
AC 2011-1520: EXAMINING THE EFFECTIVENESS OF THE FLORIDA EDUCATION FUND APPLIED MATHEMATICS SAT PREP SUMMER PROGRAM

Claude Villiers, Florida Gulf Coast University

Dr. Villiers received a Ph.D. in Civil and Coastal Engineering with a concentration in Materials and Construction, from The University of Florida in 2004. He is currently an Assistant Professor of Civil Engineering at Florida Gulf Coast University. He is working with the Founding Director, Department Chair, and fellow faculty in the growth of the new U.A. Whitaker School of Engineering into a nationally and internationally recognized center of academic excellence in interdisciplinary engineering education. Previously Dr. Villiers was an Assistant Professor at The City College of The City University of New York. Prior to this position, he was employed by the Florida Department of Transportation (FDOT) as a research engineer. Dr. Villiers also was employed by The University of Florida and worked on several projects sponsored by the FDOT and the Federal Highway Administration.

Shelby Gilbert, EdD, Florida Gulf Coast University

Dr. Yves J. Anglade, Florida A&M University/Florida State University

An Examination of the Florida Education Fund's Summer SAT Prep Program

Abstract

In the expanding global economy, many scientific and technological jobs in the United States are being outsourced to other countries where better-skilled workers are willing to do the work for smaller wages. Unfortunately, many corporations and national organizations have pointed to the lack of adequate K-12 educational opportunities for U.S. students to successfully enter, and complete, baccalaureate degrees in the scientific, technological, engineering, and mathematical (STEM) fields. As a result, the U.S. has called to action a new focus on preparing its workforce to meet the demands of these highly-skilled occupations to improve its economic standing globally. To address the issue, many universities and independent organizations have developed summer programs to provide high school students with opportunities to increase their mathematics and science understanding, improve their SAT scores, and experience real-world applications in STEM careers. The objective of this paper is to describe the effectiveness of one such program, the Florida Education Fund (FEF) Applied Mathematics SAT Prep Summer Camp, which has been implemented across the State of Florida for the last 5 years.

Background

The Florida Education Fund (FEF) was funded initially by a major grant from the McKnight Foundation of Minneapolis, Minnesota, and, subsequently, a challenge grant from the Foundation which required matching funds from the Florida Legislature. As a not-for-profit corporation established in 1984, the FEF has provided an avenue to ensure that educational advancement is possible¹.

This quasi-public entity with a statewide mission and national impact was originally known as the McKnight Programs in Higher Education, administered by the Florida Association of Colleges and Universities and serving as the forerunner to what is now known as the Florida Education Fund. The impact of the FEF's innovative programs and non-traditional approach to enhancing educational outcomes has been demonstrated across various educational levels, through three highly acclaimed programs¹:

- McKnight Doctoral Fellowship (A doctoral fellowship program)
- Minority Participation in Legal Education (A law school and college pre-law scholarship program)
- Centers of Excellence (A multifaceted program to motivate elementary and secondary students to prepare for and ultimately enter college)

Since 2004, FEF has successfully offered yearly summer camps with the goal of increasing the availability of for-credit academic programs offered during the summer months; improving student SAT scores; increasing the number of students who are prepared and eligible for acceptance to college; and exposing students to real-world math and its application in related career fields. A pure and applied math program is embedded into the summer camp to combat

summer learning loss in math and to address the dearth of students with strong skills in STEM fields. FEF hires and pays certified teachers and an administrator for each camp, as well as a college or graduate student(s) to assist camp teachers. Staff also administers at least four simulated SAT math assessments. It is believed that this repeated exposure to the test and testing environment help students alleviate anxiety and common test-taking missteps, such as the improper use of time and guessing. Daily hands-on activities which are structured to apply math in projects from exciting fields like aerospace technology, robotics, engineering, computing are presented. To date, a total of 1,815 students have graduated from FEF summer college preparatory programs. In 2010, 392 students participated in seven summer college preparatory camps, in Cocoa, Fort Myers, Fort Pierce, Kissimmee, Lake City, St. Petersburg, and Tampa. 168 of the 392 students participated in Applied Math Camps.

This paper will examine the effectiveness of the FEF Applied Mathematics SAT Prep Summer Camp by looking at students' gains in math performance. To meet the program's goals and measure student learning outcomes, a math pre-test is given to each student on the first day of class. After the students complete the 20-day camp, they are administered the fourth SAT simulation which serves as a posttest. Repeated measures analysis of variance (ANOVA) will be used to compare pretest and posttest scores of students, calculate gain scores, and determine average overall improvement of the student participants. Lessons learned from the FEF Summer Program may provide a model for other programs of similar settings.

Program Goals

The goals of FEF Summer Program were threefold:

- To engage each student in the learning process.
- To sharpen each student's math and language arts skills.
- To prepare each student to attain a competitive score on the FCAT and/or SAT.
- To increase the number of students prepared and eligible for acceptance to college; and
- To expose students to real-world math and its application in related career fields

SAT Strategies Courses

The FEF intends to make sure each and every one of our students earns the best possible score on the SAT and other standardized tests. So, we have gone directly to the source, to The College Board, the entity that develops and administers the SAT. The College Board is a not-for-profit membership association whose mission is to connect students to college success and opportunity². The College Board has trained our teachers to offer courses to prepare our students for the SAT. The FEF again is offering SAT preparation courses at our Centers of Excellence and at churches and community venues around the State. We are offering courses using The College Board's SAT materials at locations from Tallahassee to Miami.

Intensive SAT Prep Summer Camps

Each year, the FEF offers FREE Pre-College Summer Camps where students:

- Work with certified teachers and/or FEF Ph.D. Fellows
- Sharpen skills in mathematics, critical reading and/or writing
- Explore math and language arts in action through applied activities and projects
- Learn test-taking strategies that will help enhance scores on the SAT
- Take weekly simulated practice SAT's
- Participate in college planning workshops with guidance counselors and college and university admission and financial aid representatives
- Interact with professionals in career planning sessions
- Earn elective high school credit for satisfactory completion of Summer Camp requirements, if eligible

Florida Education Fund

The Florida Education Fund (FEF), under the leadership of Dr. Lawrence Morehouse, was funded initially by a major grant from the McKnight Foundation of Minneapolis, Minnesota, and, subsequently, a challenge grant from the Foundation which required matching funds from the Florida Legislature. As a not-for-profit corporation established in 1984, the FEF has provided an avenue to ensure that educational advancement is possible. The impact of the FEF's innovative programs and non-traditional approach to enhancing educational outcomes has been demonstrated across various educational levels, through its highly acclaimed programs. One such program is the Center of Excellence, which houses several pre-collegiate programs¹.

Established in 1985, the Center of Excellence, under the leadership of Lyra Logan, is a community-based initiative whose mission is to identify and motivate disadvantaged minority elementary and secondary students. The Center's mission includes: a) assuming a more proactive stance in the education of youth; b) employing the development of a group achievement model for disadvantaged elementary and secondary students; and, c) increasing the pool of students who are prepared, motivated and qualified to enter higher education. Twelve Centers throughout the state of Florida have inducted more than 17,500 high achieving students into the National Achievers Society. More than 13,250 students have participated in the Annual Brain Bowl Competition.

The SAT

The SAT Reasoning Test is a standardized test for college admissions in the United States typically taken by high school juniors and seniors. The test assesses the critical thinking skills students will need for academic success in college. The SAT score is reported to be a good predictor of academic success^{3,4}. The SAT is developed, published, and scored by The College Board⁵. The SAT consists of three major sections: Mathematics, Critical Reading, and Writing. Each section is scored on a scale of 200 to 800, with two writing sub-scores for the multiple-

choice and essay portions. The Mathematics section of the SAT contains two types of questions: multiple-choice questions (44 questions) and student-produced response questions without answer choices--"grid ins" (10 questions). The Mathematics section focuses on mathematical topics up through a third-year college preparatory course, including math concepts under the following general categories: number and operations, algebra and functions, geometry and measurement, and data analysis, statistics, and probability.

The Florida Education Fund (FEF) offered free SAT Preparation courses for over a decade starting at schools, churches and community centers around the State of Florida. To structure its course offerings, the FEF has gone directly to the source, to The College Board, the entity that develops and administers the SAT nationwide. The College Board has provided course curriculum and materials and trained FEF teachers to offer preparation courses throughout Florida. The courses offered by the FEF target students from 7th through 12th grades, focus primarily on test-taking strategies, and provide invaluable opportunities to practice taking the SAT. Experience has shown that students who practice taking the SAT generally perform better on the actual examination. Thus, the FEF's courses are designed to allow repeat attendance for continued, structured practice taking real prior SAT's.

Challenge and Highlights of the 2010 Camps for Scholastic and Career Success

In 2010, FEF offered to conduct an intensive summer academic camp for high school students at East Lee County High School. We received a response from the Lee County School District unlike any we had encountered before. The District would accept our offer only if we could serve more students by presenting camps at two additional schools at the District's expense. We agreed and began planning the three programs, funded in part by the FEF's first grant from a Florida school district to conduct for-credit summer courses. Beginning on July 12, 2010, the teachers conducted the camps at Cape Coral High School in Cape Coral, East Lee County High School in Lehigh Acres, and Estero High School in Estero, serving 111 students from all of the County's 13 high schools as well as two private schools.

As in our other 2010 camps in Brevard and St. Lucie Counties, Lee County students received instruction in critical reading, writing, and math; learned test taking skills and strategies; and sat for simulated, timed SAT practice tests each week. They also planned for college and explored careers during multiple workshop sessions.

Program Results

The test results for the 2010 Summer SAT and College Preparation Programs are presented in Figure 1. As illustrated in the chart at right, 83% of students in all 2010 camps who took pre- and post-tests increased their practice SAT scores. That percentage is up from 67% in 2009, due in part to extended programming that increased the average number of camp hours. A student evaluation was also conducted to identify the effectiveness of the Camps. The results of the survey are presented in Figure. On student evaluations 72% of students reported improved reading skills, 75% noted better writing skills, and 89% acknowledged better math skills as a result of attending the programs. Also, 98% indicated they learned new standardized test-taking

strategies, 94% felt they learned more about possible careers, and 90% believed they learned more about how to prepare for college.

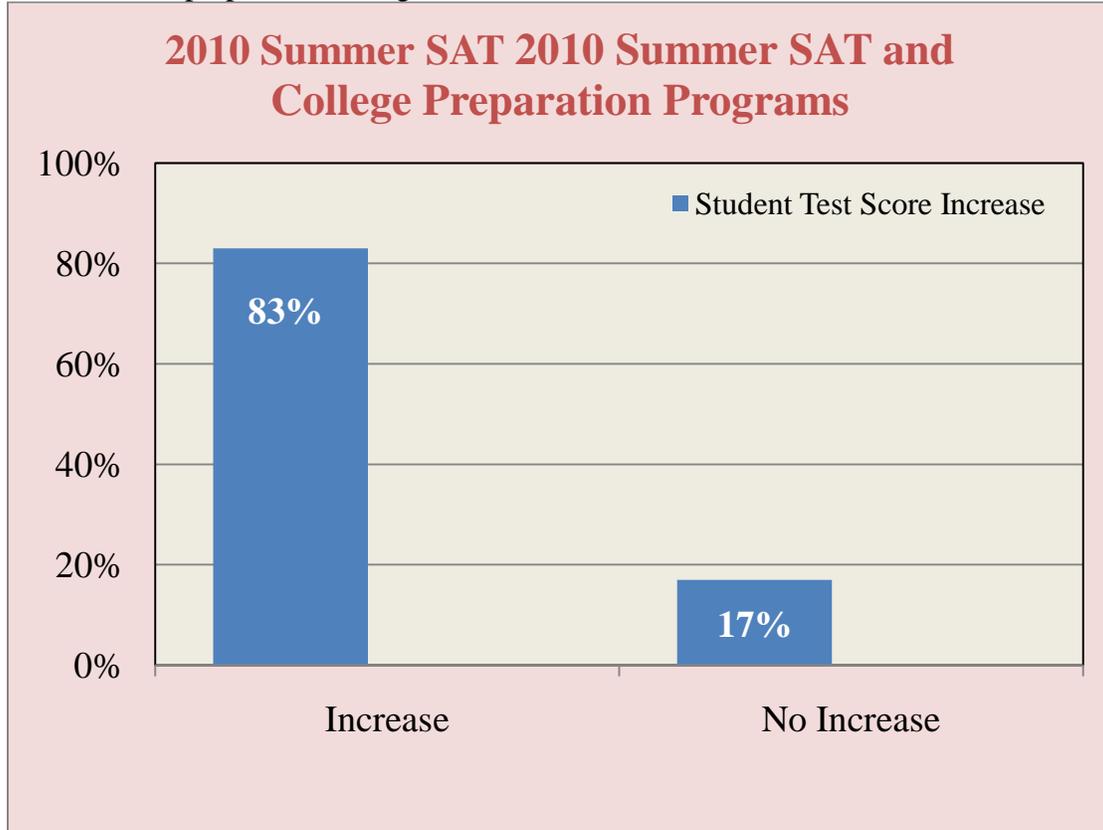


Figure 1. 2010 Summer SAT and College Preparation Programs

Students also wrote many positive comments about the camps on their evaluation forms, including the following:

- I gained better focus and improved my writing and math skills. It was a great learning experience!
- I learned great strategies for approaching the SAT. I realized I can get whatever score I work towards. The teachers helped me set a goal and work towards achieving it.
- The most important knowledge I gained from attending the camp was the different requirements for attending college.
- The best thing I gained from attending the camp was learning simple ways to solve math equations and how to manage my time.
- The most important thing I gained from attending the camp was the opportunity to meet and talk with a variety of career and college speakers and others to plan for my future.
- I learned test taking strategies that benefited me and refreshed my memory about previous material.
- The most important thing I gained from attending the camp was learning vocabulary as well as learning how to be a better writer.
- Overall, the camp was extremely beneficial. My writing and math skills have definitely improved.

- Thanks for this opportunity and for providing this course for free.
- Thank you for providing a service like this. I learned so much, and it would be wonderful if more students got to do the same.

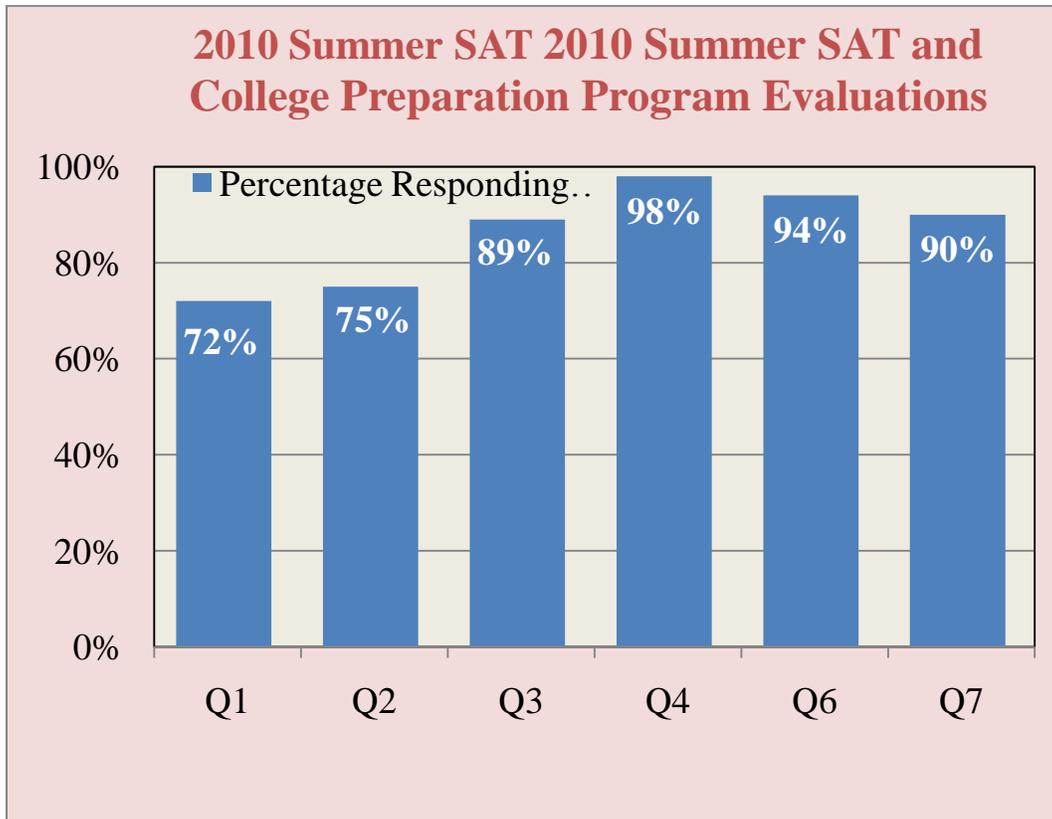


Figure 2. 2010 Summer SAT and College Preparation Program Evaluations

Applied Mathematics SAT Prep Summer Program

In to the SAT Camps, FEF offered applied mathematics (engineering or aerospace technology) with preparation for the mathematics sections on the SAT. Students gain knowledge in mathematics and high technology fields and ultimately enhance their scores on the SAT. Eligible students earn a .5 elective high school credit for satisfactory completion of all Summer Camp requirements. Below are highlights of two the Applied Mathematics SAT Prep Summer Program offered by the FEF programs

During the summer of 2008, the FEF offered an Applied Mathematics SAT Prep Summer Program at Middleton High School in Hillsborough County. The project integrated several curricular areas, including mathematics (e.g., geometry, measurement, trigonometry), science (e.g., equilibrium, density, buoyancy, gravity), and language arts (writing). They build solar-powered cars the size of matchboxes and install electrical wiring in "houses" made from planks of polystyrene. Working in teams of four, the students build and program their robots so they can

accomplish tasks, like sweeping Lego blocks across a table. Then they compete against each other in two-minute matchups to see whose design and programming — and math skills — are the best⁶. One of the students launches a hot-air balloon he constructed with tissue paper (see Figure 3)



Figure 3. A Middleton aerospace tech student launches the hot-air balloon

During summer 2009, a two-week Summer SAT, Applied Math, Engineering and College Planning Residential Program was held on the FGCU Campus. Under the leadership of Director Catherine Doyle, Coordinator Darlyn Scott, and the staff members of the Student Support Services and Outreach Programs and FGCU, thirty nine students participated in and successfully completed the Summer Residential Program. These students were from Collier, Charlotte, Hendry, Glades, and Lee Counties. Dr. Claude Villiers from the Whitaker School of Engineering (WSOE) assisted with use of the new Engineering facilities and had several other engineering professors give presentations on all the opportunities available through the engineering fields. The program represented a joint venture between Student Support Services and Outreach Programs, the FGCU U.A. Whitaker School of Engineering and the Florida Education Fund⁷.

The Applied Mathematics SAT Prep Summer Program was structured around several disciplines within engineering. There were different components to the program including a civil engineering component, a bioengineering component, and an environmental engineering component. To bridge the connection to engineering and students' high school courses, the summer program also had a math component and an SAT preparation component. Figure 4 was a photograph taken during the Applied Mathematics SAT Prep Summer Camp.



Figure 4. Students taking SAT math practice exam, students performing water filtration project, and students learning about sample truss bridge project, respectively.

Program Highlights and Accomplishments

As a result of the dedication and commitment of the Applied Mathematics SAT Prep Summer Program the students who participated in the program have benefited as follows:

- 70% of the students increased their scores on both the math and reading practice SAT
- All rising seniors applied to 3 colleges and universities
- Participants learned the importance of college planning in relation to career choices
- Participants were introduced to opportunities in engineering
- Students learned how to apply math in experiments and research to engineering projects
- Students were exposed to real life experience and learned from world class experts

Bibliography

1. Florida Department of Transportation - Office of Student Financial Assistance "2009-10 Annual Report to the Commissioner" Tallahassee, Florida, October 2010.
<http://www.floridastudentfinancialaid.org/SSFAD/pdf/annualreportcurrent.pdf> Accessed March 11, 2011.
2. Topiel, J. "2009 College-Bound Seniors Are Most Diverse Group Ever to Take SAT As More Minority Students Prepare for Higher Education" In College Board Press Release, New York, August 2009.
<http://press.collegeboard.org/releases/2009/2009-college-bound-seniors-are-most-diverse-group-ever-take-sat174-more-minority-students-pr> Accessed March 11, 2011.
3. Gehring, J. "SAT Said to be reliable predictor of college success. In *Education Week*. 20(34): 3, 2001.
4. Lackey, L., Jack L., Helen G., Marjorie D. "Efficacy of Using a Single, Non-Technical Variable to Predict the Academic Success of Freshmen Engineering Student" In *Journal Engineering Education*, Volume 41, January 2003.
5. Kobrin, J., Brian P., Emily S., Krista M., and Sandra B., "Validity of the SAT for Predicting First-Year College Grade Point Average" College Board Research Report No. 2008-5, In The College Board, New York, 2008
http://professionals.collegeboard.com/profdownload/Validity_of_the_SAT_for_Predicting_First_Year_College_Grade_Point_Average.pdf Accessed March 11, 2011.
6. Matus, Ron , "Summer school camp uses robots to teach math and science" St. Petersburg Times, July 8, 2009. <http://www.tampabay.com/news/education/k12/article1016449.ece> Accessed March 11, 2011.
7. Villiers, C., Shelby G., Lyra L., Kathy D., Lee D. "Fostering Excellence in High School Students Exposed to Applied Mathematics and SAT Prep Summer Program". *Proceedings of the 2010 ASEE Annual Conference and Exposition*, June, 2010.