

The Unique Research Curriculum, Motivations, and Results of the Rockdale Magnet School for Science and Technology

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Introduction

Opening in the 2000 academic year, the Rockdale Magnet School for Science and Technology is an alliance between the Georgia Institute of Technology's College of Engineering and the Rockdale County (Georgia) Public Schools. This magnet high school provides a unique combination of required research classes and projects, an international research partnership with a French high school, and direct liaison with college engineering personnel. Specialized AP and magnet school science, mathematics, and research classes are taught to the participating 130 magnet students by magnet school teachers, while non-magnet school classes are taken with the general population and their teachers in a 1300 student high school. Each student participates in required research and formally defines, executes, and presents their research project in multiple fora. The relationship with Georgia Tech provides access to personnel (a dedicated liaison engineering PhD, professorial, graduate, and undergraduate assistance) and facilities (i.e. nuclear, biomedical, chemical, instrumentation, military) typically unavailable and often unknown to traditional high school science students. Although only beginning its third year and incorporating about 45 rising 9th graders each year, to date and amongst other honors, the school has dominated regional science and engineering fair awards, sent two students to the International Science and Engineering Fair, and produced two Siemens Westinghouse semi-finalists. This paper presents the school's curriculum, its motivating goals and philosophy, and some results to date.

Georgia Tech Relationship

The Rockdale Magnet School for Science and Technology is a four year public high school located in the county seat of Conyers, Georgia about 25 miles east of Georgia Tech which is located in downtown Atlanta, Georgia. Until the last ten years, Conyers was an independent community. However, the Metro Atlanta region is one of the fastest growing US cities and is beginning to include Conyers as a suburb. Because the county hosts many technology-oriented business firms and has various ties to the nearby Georgia Tech community, Rockdale business and community leadership decided to implement a specialized high school and entered into a dialog with Georgia Tech near inception.

Like most research universities, Georgia Tech continuously searches for and fosters an indigenous pool of well prepared applicants. Georgia Tech has an active center for K-12 outreach. However, the liaison between Georgia Tech and the magnet high school was to be different. In dialog with the Rockdale County Public Schools (RCPS), Georgia Tech's Dean of Engineering committed to a direct connection between his office and the magnet school to facilitate the development and operation of the magnet school.

During the spring of 2000, Dr. Whit Smith (author of this paper) of Georgia Tech's School of Electrical Engineering began working with the planners in the Rockdale County Public Schools and continues as liaison. Shortly thereafter, RCPS officials hired Mrs. Angela Quick to be the magnet school's director. Mrs. Angela Quick (co-author) was the director of another magnet high school and had pioneered the research-oriented magnet school curriculum culminating in that presented herein.

Beyond initial consultation, Georgia Tech provides access to many of its resources with the primary contribution being mentors and facilities for the magnet school students' research projects. The high school classes visits Georgia Tech at least once annually as a group to participate in college classes and attend various campus events. For example, all magnet freshmen attend at least one collage introductory biology and chemistry class.

Recruiting

With plans to have about 40 students in each of the four high school grades following the initial transient and annual attrition, the school accepts about 45 rising ninth graders each year. During the initial year, a smaller tenth grade class was accepted.

Public information sessions for parents and their prospective students are offered during winter evenings with notices being distributed to all eligible eighth graders in the county. Although these initially were hosted by Georgia Tech and Rockdale County Public School representatives, the existing magnet school students now perform most of the presentation and are dramatically effective in communicating both content and enthusiasm.

Interested parents of eighth grade students formally apply to have their child enter the magnet school's admissions process. During the spring preceding the student's entry into the magnet school, the student submits grades, an essay, teacher recommendations, then participates in observed group activities and individual interviews with interviewees provided by the school system, Georgia Tech, and local industry representatives. After composite comparison and evaluation, 45 students are chosen and the parents and appropriate school officials are notified.

Newly accepted rising ninth graders spend a weekend in Georgia Tech dormitories at the end of their eighth grade year. Hosted by Georgia Tech personnel and students and magnet school teachers and upperclassmen, the rising magnet school freshmen visit campus facilities amongst a background of community-building activities. When they start their ninth grade tenure the following autumn, they already have some context for their upcoming activities and expectations.

Curriculum and the Research Class

The Rockdale Magnet School for Science and Technology is embedded as a "School-within-a-School" in the larger 1300-student Rockdale High School. The magnet school students experience mathematics, science, computer science, and research classes specific to the magnet school and taught by teachers specific to the magnet school. The students' other classes are taken with the general high school population and their teachers. See Table 1 for individual classes.

Magnet Classes	Non-Magnet Classes
Freshmen	
Magnet Math Geometry or Algebra 2 <i>Magnet Research 1</i> Magnet Biology	English 1 Social Studies Foreign Language or Elective Health/PE/Elective
Sophomores	
Magnet Math Algebra 2 or Pre-Calculus <i>Magnet Research 2</i> Magnet Chemistry AP Biology (Elective)	English 2 Social Studies Foreign Language or Elective Elective
Juniors	
Magnet Math Pre-Calculus or BC Calculus AP Biology or AP Chemistry Magnet Physics <i>Magnet Research 3</i> <i>(Independent Study)</i>	English 3 Social Studies Foreign Language or Elective Elective
Seniors	
Magnet Math BC Calculus or Joint Enrollment AP Physics AP Computer Science	English 4 Social Studies Foreign Language or Elective Elective

Table 1: Curriculum for Rockdale Magnet School

Unique to this magnet school are the research classes. Each student participates in required research classes during their 9th, 10th, and 11th grades, and each student formally defines, executes, and presents their research project in multiple fora. Research ideology is presented in 9th grade with students' initial projects requiring a single independent and dependant variables with complexity increasing during subsequent grades. Note that these research projects are not science fair projects although they usually are later modified and submitted as entries in local and regional science and engineering fairs. All students are required to procure mentors for their projects, submit a tiered series of progress reports, and present their results in various fora including science fairs and an annual reviewed research symposium.

The research projects topics are chosen by the students. As with their later decisions regarding college major and job selection, this tends to be one of their most difficult decisions. Of particular difficulty is narrowing their research project to include an experiment with only one

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independent and one dependent variable. To date, the students research topics include most of the topical categories (i.e. biology, mathematics, engineering, physics...) defined for the International Science and Engineering fair (www.sciserv.org/isef). When prodded, the students can be quite resourceful in procuring mentors. In addition to Georgia Tech personnel, their mentors have included local and distant industry technical professionals, local law enforcement (i.e. forensics...), qualified parents (engineers, computer specialists), hospital personnel, and other college and university faculty. A similar creativity in procurement has been demonstrated with many students soliciting local and national business for experimental resources. Corporate donations include gasoline engines, fiber-optic instrumentation, aerodynamic and spectral analysis software, automotive components, and biological samples and storage facilities. Once the students experience other students' ability to procure mentors and experimental resources, they correctly presume that they are similarly empowered.

Through the research classes, projects, presentations, and sense of community, the developers of the Rockdale Magnet School for Science and Technology hope to promote:

1. Written and Oral Communications
2. Problem-Based Learning emphasizing Theory & Applications
3. Opportunities for growth of maturity and responsibility through challenge, vigor, and academic rigor

Successes

In February 2001, 24 of the initial magnet school students participated in the joint DeKalb/Rockdale County regional science and engineering fair where they were competing with about 100,000 eligible students in the Metro Atlanta area. The Rockdale Magnet School students won every single first place prize in every category. Having exhausted the supply of available first place prizes, the remaining magnet students took second and third place prizes. Results were similar the following year in the same forum.

As of this writing, the magnet school has had several state science fair wins, sent two students to the International Science and Engineering Fair, and produced two Siemens Westinghouse semi-finalists. Students participated in math team and Georgia Junior Science & Humanities Symposia competitions. A contemporary list of activities and competitions are available at the schools' web site at www.rockdale.gatech.edu.

The magnet students are not myopic. More than one-third of the larger high school's soccer team consists of magnet school students. In addition to most of the offered sports options, the students participate in drama, music, and other extracurricular activities.

Challenges

New ventures often are initiated and maintained by a small handful of champions. Most of these operated quietly to prompt the Rockdale Magnet School. Challenges included having the community and teachers accept and support the existence the magnet school and its research-oriented curriculum. Of particular note was the reaction of some teachers who perceived that their best students might be drawn away from them and into a new initiative with which they may or may not be participating.

Of concern to some parents is the perception of college acceptance of grades and accolades from the more difficult magnet school and its classes. This produced a lengthy dialog which resulted in normalization of magnet school grades and independent valedictorian selection and class rankings for the magnet and larger high school.

Meshing the magnet and larger non-magnet school is a continuing challenge both from logistics and motivational viewpoints. Magnet school initiatives are constantly moderated by the larger high school needs to accept and provide for the entire community and the efforts required to counter the messages shouted by the ambient popular culture.

With the introduction of joint research projects and an exchange program with students in a sister school in France, the small handful of champions are stretched to their limits. As the school moves from its initial start-up transition to steady-state, the operation needs to depend less on a few individuals and become more systematic. Herein is a fundamental challenge for the present leadership.

To facilitate funding for travel and various other support activities beyond that traditionally funded by local schools, champions for the Rockdale Magnet School established an independent 501c3 corporation with a board consisting of volunteers which actively promotes fundraising activities. To date and amongst other accomplishments, this group raised funds sufficient to send ten students and their chaperones to their French sister school at almost no cost to the public school system.

Conclusion & Future

Although new ninth graders complain about the heavier academic workload, by Christmas they realize that their study skills place them at a distinct advantage over their non-magnet school peers. By the time of the winter recruiting for the next incoming class, the existing students have become cheerleaders for their school.

In a world where conflicting worldviews and popular culture dominates and leaves many as isolated individuals, perhaps the greatest contribution is the sense of community perceived by the magnet students. This is apparent in the numbers of students who volunteer to appear on evenings or Saturday afternoons in the schools' laboratories to finish their experimental work and perhaps share pizza following.

Like most agents of change, the magnet school prompted some resistance. However, the community is beginning to recognize and hail the school's benefits and contributions. The first senior class will graduate in the spring of 2003. These authors hope to submit another paper in a few years showing tracking data as the magnet high school students proceed through their college careers.

Biographies

DR. WILLIAM W. SMITH, JR is a Senior Research Engineer in Georgia Tech's School of Electrical and Computer Engineering. In addition to classroom teaching, research, and consulting work with satellite, navigation, and instrumentation, Dr. Smith works with a variety of pre-college, undergraduate, and graduate students on programmatic and individual research and design projects.

ANGELA HINSON QUICK is the director of the Rockdale Magnet School for Science and Technology since 2000. Mrs. Quick received her undergraduate degree from Appalachian State University and her Master of Science Education from the University of South Carolina. She has 10 years of classroom science teaching and 6 years as directors of magnet high schools and pioneered the described magnet research curriculum.