts by the early 1980's (MAGI, p. 2). Moreover, the number of magnet schools increased despite reductions in federal funding and seventy-four school districts set up magnets in 1982-83 with no federal support.

As to their success, Blank et al. (1983) found that magnet schools promoted desegregation while fostering student achievement. The schools enrolled students who achieved at the average as well as their above average counterparts, offered meaningful educational options to their constituents, encouraged parental involvement and helped school districts improve their image. MAGI also reviewed more than seventy reports from school districts across the country and found that a majority reported positive findings for student achievement and desegregation.

The School District of Philadelphia prepared a proposal which supported the creation of five neighborhood elementary magnet schools and underwrote programs in five high school magnets. These elementary schools, which were barely desegregated, served communities where relatively high percentages of white students lived. These students, however, did not enroll in the public school, selecting either a private or parochial school in the public school's place. The magnets were given funds to underwrite unique programs designed to attract white students from the local private and parochial schools. Thus, there were two major differences between the elementary magnet and its high school counterpart: First, the elementary school continued to serve its community and second, the elementary school administrator was restricted to recruiting in the school's attendance area.

Most of the literature surrounding magnet schools focuses on high schools. However, information on elementary school magnets is emerging. Raywid (1985) studied the options for students enrolled in the elementary grades.

Parents support magnet schools because they feel that they have more influence on the school's activities. Magnet schools usually are under the district's direct control, a feature which permits more autonomy. Additionally, the magnets tend to attract teachers and administrators who are more successful in working with students than their colleagues in neighborhood schools. This success may reside, to some extent, in additional funding for materials and supplies.

Magnet schools have taken different forms since their inception. Magnets have operated as schools without walls, open education facilities, learning centers and continuation centers as well as in the traditional mode. Nevertheless, two factors underlie the magnets: First, they were designed, developed and initiated by those working in them and second, they were defined in terms of departures from traditional schools while operating through one of two forms, curricular or instructional (Wolf et al., 1974).

New York City's open enrollment plan began in 1960 in order to allow students enrolled in schools with substantial minority populations to transfer to schools with unused space and varied ethnic student bodies. This approach continues today but it has been eclipsed by other motives. Transfers are being used to help stabilize schools in changing neighborhoods, maintain racial balance, integrate the schools and equalize their use. Fox (1967) commented that only a few white students enrolled in predominantly black schools. However, the open enrollment project permitted more opportunities for improved education and led into meaningful desegregation programs.

Raywid noted that open enrollment attracted only a few students, far less than the anticipated number, and cited two possible reasons for this miscalculation. First, students who were interested in transferring could not identify a target school; they were limited to designating a group of schools they would consider with the assignment left to district administrators. Second, the inner city students' low socioeconomic status defined the option as a means to move out of a situation as opposed to an educational opportunity.

In 1976, ESAA authorized grants to support the planning and implementation of magnet schools for those districts which had to desegregate. Magnet schools became prominent because of their potential as an attractive approach for desegregation. Clearly, forced busing was not palatable to many citizens while magnets provided a positive causeway to desegregation by offering enhanced academic programs to students as well as routes to parental satisfaction and public confidence in the schools.

Fleming et al. (1982) noted that there were approximately one thousand magnet schcols in districts which enrolled at least twenty thousand students. Fleming added that these districts accounted for approximately one-third of those operating in the country. Here, the magnet schools enrolled from one to thirty-seven percent of the host district's student population with the elementary magnets tending to focus on pedagogical style, traditional, open or Montessori, rather than taking an academic focus.

McMillan defined a magnet school as one which offers a special or distinctive program designed to attract students of all races, thus fostering voluntary desegregation (1980). While this objective was critical when magnet schools appeared on the educational scene, their emphasis has turned to offering enriched and accelerated education programs. This change is impressive because magnets have been more effective as agents for improved educational quality than for desegregating school districts (Fleming, et al.)

In terms of desegregation, magnets have been most successful where minority students account for less than thirty percent of the school's enrollment and there is more than one minority group represented. Success also seems to be enhanced when magnets serve as a part of a desegregation program rather than the sole component.

> The most recent and extensive magnet school study concludes that the contributions of such schools to districtwide desegregation are directly related to

such variables as district purposes, which are not always districtwide desegregation but can, for example, pertain simply to desegregating particular schools. Levels of district commitment and local implementation are also crucial success determinants, and these can range from weak and ambivalent support, and quite minimal change at the school level, to high levels of conviction and innovation (Raywid, p. 450).

Magnet schools have been evaluated along two strands, either process or achievement. Raywid found that one-third of her sample provided high quality in either strand. She claimed that this finding showed that establishing magnet schools will not ensure the success of a desegregation program but can display the magnet's potential, ranking it favorably with respect to most urban educational programs.

Raywid cited one unanticipated finding: A strong local commitment for magnets. This commitment was demonstrated by instructional innovations in the school, the dedication of the faculty as a whole and its members, individually, and a multifaceted camaraderie through the unique aspects of the magnet, a camaraderie which embraced teachers, students, administrators and support staff.

Magnet schools can help promote desegregation in school districts while encouraging revitalization in their hosts. Magnets have been associated with quality educational programs while generating high satisfaction levels among those who are associated with them. Overriding these points, magnet schools can help restore the public's confidence in their schools.

Raywid also called attention to some problems associated with magnet schools. Primarily, the magnet may attract too few or too many students and fail to act as a desegregation agent. Moreover, qualified applicants who are not admitted to the magnet may have a reasonable complaint and could possibly generate more problems for the school and its district.

In addition, the magnet may not be able to accept those students who are most in need of its services. Self-selection, marketing and grade maintenance could lead to skimming, a practice which removes high achieving students from other schools. Clearly, skimming would not benefit any party in the action.

Student costs at magnets tend to be higher than at traditional schools. This matter is exacerbated at the secondary level. Reduced teacher-student ratios at magnets also contribute to higher costs.

Blank et al. (1982) listed eight components associated with success in magnet schools. First, complete access for all eligible students is necessary. Second, the school must offer an appealing curricular theme and third, sound leadership must be in place. Fourth, the magnet's site must be on neutral ground and fifth, transportation and security must be adequate. Sixth, students and staff must reflect the community's interests and seventh, strategies designed to ensure that other schools will not be deprived must be in place. Eighth, seed funding must be allocated.

Interdistrict programs designed to encourage desegregation through magnet schools have taken place (Mirga, 1983). In St. Louis, magnet schools were established and students from twenty-three suburban districts enrolled. The sending districts received funds for their eligible students and reimbursed the target district. Similar plans are operating in a small number of Michigan and Wisconsin school districts (Bennett, 1984).

Blank (1986) examined the magnet school's role in terms of either restoring or setting a sound relationship with its community. In this context, Blank discussed various marketing approaches including public relations, student recruiting and publicity.

The researcher cited four magnet school characteristics: (1) promoting a theme, (2) fostering desegregation, (3) permitting voluntary enrollment and (4) accessibility to all eligible students in a district (Levine and Havighurst, 1977). At the time Blank's article appeared, there were eleven hundred magnet schools in 140 districts across the United States. Their growth may be attributed to four factors: (1) a student's desire to avoid a mandatory assignment, (2) the magnet's curricular diversity, (3) parental and community pressures and interests and (4) the student's concern about career paths (Fleming et al., 1982).

Blank surveyed fifteen school districts with three magnet schools in each one. Overall, there were thirty-four secondary schools and eleven elementary schools. Blank found that marketing was an important component in attracting students to magnets. The marketing component included staff recruiting, letters to parents, site visits by parents, media use and student presentations.

MAGI (1985) found that magnet schools provided quality education and promoted racial balance. The study was conducted in New York State where eight school districts received funds for desegregation and included elementary and secondary magnets.

Magnet schools were characterized by high student achievement at the elementary and secondary levels. Student attendance was higher in the magnets than in their districts' schools and dropout rates were lower. The magnets were described as possessing strong identities, showing clear goals and offering rich curricula. Parental support and participation were unusually high as the magnets produced positive climates characterized by strong leadership, cohesion, teaching excellence and sound working relationships. Communication levels were high and teacher turnover was low.

Regarding racial isolation, high minority schools reduced their minority enrollment substantially. Here, average minority enrollment was reduced from 90 percent to 54 percent over ten years. Racial composition in the magnets reflected that of their communities despite relatively large discrepancies at their inception.

The literature has shown that magnet schools can serve as viable components of school desegregation programs while offering sound instructional programs. Magnets can operate at the secondary and elementary levels through curricular and instructional approaches. While student achievement and attendance are described as high for the magnet schools, this finding must be balanced against the skimming phenomenon where similar figures would be found for these students in their home schools.

Attitudes

Attitudes toward magnet school programs have been studied but interest in this potentially fruitful area has not been as strong as in others such as achievement, attendance and persistence in the magnet. Attitudes may be crucial to student success in school and deserve educators' attention. We took steps in this direction by examining the attitudes of students enrolled in an elementary magnet school where science was the attraction.

Attitudes toward Magnet Schools We were unable to locate any research on elementary student attitudes toward their magnet school and will present information designed to show where research activities have taken place recently. Wright (1986) attempted to identify the factors which facilitated parental participation in magnet school activities. In addition, he assessed parents' attitudes toward magnet school programs. Wright collected data from 600 magnet school parents and 300 nonmagnet school parents and found no significant differences for demography between minority and majority parents. Both groups cited the magnet school's location and curriculum as important in terms of student enrollment. Gillenwaters (1986) studied junior high school magnet students' attitudes and found that these students perceived themselves as highly motivated, in control of their activities and committed to their educational program. Barrow (1987) studied high school magnet students' motivation and found that rigorous academic standards served as the primary motivator. However, the lack of an interscholastic athletic program deterred potential students from enrolling.

Attitudes toward Science Student attitudes toward science have been examined for a number of years. Recently, researchers have taken novel approaches to the topic as well as working over the same ground as their predecessors. The current literature has yielded a number of studies on attitudes and points to a resurgent interest in the area with an eye toward improving student achievement.

In an interesting study, Conwell, Helgeson and Wachowiak (1987) examined the effect of matching cognitive style and science instruction. The study group was made up of fifty-six elementary education majors who were identified as Sensing Feeling types on the Myers-Briggs Type Indicator.

Attitudes toward science were assessed in the study and no significant differences were found with regard to cognitive style. The researchers claimed that the effects of matching cognitive and teaching styles are difficult to identify. Nevertheless, the negative attitudes held by elementary teachers toward science instruction is a problem which calls for attention. This phenomenon could influence their students' attitudes and matching styles may be one approach to resolving this dilemma.

Pupil attitudes toward science emerged as one of the research interests of elementary teachers in a survey conducted by Gabel et al. (1987). Five hundred and fifty-three elementary teachers in ninety-eight schools across the country returned their questionnaires. The researchers called attention to a gender bias in the study group as 88 percent of the respondents were female. They asked if this percent reflected the proportion of female teachers in the population or if females were more likely to return questionnaires.

According to Finson and Enochs (1987), students' attitudes toward science can be improved by visiting science-technology museums. The researchers commented that visits ought to be preceded and followed by related classroom activities in order to maximize learning. Additionally, hands-on programs were more likely to produce more positive attitudes than those with which students could not interact. Neither socioeconomic status nor gender appeared as factors.

Grade level appeared to influence attitudes. Here sixth, seventh and eighth grade students joined the study and attitudes decreased through the grades. The researchers attributed this phenomenon to increased departmentalization, fewer hands-on activities and emotional trauma.

Finson and Enochs looked at school type in their data analyses. Here, they differentiated between public and private schools. The private schools had a fundamentalist orientation and their approach to science could differ from that of the public schools. Since there were no significant differences on this variable, the writers postulated that the religious schools had incorporated current science curricula in their instructional programs or the museum experience was strong enough to overcome this exclusion. The writers also cited the possible combination of these factors in this regard.

The elementary science-magnet school examined in this study did include museum visits in its science program. Trips to environmental centers and other science oriented facilities were also part of the program. The entire student body took these excursions.

Kyle, Bonstetter and Gadsden (1988) studied the influence of a science curriculum on students' and teachers' attitudes toward the subject. The researchers used two curricula, traditional and process, with 228 students enrolled in grades two through six. For instrumentation, Kyle et al. used teacher and student versions of Preferences and

Understandings, questionnaires adapted by Yager and Bonnstetter (1984). These adaptions were based on thirty-two attitudinal items used in The Third Assessment of Science (NAEP, 1978A).

The results showed that students who had spent a year in a process oriented science program had more positive attitudes toward science than their counterparts in a traditional science program. This finding persisted through the grades studied in the investigation. Differences attributable to gender occurred on six items in the traditional setting. With respect to the present study, males selected science as their most or second most favorite subject significantly more often than females, while females were significantly less likely to feel successful and feel science was useful The remaining items addressed points which were not examined in the present study.

Kyle et al. commented on the value of staff development in constructing comprehensive science education programs:

> The data clearly indicate, however, that in spite of very similar perceptions of science, that when teachers receive the necessary inservice education and implementation support they are able to deliver a curriculum that interests, excites, and encourages students of both genders to develop positive images of science and scientists. The process of staff development, correlated with district-wide support

for curricular innovations,is a necessary component for any successful program implementation (p. 116).

Yager and Bonnstetter (1984) constructed an instrument designed to collect information on student attitudes toward science. Their instrument was based on the affective items included in NAEP's third science assessment. The writers claimed that this assessment was the first one to include "an extensive battery of items dealing with the affective domain" (p. 406), items which permit insights to students' perceptions of their teachers, their classes and their coursework. The information gleaned from students' responses to these items may be more meaningful than achievement scores for reviewing science education programs.

Yager and Bonnstetter used this instrument in their follow-up study. The researchers wanted to determine if any changes in attitudes toward science had taken place since data from the Third Assessment were collected five years earlier. According to the writers, major changes had taken place in science curricula in that five year period and their study would help determine if individuals' attitudes had changed with the introduction of these new curricula.

Thirteen items were used to form the instrument which was administered in fifteen Iowa school districts. Approximately 700 instruments were returned with representation among the students in school about the same as in the Third Assessment. Returns for the adult sample were somewhat less than the percent stated by the NAEP.

According to Yager and Bonnstetter, their results followed those of the NAEP. This finding seems to suggest that the efforts of science educators to improve performance and attitudes through various strategies failed to bear fruit. However, the five year period between the Third Assessment and the follow-up study may be too short to show the type of improvement the researchers sought.

Yager and Yager (1985) found that the results obtained in four studies on students' attitudes toward science were similar. Younger students were more excited about science than their older counterparts and teachers were looked on as information providers. Students did not feel more successful or curious as they worked through science programs and the schools failed to provide sound information on science careers nor did they encourage their students to follow these careers.

Barrington and Hendricks (1988) examined the attitudes toward science held by gifted and average students in grades three, seven and eleven. The researchers used the NAEP based attitude questionnaire constructed by Yager and Bonnstetter (1984) and found that the intellectually gifted students had significantly more positive attitudes toward science than their average peers. There were no significant differences attributable to gender. The writers suggested that their results support the need for differentiated curricula.

The NAEP (1988) found that a majority of the students who participated in the 1986 Assessment were unenthusiastic about science. Their attitudes toward the subject declined as they progressed through school, reflecting those found in the 1986 Mathematics Assessment and Yager and Yager (1985). The relationship between achievement and attitudes was inconsistent. Consequently, the NAEP must look for other reasons to explain the increase in science proficiency which occurred between the 1986 Assessment and its predecessor.

Summary

We found little information on students' attitudes toward magnet schools at the elementary level. Perhaps the relatively small number of schools in this category is linked to the lack of research interest in the area. In comparison, the research on students' attitudes toward science is abundant, a portion of it based on the NAEP's efforts in the area. With these interests at hand, we used a set of NAEP items to determine if the attitudes toward science held by students enrolled in an elementary science-magnet school differed significantly from students enrolled in a neighboring school without a magnet component.

Procedures

We asked the principals of the elementary science-magnet school and a neighboring school if they would be interested in participating in a study designed to determine if the implementation of the magnet would generate more positive attitudes in the magnet's students. Both principals agreed. Their schools were similar in that both served largely Hispanic student populations and were eligible for Chapter 1 services.

The elementary science-magnet school received additional funds through the grant in order to implement its program. These funds were used to purchase materials and supplies and underwrite four positions, three classroom teachers and one science coordinator. This strategy allowed the principal to reduce class size and delegate the major implementation responsibility to one person.

The science coordinator handled program paperwork, set up the science staff development program, worked with groups of teachers within and across grades, assisted individual teachers, prepared publicity releases and arranged special events. These events included school and class trips to science-oriented educational facilities such as the Franklin Institute, a science technology museum, and the Schuylkill Valley Nature Center, an environmental center, and parental and community involvement programs.

Science activities varied from grade to grade as the school had to follow the School District's Standardized Curriculum. However, the enrichment phase was evident through classroom observations, posters which lined the school's corridors, models which were placed in appropriate locations throughout the school and an active parental involvement program in an area where previous activities attracted only a few individuals. Thus, the study condition was established and we wanted to judge its effect.

We prepared an instrument based on a set of thirteen items which were released by the NAEP. Our instrument appears in the Appendix. In our opinion, the NAEP's use of the items established validity and reliability and it was not necessary to collect data in order to establish these properties. We asked the principals to administer the instrument to all of their fourth, fifth and sixth graders because we were interested in an analysis by grade and held the opinion that an instrument used by younger children could be handled by their older counterparts. The instrument was administered as we asked. We observed three administrations and there were no problems associated with them. We asked the other teachers about their administration and they reported that they had no problems. We had our data placed on a computer file and used SPSSX programs to analyze them.

Results

Table 1 is a summary data table which shows the number of students enrolled in the magnet and comparison schools. Breakdowns by gender, ethnicity and grade are included. Both schools had student populations with high Hispanic percentages, 68 percent in the magnet school and 75 percent in the comparison school.

For our first series of analyses, we examined the students' choice of their first and second favorite subjects. Here, 111 magnet school students selected science as their first or second choice and sixty-six selected another subject.

In the comparison school, seventy-seven students selected science and 104, another subject. Chi-square was 13.80 and significant beyond .001. This information appears in Table 2.

Table 3 shows subject selection by grade. In grade four, sixty students selected science and thirty-nine, another subject. In grade five, the numbers were seventy-four and forty-four, respectively, and in grade six, fifty-four and eighty-seven. Chi-square was 18.94 and significant beyond the .001 level

Tables 4 and 5 show subject selection by gender and ethnicity. Neither variable was significant. We combined the Asian students enrolled in the magnet schools with the white students in order to preserve as much of our data as possible.

Table 1

Summary Data Table: Student Enrollment by Ethnicity and Gender: Magnet and Comparison Elementary Schools

	White	Black	Hispanic	Other	Total
School					
Magnet					
Male	18	12	48	2	80
Grade 4	4	2	17	1	24
Grade 5	6	3	16	1	26
Grade 6	8	7	15	0	30
Female	16	9	72	0	97
Grade 4	6	2	18	0	26
Grade 5	4	2	30	0	36
Grade 6	6	5	24	0	35
Comparison					
Male	1	22	69	0	92
Grade 4	0	8	16	0	24
Grade 5	0	6	21	0	27
Grade 6	1	8	32	0	40
Female	0	22	67	0	89
Grade 4	0	10	15	0	25
Grade 5	0	8	21	0	29
Grade 6	0	4	31	0	35
Total	35	65	256	2	358

Table 2

Results of Chi-Square Analysis: Science First or Second Choice by School

	Selection Science	Other	Chi-Square	df	Sig.
School					
Magnet	111	66			
Comparison	77	104	13.80	1	<.001***

Table 3

Results of Chi-Square Analysis: S ience First or Second Choice by Grade

	Selection Science	Other	Chi-Square	df	Sig.
Grade					
Four	60	39			
Five	74	44			
Six	54	[illegible]7	18.94	2	<.001***

Table 4

Results of Chi-Square Analysis: Science First or Second Choice by Gender

	Selection Science	Other	Chi-Square	df	Sig.
Gender					
Male	84	88			
Female	86	100	.15	1	.70

Table 5

Results of Chi-Square Analysis: Science First or Second Choice by Ethnicity

	Selection Science	Other	Chi-Square	df	Sig.
Ethnicity					
White+	23	14			
Black	28	37			
Hispanic	137	119	3.81	2	.14

Tables 6 and 7 show subject selection by grade in the magnet and comparison schools. We found a significant difference in the magnet school where chi-square was 26.23 and significant beyond .001. Chi-square did not reach significance in the comparison school.

Table 6

Results of Chi-Square Analysis: Science First or Second Choice by Grade - Magnet School

	Selection Science	Other	Chi-Square	df	Sig.
Grade					
Four	40	10			
Five	46	16			
Six	25	40	26.23	2	<.001***

Table 7

Results of Chi-Square Analysis: Science First or Second Choice by Grade - Comparison School

	Selection Science	Other	Chi-Square	df	Sig.
Grade					
Four	20	29			
Five	28	28			
Six	29	47	1.93	2	.38

Tables 8 and 9 show subject selection by gender in both schools. In both cases, differences were not significant. Tables 10 and 11 show subject selection by ethnicity in both schools and the differences were not significant.

Table 8

Results of Chi-Square Analysis: Science First or Second Choice by Gender - Magnet School

	Selection Science	Other	Chi-Square	df	Sig.
Gender					
Male	32	48			
Female	34	63	.27	1	.60

Table 9

Results of Chi-Square Analysis: Science First or Second Choice by Gender - Comparison School

	Selection Science	Other	Chi-Square	df	Sig.
Gender					
Male	52	40			
Female	52	37	.01	1	.91

Table 10

Results of Chi-Square Analysis: Science First or Second Choice by Ethnicity - Magnet School

	Selection Science	Other	Chi-Square	df	Sig.
Ethnicity					
White	22	14			
Black	13	8			
Hispanic	76	44	.06	2	.97

Table 11

Results of Chi-Square Analysis: Science First or Second Choice by Ethnicity - Comparison School

	Selection Science	Other	Chi-Square	df	Sig.
Ethnicity					
Black	15	29			
Hispanic	62	75	1.16	1	.28

Table 12

Student Responses to Item 1A: What Has Been Your Most Favorite Subject in School ?

Subject	School	
	Magnet	Comparison
Science	65	35
Gym	38	30
Math	35	60
Social Studies	18	6
Art	7	18
Music	6	8
Reading	5	17
Spelling	2	0
History	1	0
ESOL	0	6
No Answer	0	1
Total	177	181

Table 13

Student Responses to Item 1B: What Has Been Your Second Most Favorite Subject in School ?

Subject	School Magnet	School Comparison
Science	46	42
Music	7	14
Gym	35	17
Mathematics	41	30
Health	1	1
Reading	13	30
Art	8	14
Social Studies	19	12
Language Arts	2	1
Writing	1	2
Homework	1	0
Spelling	1	5
Recess	1	0
ESOL	0	8
No Answer	1	5
Total	177	181

Student responses to items 2A through 12E appear in Tables 14 through 41. We found that the response patterns were similar for eighteen items and dissimilar for twelve items. We did not conduct further analyses for the items which had similar response patterns because we felt the results would add little to our effort. We did examine the items which generated differences.

One item, 2B, which generated dissimilar responses was: "Do you wish you had more science in school ?" Here, 73 percent (129) of the magnet school students answered yes while 54 percent (97) of the comparison school students did so. Item 6B asked: "Think about being a scientist. Would being a scientist make you rich ?" In this case, 29 percent of the magnet school students and 38 percent of the comparison school students answered yes. Item 6C asked: "Think about being a scientist. Would being a scientist be too much work for you ?" Here, 49 percent of the magnet school students answered no and 32 percent of the comparison school students did so.

Four questions appeared under Item 11 as students were asked if they could help solve the problems of (1) pollution, (2) energy waste, (3) food shortages and (4) disease. Here, we found different response patterns in three of the four, pollution, food shortages and disease. In each case, the comparison school students were more likely to claim they could help. The percents for pollution were 37 and 42, for food shortages 37 and 51 and for disease 24 and 31.

Five questions were clustered under Item 12 where students were asked if they or their families could use information gained from experiments to make a decision about (1) buying cereal, (2) keeping healthy, (3) buying a car (4) selecting toothpaste and (5) choosing friends. Comparison group students were more likely to rely on the results in each case. The percents were 40 and 54, 71 and 84, 21 and 39, 38 and 46 and 23 and 32, respectively.

Table 14

Student Responses to Item 2A: Do You Have Any Science in School ?

School	Response		
	Yes	No	Don't Know
Magnet	175	1	1
Comparison	181	0	0

Table 15

Student Responses to Item 2B: Do You Wish You Had More Science in School ?

School	Response			
	Yes	No	Don't Know	No Answer
Magnet	129	17	29	2
Comparison	97	49	34	1

Table 16

Student Responses to Item 3A: When You Have Science in School, How Does It Usually Make You Feel ? Does Science Make You Feel Happy ?

	Response			
School	Yes	No	Don't Know	No Answer
Magnet	124	26	16	11
Comparison	122	27	19	13

Table 17

Student Responses to Item 3B: When You Have Science in School, How Does It Usually Make You Feel ? Does Science Make You Feel Interested ?

	Response			
School	Yes	No	Don't Know	No Answer
Magnet	156	9	7	5
Comparison	153	14	9	5

Table 18

Student Responses to Item 3C: When You Have Science in School, How Does It Usually Make You Feel ? Does Science Make You Feel Dumb ?

School	Response			
	Yes	No	Don't Know	No Answer
Magnet	3	147	14	13
Comparison	3	147	17	14

Table 19

Student Responses to Item 3D: When You Have Science in School, How Does It Usually Make You Feel ? Does Science Make You Feel Excited ?

School	Response			
	Yes	No	Don't Know	No Answer
Magnet	123	25	18	11
Comparison	119	33	19	10

Table 20

Student Responses to Item 3E: When You Have Science in School, How Does It Usually Make You Feel ? Does Science Make You Feel Successful ?

School	Response Yes	No	Don't Know	No Answer
Magnet	107	25	35	10
Comparison	113	20	38	10

Table 21

Student Responses to Item 4: Are The Things You Learn in Science Useful to You When You Are Not in School ?

School	Response Yes	No	I Don't Know
Magnet	125	20	32
Comparison	132	24	25

Table 22

Student Responses to Item 5: Do You Think That Knowing A Lot About Science Will Help You When You Grow Up ?

School	Response		
	Yes	No	I Don't Know
Magnet	142	4	31
Comparison	148	9	24

Table 23

Student Responses to Item 6A: Think About Being A Scientist. Would Being A Scientist Be Fun For You ?

School	Response			
	Yes	No	I Don't Know	No Answer
Magnet	112	22	38	5
Comparison	112	26	38	5

Table 24

Student Responses to Item 6B: Think About Being A Scientist. Would Being A Scientist Make You Rich ?

School	Response Yes	No	I Don't Know	No Answer
Magnet	51	32	84	10
Comparison	69	34	72	6

Table 25

Student Responses to Item 6C: Think About Being A Scientist. Would Being A Scientist Be Too Much Work For You ?

School	Response Yes	No	I Don't Know	No Answer
Magnet	35	87	44	11
Comparison	112	26	38	5

Table 26

Student Responses to Item 6D: Think About Being A Scientist. Would Being A Scientist Be Boring For You ?

School	Response			
	Yes	No	I Don't Know	No Answer
Magnet	15	118	32	12
Comparison	25	120	28	8

Table 27

Student Responses to Item 6E: Think About Being A Scientist. Would Being A Scientist Make You Important ?

School	Response			
	Yes	No	I Don't Know	No Answer
Magnet	112	13	46	6
Comparison	124	14	39	4

Table 28

Student Responses to Item 6F: Think About Being A Scientist. Would Being A Scientist Make You Lonely ?

School	Response			
	Yes	No	I Don't Know	No Answer
Magnet	13	105	47	12
Comparison	17	120	37	7

Table 29

Student Responses to Item 7: Do You Think Pollution Is A Serious Problem in The World Today ?

School	Response			
	Yes	No	I Don't Know	No Answer
Magnet	146	5	26	0
Comparison	133	10	37	1

Table 30

Student Responses to Item 8: Do You Think Energy Waste Is A Serious Problem in The World Today ?

School	Response			
	Yes	No	I Don't Know	No Answer
Magnet	123	10	44	0
Comparison	119	23	38	1

Table 31

Student Responses to Item 9: Do You Think Food Shortage. Is A Serious Problem in The World Today ?

School	Response			
	Yes	No	I Don't Know	No Answer
Magnet	123	15	38	1
Comparison	106	36	38	1

Table 32

Student Responses to Item 10: Do You Think Disease Is A Serious Problem in The World Today ?

	Response		
School	Yes	No	I Don't Know
Magnet	153	2	22
Comparison	160	2	19

Table 33

Student Responses to Item 11A: Can You Help Solve The Problem of Pollution ?

	Response			
School	Yes	No	I Don't Know	No Answer
Magnet	65	38	71	3
Comparison	77	45	59	0

Table 34

Student Responses to Item 11B: Can You Help Solve The Problem of Energy Waste ?

School	Response			
	Yes	No	I Don't Know	No Answer
Magnet	79	29	65	4
Comparison	78	44	58	1

Table 35

Student Responses to Item 11C: Can You Help Solve The Problem of Food Shortages ?

School	Response			
	Yes	No	I Don't Know	No Answer
Magnet	66	35	72	4
Comparison	93	39	48	1

Table 36

Student Responses to Item 11D: Can You Help Solve The Problem of Disease ?

School	Yes	No	I Don't Know	No Answer
	Response			
Magnet	43	63	67	4
Comparison	57	72	51	1

Table 37

Student Responses to Item 12A: Can You or Your Family Use Information Gained from Scientific Experiments to Decide What Cereal to Buy ?

School	Yes	No	I Don't Know	No Answer
	Response			
Magnet	70	57	45	5
Comparison	97	49	34	1

Table 38

Student Responses to Item 12B: Can You or Your Family Use Information Gained from Scientific Experiments to Keep Healthy ?

	Response			
School	Yes	No	I Don't Know	No Answer
Magnet	125	22	30	0
Comparison	153	12	15	1

Table 39

Student Responses to Item 12C: Can You or Your Family Use Information Gained from Scientific Experiments to Buy A Car ?

	Response			
School	Yes	No	I Don't Know	No Answer
Magnet	38	83	51	5
Comparison	70	78	32	1

Table 40

Student Responses to Item 12D: Can You or Your Family Use Information Gained from Scientific Experiments to Choose A Toothpaste ?

School	Response			
	Yes	No	I Don't Know	No Answer
Magnet	67	59	46	5
Comparison	84	62	33	2

Table 41

Student Responses to Item 12E: Can You or Your Family Use Information Gained from Scientific Experiments to Choose Friends ?

School	Response			
	Yes	No	I Don't Know	No Answer
Magnet	41	101	30	5
Comparison	58	98	25	0

Conclusions

Students enrolled in an elementary science-magnet school were more likely to identify science as their favorite or second favorite subject than their counterparts enrolled in a comparison school. The difference between the schools reached significance at the .001 level according to chi-square. We studied the data by grade, four, five and six and found that a significant difference emerged as students enrolled in grades four and five showed a different response pattern than those enrolled in grade six. We followed this finding through the schools and found that the significance persisted through the magnet school but not through the comparison school. When we discussed this point with the magnet school's principal, he reported that a substitute teacher had been placed in one of the two sixth grade classes. This teacher's performance was not satisfactory and could have undermined the magnet's influence. Neither gender nor ethnicity was a factor in terms of subject selection, overall, or in the schools, individually.

The magnet school students wanted more science in school and were less likely to think that scientists were rich. Additionally, the magnet school students felt that they could handle a scientist's responsibilities. The comparison school students felt that they would be able to help solve the problems of pollution, food shortages and disease and were more likely to use science in making decisions than their magnet school counterparts.

Discussion

The magnet school students selected science as the favorite or second favorite subject. This finding can probably be attributed to the school's magnet status. The students desire for additional science can also be linked to the magnet.

Students' responses to the remaining questions were inconsistent. We hypothesized that the magnet students would express more positive responses to the questions than their comparison school counterparts. While the magnet school students' responses were positive and showed exposure to science, their response patterns, generally, did not differ from those of the comparison school students. We suspect that the comparison school students' responses were influenced by social desirability and response set.

Our magnet school sample seemed to respond realistically to the item which asked if they could become rich as a scientist. That the comparison school group felt science was a financially rewarding career could be attributed to social desirability. Interestingly, a higher percentage of the magnet school group felt they could handle science in terms of their workload. The comparison group students believed they could contribute to problems which called for solutions rooted in science and use science in their lives to a greater degree than the magnet school students. Perhaps the magnet students took on a realistic point of view toward these topics and were conscious of their present limitations. Clearly, these points require more attention and can serve as a base for future research activities.

Educators interested in setting up elementary science magnet programs must realize that introducing a novel curriculum is only the first step. Participating faculty members must support the program and learn how to implement it. The absence of a trained teacher in one classroom led to a significant difference for favorite and second favorite subject selection attributable to grade level in the magnet school lending support for Kyle, Bonstetter and Gadsden's comment on the value of staff development

The administrative component of the program must be addressed as well. Materials and supplies must be ordered and replenished, appropriate field trips must be scheduled and parents and community organizations should be informed of all activities. Should these tasks remain open, the program's value will be limited.

To date, twelve white students have been recruited by the elementary science magnet which has operated for one school year. While the program has been implemented, more time may be necessary to reach its target students. We intend to monitor future student enrollment in order to determine if a meaningful number of white students enroll in the school and confirm the elementary science magnet school's role in desegregation.

We did not look at student achievement in our study. This variable will be examined in a subsequent effort. We will follow our magnet school students as they progress through the grades in the magnet, other elementary schools and in secondary schools. We intend to collect data designed to show their performance in science in an attempt to determine if their magnet experience influences their subsequent achievement in the discipline.

References

Barrington, B. and Hendricks, B. "Attitudes toward Science and Science Knowledge of Intellectually Gifted and Average Students in Third, Seventh, and Eleventh Grades." Journal of Research in Science Teaching, 1988, 25, 679-87.

Barrow, G. "Characteristics of Magnet High School Students and Motivation of Students and Their Parents to Attend a Magnet School." 1986, Dissertation Abstracts International, 1987, 48, 1166A.

Bennett, D. "A Plan for Increasing Educational Opportunities and Improving Racial Balance in Milwaukee." In C. A. Willie (Ed.), School Desegregation Plans that Work. Westport, CN: Greenwood, 1984.

Blank, R., Dentler, R., Baltzell, D. and Chabotar, K. Survey of Magnet Schools - Final Report: Analyzing a Model for Quality Integrated Education. Washington, D. C.: J. H. Lowrey, 1983

Blank, R. "Marketing and Recruiting in Urban Magnet Schools: Implications for Change in School-Community Relations." Urban Education, 1986, 21, 263-79.

Conwell, C., Helgeson, S. and Wachowiak, D. "The Effect of Matching and Mismatching Cognitive Style and Science Instruction." Journal of Research in Science Teaching, 1987, 24, 713-22.

Federal Register, 97, 45, May 16, 1980.

Finson, K. and Enochs, L. "Student Attitudes toward Science-Technology-Society Resulting from Visitation to a Science-Technology Museum." Journal of Research in Science Teaching, 1987, 24, 593-609.

Fleming, P., Blank, R., Dentler, R. and Baltzell, D. Survey of Magnet Schools: Interim Report. Washington, D. C.: J. H. Lowrey and Associates, 1982.

Fox, D. Expansion of the Free Choice Open Enrollment Program. New York: Center for Urban Education, 1967.

Gabel, D., Samuel, K., Helgeson, S., McGuire, S., Novak, J. and Butzow, J. "Science Education Research Interests of Elementary Teachers." Journal of Research in Science Teaching, 1987, 24, 659-77.

Gillenwaters, B. "A Study of Choice as a Determiner of Student Attitudes in a Magnet School." 1986, Dissertation Abstracts International, 1987, 47, 1166A.

Kyle, W., Bonnstetter, R. and Gadsden, T. "An Implementation Study: An Analysis of Elementary Students' and Teachers' Attitudes toward Science in Process-Approach vs. Traditional Science Classes." Journal of Research in Science Teaching, 1988, 25, 103-120.

Levine, D. and Havighurst, R. The Future of Big City Schools. San Francisco: McCutchan, 1977.

McMillan, C. Magnet Schools: An Approach to Voluntary Desegregation. Bloomington: Phi Delta Kappa, 1980.

Mullis, I. and Jenkins, L. The Science Report Card - Elements of Risk and Recovery: Trends and Achievement Based on the 1986 National Assessment. Princeton: Educational Testing Service, 1988.

MAGI Educational Services. New York State Magnet School Research Study: Final Report. (ERIC Document Reproduction Service No. ED 276 792, 1985)

Mirga, T. "Court Upholds Interdistrict Busing Plan." Education Week. October 19, 1983. p. 13.

National Assessment of Educational Progress. Science: Third Assessment: 1976-77. Denver: Education Commission of the States, 1978A. (NAEP No. 08-S-08)

_______. The Third Assessment of Science, 1976-77, Released Exercise Set ... iver, Education Commission of the States, 19/8B. (ERIC Document Reproduction Service No. ED 161 686, 1978)

Raywid, M. "Family Choice Arrangements in Public Schools: A Review of the Literature." Review of Educational Research, 1985, 55, 435-67.

Wal rg, H., Welch W. and Fraser, B. Use of National Assessment in Science Data in Testing a Model of Educational Productivity. Symposium conducted at the Annual Meeting of the American Educational Research Association, Chicago, M rch-April, 1985.

Wolf, T., Walker, M. and Mackin, R. Summary of the NASP Survey, 1974. Amherst: National Alternative Schools Program, University of Massachusetts, 1974.

Wright, C. "Patterns of Participation of Parents in Magnet School Programs of the Glendale elementary School District." Dissertation Abstracts International, 1987, 47, 3939A.

Yager, R. and Bonnstetter, R. "Student Perceptions of Science Teachers, Classes and Course Content." School Science and Mathematics, 1984, 84, 406-14.

Yager,R. and Yager, S. "The Effect of Schooling upon Understanding of Selected Science Terms." Journal of Research in Science Teaching." 1984, 22, 359-64.

_______. "Changes in Perceptions of Science for Third, Seventh and Eleventh Grade Students." Journal of Research in Science Teaching, 1985. 22, 347-58.

Appendix

Name ______________________________

School ______________________________

Grade ______________

1. For this exercise, write out your answers to questions A and B below:

A. What has been your most favorite subject in school ?

____

B. What has been your second most favorite subject in school ?

____

2. For each part of the exercise below, the answer choices are "Yes," "No," or "I don't know." For this kind of exercise, put a check on the line next to the answer you choose.

A. Do You have any science in school ?

____ Yes
____ No
____ I don't know

B. Do you wish you had more science in school ?

____ Yes
____ No
____ I don't know

3. When you have science in school, how does it usually make you feel ?

Does science make you feel

A. Happy	____ Yes	____ No	____ I don't know
B. Interested	____ Yes	____ No	____ I don't know
C. Dumb	____ Yes	____ No	____ I don't know
D. Excited	____ Yes	____ No	____ I don't know
E. Successful	____ Yes	____ No	____ I don't know

4. Are the things you learn in science useful to you when you are not in school ?

____ Yes

____ No

____ I don't know

5. Do you think that knowing a lot about science will help you when you grow up ?

____ Yes

____ No

____ I don't know

6. Think about being a scientist. Would being a scientist

A. Be fun for you ? ____Yes ____No ____I don't know

B. Make you rich ? ____Yes ____No ____I don't know

C. Be too much work for you ? ____Yes ____No ____I don't know

D. Be boring for you ? ____Yes ____No ____I don't know

E. Make you important ? ____Yes ____No ____I don't know

F. Make you lonely ? ____Yes ____No ____I don't know

7. Do you think pollution is a serious problem in the world today ?

____Yes ____No ____I don't know

8. Do you think energy waste is a serious problem in the world today ?

____Yes ____No ____I don't know

9. Do you think food shortage is a serious problem in the world today ?

____Yes ____No ____I don't know

10. Do you think disease is a serious problem in the world today ?

____Yes ____No ____I don't know

11. For each of the word problems below, tell if the things you can do really can help solve these problems. Can you help solve the problems of

A. Pollution ____Yes ____No ____I don't know

B. Energy waste ____Yes ____No ____I don't know

C. Food Shortages ____Yes ____No ____I don't know

D. Disease ____Yes ____No ____I don't know

12. For each of the following, tell if you or your family can use information gained from scientific experiments to do these things.

Can you or your family use information gained from scientific experiments to

A. Decide what cereal to buy ____Yes ____No ____I don't know

B. Keep healthy ____Yes ____No ____I don't know

C. Buy a car ____Yes ____No ____I don't know

D. Choose a toothpaste ____Yes ____No ____I don't know

E. Choose friends ____Yes ____No ____I don't know