

TOUR OF FERNBANK SCIENCE CENTER AND
FERNBANK MUSEUM OF NATURAL HISTORY

**AN ENHANCED APPROACH TO SCIENCE EDUCATION:
AN EVALUATION OF THE FERNBANK
SCIENTIFIC TOOLS AND TECHNIQUES PROGRAM**

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Objectives

The purpose of this paper is to present the findings of an evaluation of the Fernbank Science Center's Scientific Tools and Techniques (STT) program. This 15 minute paper presentation will be given in conjunction with a tour of the Science Center and Museum and observation of STT classes actually in session.

Perspective

The STT Program at Fernbank Science Center is an innovative quarter-long magnet program which is available to ninth and tenth grade students in DeKalb County who show a special interest in mathematics and science. In addition to classroom lectures, this comprehensive program in science education incorporates laboratory research, field trips, and individual instruction. Topics covered include meteorology, physics, chemistry, geology, astronomy, aerospace, animal ecology, plant ecology, electron microscopy, microbiology, ornithology, and physiology. The STT program is taught both in the Naturalist Center of the new Fernbank Museum of Natural History and Fernbank Science Center. The overall Fernbank complex is a unique partnership of the DeKalb County School System and Fernbank Inc., a non-profit corporation.

Data Sources

Data for the program evaluation were obtained from the academic student histories and, in addition to gender and race, consisted of the number of science courses taken (NSC) and the science grade point average (GPA). A control group was obtained by matching each student in the STT program with a student who did not take the STT program but had the same home school, gender, race, eighth grade science GPA, and specific eighth grade science courses. The sample size for the STT program evaluation was 125 students a year for four years. Thus, the overall sample size was 1000 students. In addition, a mailed questionnaire was sent to each student in the experimental and control group.

Methods

The primary hypothesis is that the population mean science GPA of the STT group will be greater than the control group. Descriptive statistics are presented for the quasi-experimental design that compares the STT program to a matched control group. In addition, a repeated measures multivariate analysis of variance (MANOVA) was run on science GPA and the number of science courses taken (NSC). Responses to the items that were asked of both the STT and control groups on the questionnaire are compared using inferential statistics.

Results

Overall, the students in the STT program at the end of their senior year had a science GPA of 3.196 compared to the control group which had a GPA of 2.977, a difference of 7.36 percent. For the subgroup of Black Males, the mean GPA for the STT program was 2.887 in contrast to a mean GPA of 2.426 for the control group, a difference of 19.00 percent. The number of science courses taken by students in the STT program at the end of their senior year was 7.872 compared to 7.588, a difference of 3.74 percent. For the subgroup of Black Males, the mean number of science courses taken was 7.690 compared to the control group which had a mean number of science courses taken of 6.381, a difference of 20.51 percent.

As part of the study a questionnaire was mailed to students in the STT and control groups. The response rate for an initial mailing and a follow-up was 40.8 percent. A univariate analysis of variance for one-within and two-between factors for selected responses on the questionnaire resulted in week non-significance for responses grouped according to the week in which they were received. Among the findings of the questionnaire are 1) STT students are three times as likely to be employed full-time in science or a science-related field as the control, 2) STT students are almost twice as likely to have majored in science in college as the control, and 3) STT students are four times as likely to have received a science award while in college as the control.

Educational and Scientific Importance of the Study

As far as can be determined, there is no science program of this magnitude involving a partnership between a museum and a school system in the United States. Furthermore, the results indicate that the STT program could serve as a model for enhanced science education. Based on these results, a science program patterned after STT will be offered to inner city seventh grade students this summer. In addition, a qualitative research study to assess the STT program in the new Fernbank Museum by the DeKalb School System is under consideration.

Multivariate Analysis of Variance for
One-Within and Two-Between Factors for
Two Dependent Variables (GPA and NSC)

Between-Subjects Effects	Wilks Lambda	p-value
Sex by Race by Year	0.988	0.481
Race by Year	0.990	0.596
Sex by Year	0.993	0.763
Sex by Race	0.993	0.194
Year	0.963	0.008
Race	0.985	0.034
Sex	0.987	0.050
Within-Subjects Effects		
Sex by Race by Year by Condition	0.990	0.563
Race by Year by Condition	0.989	0.528
Sex by Year by Condition	0.987	0.399
Sex by Race by Condition	0.987	0.045
Year by Condition	0.970	0.032
Race by Condition	0.998	0.698
Sex by Condition	0.998	0.702
Condition	0.226	<0.001

Note: The factor Condition has two levels which are Experimental and Control.

Univariate Analysis of Variance for
One-Within and Two-Between Factors
For GPA as Dependent Variable

Tests of Between-Subjects Effects.

	SS	DF	MS	F	Sig of F
Within Cells	325.22	460	.71		
Constant	5554.31	1	5554.31	7856.13	.000
Sex	6.42	1	6.42	9.08	.003
Race	29.06	1	29.06	41.11	.000
Year	9.16	3	3.05	4.32	.005
Sex by Race	.67	1	.67	.95	.330
Sex by Year	2.00	3	.67	.94	.420
Race by Year	2.41	3	.80	1.14	.333
Sex by Race by Year	1.28	3	.43	.60	.614

Tests involving 'Cond' Within-Subject Effect.

	SS	DF	MS	F	Sig of F
Within Cells	169.63	460	.37		
Cond	12.17	1	12.17	33.01	.000
Sex by Cond	2.38	1	2.38	6.44	.011
Race by Cond	2.21	1	2.21	6.01	.015
Year by Cond	1.99	3	.66	1.80	.146
Sex by Race by Cond	.01	1	.01	.02	.884
Sex by Year by Cond	1.55	3	.52	1.40	.241
Race by Year by Cond	.33	3	.11	.29	.830
Sex by Race by Year by Cond	.52	3	.17	.47	.701

Univariate Analysis of Variance for
One-Within and Two-Between Factors
For NSC as Dependent Variable

Tests of Between-Subjects Effects.

	SS	DF	MS	F	Sig of F
Within Cells	4492.68	460	9.77		
Constant	36354.40	1	36354.40	3722.28	.000
Sex	17.14	1	17.14	1.75	.186
Race	9.06	1	9.06	.93	.336
Year	137.30	3	45.77	4.69	.003
Sex by Race	27.81	1	27.81	2.85	.092
Sex by Year	10.37	3	3.46	.35	.786
Race by Year	25.73	3	8.58	.88	.452
Sex by Race by Year	12.72	3	4.24	.43	.729

Tests involving 'Cond' Within-Subject Effect.

	SS	DF	MS	F	Sig
of F					
Within Cells	3155.97	460	6.86		
Cond	24.05	1	24.05	3.51	.062
Sex by Cond	10.42	1	10.42	1.52	.218
Race by Cond	4.02	1	4.02	.59	.445
Year by Cond	18.72	3	6.24	.91	.436
Sex by Race by Cond	14.75	1	14.75	2.15	.143
Sex by Year by Cond	21.64	3	7.21	1.05	.370
Race by Year by Cond	17.06	3	5.69	.83	.478
Sex by Race by Year by Cond	27.78	3	9.26	1.35	.258

Comparison of GPA and NSC
Between Treatment and Control

Initial Sample

Group	GPA	NSC
Treatment	3.165	7.954
Control	2.938	7.620
	7.73 %	4.38 %

Comparison of GPA and NSC
Between Treatment and Control
Missing Value Cases Removed

Group	GPA	NSC
Treatment	3.210	7.954
Control	2.980	7.620
	7.71 %	4.38 %

Comparison of GPA and NSC
Between Treatment and Control
Mean Values Substituted

Group	GPA	NSC
Treatment	3.207	7.954
Control	2.978	7.620
	7.68 %	4.38 %

Comparison of GPA and NSC
 Between Treatment and Control
 "Other" Category Removed

Group	GPA	NSC
Treatment	3.196	7.872
Control	2.977	7.588
	7.36 %	3.74 %

Comparison of GPA
 Between Treatment and Control
 "Other" Category Removed

Group	FW	FB	MW	MB
Treatment	3.360	2.960	3.226	2.887
Control	3.320	2.700	2.943	2.426
	1.20 %	9.63 %	9.62 %	19.00 %

Comparison of NSC
 Between Treatment and Control
 "Other" Category Removed

Group	FW	FB	MW	MB
Treatment	7.824	7.824	7.958	7.690
Control	7.514	7.851	7.788	6.381
	4.13 %	0.00 %	2.18 %	20.51 %

SURVEY RESULTS

	Question	Per Cent	
		Experimental	Control
1.	Employed full-time in science or related field	12.1	4.2
2.	Employed part-time in science or related field	16.5	6.6
3.	Two-year college graduate	3.0	3.0
4.	Four-year college graduate	34.6	29.3
5.	Currently enrolled in college	68.4	73.7
6.	Majored or currently majoring in science	45.0	26.3
7.	Worked as a science lab assistant in HS	8.7	1.8
8.	Worked as a science lab assistant in college	18.6	3.6
9.	Received a science award in high school	46.8	20.4
10.	Received a science award in college	8.2	2.4

Scale (0=Low, 5=High)

	Question	Experimental	Control
11.	Motivated to seek job in science by HS courses	3.293	2.677
12.	Motivated to take college science courses by HS courses	3.784	3.180
13.	Motivated to join science groups by HS courses	3.069	2.527
14.	Motivated to become interested in science hobbies	3.649	3.000

	Question	Per Cent	
		Experimental	Control
15.	Would recommend the STT program to students today	96.2	
16.	Had siblings who participated in STT	21.3	
17.	Used facilities at Fernbank after STT	48.1	
18.	Used planetarium	36.2	
19.	Used library	25.5	
20.	Attended lectures	13.6	
21.	Visited exhibits	32.8	
22.	Enrolled in Independent Study	10.2	
23.	Had one-on-one help from Fernbank instructor	10.2	
24.	Attended a Fernbank Festival	19.6	
25.	Joined STT Alumni Club	19.6	

Scale (0=Low, 5=High)

	Question	Experimental	Control
26.	STT motivated me to select more science courses	3.872	
27.	STT made me feel more confident in science courses	4.340	
28.	STT was a valuable experience	4.664	

Note: The returned questionnaires were grouped according to the first, second, third, or fourth week in which they were received. Those received after the fourth week were placed in group five.

A univariate analysis of variance for one-within and two-between factors for questions 11-14 resulted in week non-significance for the first four weeks of responses versus the last group of responses.

Appendix Overview of Fernbank

Audience

Fernbank's primary audience is within a one hour drive and is essentially metro Atlanta, the 11th largest MSA in the United States with a population of 4,112,198 people. Of this area 37% is minority. Inner city Atlanta closer to Fernbank has a larger minority population. Fernbank is six miles east of the center of downtown Atlanta. DeKalb County Schools (one of the Fernbank partnership) enrollment is 76.6% Afro-American, 3.8% Asian, 6.4% Hispanic 2.1% multiracial and 10.8% Caucasian. It is a system where the minority is a majority. The Atlanta school system has a similar demographic. DeKalb and the Atlanta system are the two largest in the Metroplex.

Fernbank is very successful at reaching underserved audiences. Most local families have been to Fernbank if not recently, then when they were in school. As a result our image with underserved populations is a favorable one.

History

The Fernbank Science Center was founded in 1967 as a partnership between the DeKalb County schools and the Fernbank Foundation, a 501(C) (3) not for profit and is a unique application of formal and informal science education. As one of the founding members of the Association of Science and Technology Centers (ASTC) Fernbank has been an innovator for nearly 35 years. The initial facility included a 500-seat planetarium, an observatory with a 36-inch reflecting telescope, an Apollo capsule, exhibit halls and classrooms, greenhouses, gardens and an old growth forest preserve, the only one in Atlanta. The forest is designated as one of the best walks in Georgia and will be featured in a new publication on Urban Forests by the Georgia Department of Natural Resources. As part of the long-range plan Fernbank Natural History Museum opened in 1996 with an IMAX theater and an extra 160,000 square feet of new space. Over 800,000 people visit the Fernbank Complex each year.

Program

The bulk of Fernbank's visitation is in single field trip visits or public attendance but we also produce extensive educational programs ranging from vocational horticulture to aerospace education. Fernbank is a partner with NASA's SEMAA program and produces curriculum for the program. We serve over 825 students in it each year in summer, fall and spring daytime sessions that include 21 hours of study for upper level students and 12 hours of study for elementary students. Fernbank also does SpaceStation Fernbank, a summer aerospace camp. As part of the SEMAA program Fernbank pioneered Parents Café program to involve parents in the SEMAA activities while their child attends class and to provide continuing education in science and life and parenting skills. Last year we served 1048 parents in the SEMAA program.

Similarly, students visit our Quest summer camps on other topics as well as a variety of programs, lectures and activities in the forest and gardens. These range from bird watching and bird banding to composting.

Fernbank has also been instrumental in writing the DeKalb County Schools Science Standards, which are based in state and national standards.

Staff

Fernbank has a center of excellence in its educational program and boasts of one of the finest faculties at any museum or science center in North America. There are over 60 professional scientists and educators on staff and over two thirds of them have advanced degrees. The disciplines include astronomy, chemistry, physics, biology, microbiology, computer science, the history of science, meteorology, entomology, forestry, horticulture, ornithology, geology, environmental science, ecology, paleontology, archeology, physiology, neuroscience, genetics as well as science and aerospace education at all grade levels. There are 180 staff members with one half of those supported by the DeKalb County Schools.

Since Fernbank's inception as a partnership between a school system and a 501(c)(3) non-profit foundation, Fernbank has excelled at creating additional partnerships. Present partners include NASA, Zoo Atlanta, The Arabia Mountain Project, Project GLOBE, Morehouse School of Medicine, Georgia Tech, Emory University, The Atlanta Black College Network, Agnes Scott College, Georgia State University and various interest or professional groups and clubs ranging from Audubon and Astronomy to Tourism and Watershed Alliances.