



TECHNICAL BRIEF

Issue: 200-1203-12

September 2007

Mississippi School for Mathematics and Science: Assessing the Benefits of a Residential High School for Gifted Students in Mississippi

BY: LYDIA QUARLES, J.D. and THOMAS EASTERLING, Ph.D.

Introduction

The Mississippi School for Mathematics and Science, since its founding in 1987, has served as a flagship of secondary learning for the state. It is a public, residential school that offers an advanced curriculum and high-level research opportunities for about 250 students per year. It requires neither tuition nor fees for room and board. Its graduates excel in institutions of higher learning across Mississippi and the nation, and have become leaders in the communities in which they live.

MSMS is uniquely situated to help Mississippi meet its educational goals for the 21st Century: improving high school design, developing pathways that bring education and the real world together, and reducing the drop-out rate. It directly serves the state's best and brightest high school students. However, there can be little doubt that MSMS exists for the general good of Mississippi. MSMS also exists for the general good of the nation. In the twenty years since the school admitted its first students, our country's inattentiveness to its most capable students has seriously compromised its intellectual infrastructure. According to the National Science Foundation, the number of non-U.S. citizens earning graduate degrees in non-biological fields has more than doubled; the number of U.S. citizens earning such degrees climbed just seventeen percent. The number of engineering degrees earned by U.S. citizens peaked in 1985—twenty-two years ago—and is currently down by seventeen percent. Our state and our nation will be shoved aside by international competitors unless we address this issue. Funding science and math schools such as MSMS, according to the Information Technology and Innovation Foundation, gives us our most realistic hope for reversing this dangerous trend.

The Mission and Governance of the School

Mississippi Code 37-139-3 empowers MSMS to enroll eleventh and twelfth graders from across the state without regard to race, creed or color. The code also gives specific direction regarding MSMS' curriculum: "The emphasis of this school shall be dedicated to the academic teaching of mathematics and the sciences, but shall not preclude some emphasis being placed on the

arts and humanities as deemed appropriate by the board.” The faculty and administration of the school have recently affirmed their commitment to the code by articulating the following mission and beliefs statements: “Our mission is to enhance the future of Mississippi by providing innovative learning experiences in a residential environment to meet individual needs of gifted and talented students and by providing quality educational leadership and aggressive outreach programs. We believe that MSMS addresses the extraordinary needs of Mississippi’s gifted and talented students through innovative and rigorous research-based courses; teaches students how to integrate technology with current content in courses; offers a living-learning environment that facilitates students’ intellectual growth, encourages their social maturity and self-confidence, and strengthens their citizenship; stimulates excellence in all Mississippi schools by providing a model of educational leadership; and courts active participation from all of the community’s stakeholders.”

Mississippi Code gives the State Board of Education broad governance over MSMS policy and funding, but places responsibility for the execution of the school’s daily affairs on the shoulders of its Executive Director. The code also locates MSMS on the campus of Mississippi University for Women. Structure of MSMS’ governance gives the school leeway to develop curriculum and research opportunities that emphasize excellence rather than remediation. MSMS and MUW strive to maintain a relationship that is mutually beneficial. MSMS students can take college-level courses—either within the university itself or through dual-enrollment— and can make use of the library and limited number of other facilities. MUW receives a fair market price from MSMS for the services it renders, including use of the cafeteria, grounds and maintenance fees, and accounting and book keeping costs. MUW students enjoy employment opportunities at MSMS. MUW also has the first chance to recruit a concentrated body of the state’s best high school seniors.

MSMS and Improving High School Design in the State of Mississippi

School design refers to a school’s psychological environment as well as its physical architecture. A well-designed high school, psychologically speaking, promotes strong relationships between students and faculty, offers curriculum and instruction that facilitate high student achievement, and encourages students to become better citizens in the communities in which they live. A number of factors complicate efforts to improve school design in Mississippi. First, the state is seeking investment from manufacturing and technological sectors, which will require more emphasis on mathematics and science at the secondary level. Second, because such a large percentage of Mississippi’s children live in impoverished homes—28.6 percent, according to the U.S. Census Bureau—it is safe to assume that at least a third of our public school students, however intelligent they are, will come from households preoccupied by issues that distract students from doing well in school. Finally, according to Dr. Hank Bounds, State Superintendent of Education, Mississippi has not changed basic components of its educational structure for the last forty years.

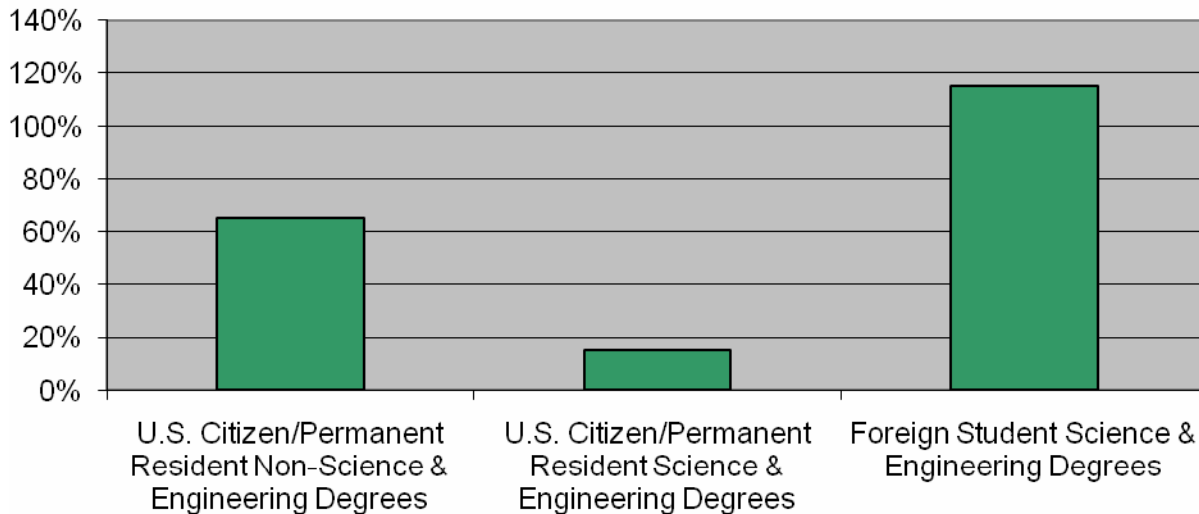
MSMS offers the state of Mississippi a model for improving school design. All MSMS courses are taught at the honors or college level. Even students who arrive with the minimum required coursework improve academically because the school has an esprit de corps that stresses academic achievement. MSMS maintains a low student-teacher ratio (15:1) and offers an array of demanding courses in every discipline, from calculus-based physics to university-level English courses, from advanced topics in higher math to Italian, Spanish, French and German. The school hires teachers who stay beyond their contract hours to help students master the goals of their courses and to run clubs. Although the school participates in a handful of interscholastic sports, practice is not required because student-athletes understand that their coursework must come first.

The school has accumulated beaucoup of anecdotal evidence to support its contention that it prepares students for college and the workforce. Perhaps the most tangible evidence is that ACT scores go up by an average of four points from the time students apply to MSMS to the time they graduate. It would be more accurate holistically, though, to mention that the faculty and staff of MSMS understand how crucial it is to nurture a living-learning environment where every event in a student's day becomes an opportunity for enlightenment, and where every student's inquisitiveness is encouraged rather than quashed.

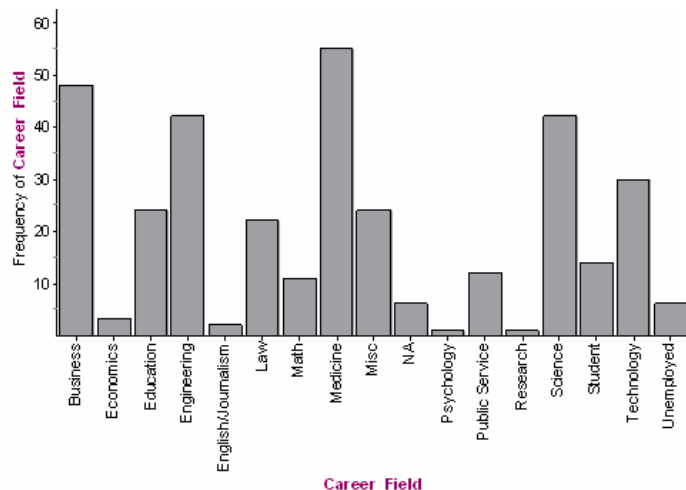
MSMS and Developing Pathways to Careers in Math & Science Fields

The school's emphasis on mathematics and science gives students the skills they need for career pathways in engineering, medicine, medical research, and business. Nurturing such skills is essential to our national well-being. The number of students entering non-biological science fields has plummeted during the last two decades. Consider the following graph on graduate degrees earned by U.S. citizens verses non-U.S. citizens¹:

Percent Change in U.S. Graduate Degrees: 1985-2000



¹ Our source in the Information Technology and Innovation Foundation's March 2007 newsletter, "Addressing the STEM Challenge by Expanding Specialty Math and Science High Schools."



Schools like MSMS have led the way in reversing the trend. According to a survey of MSMS alumni taken in 2006, a large number of its graduates work in scientific, technological, and mathematical fields:²

At MSMS, many math and science courses invite students to complete work with real-world applications. In chemistry courses, for instance, students study reaction rate and chemical equilibrium. Both topics are important when an industry decides to make a new product, because together they determine the amount of

product made and how fast it is made. Students also examine acids and bases. There are many applications of this topic, from how an antacid works to the pH of the soil determining the color of flowers. Such topics relate directly to Mississippi’s success in attracting manufacturers.

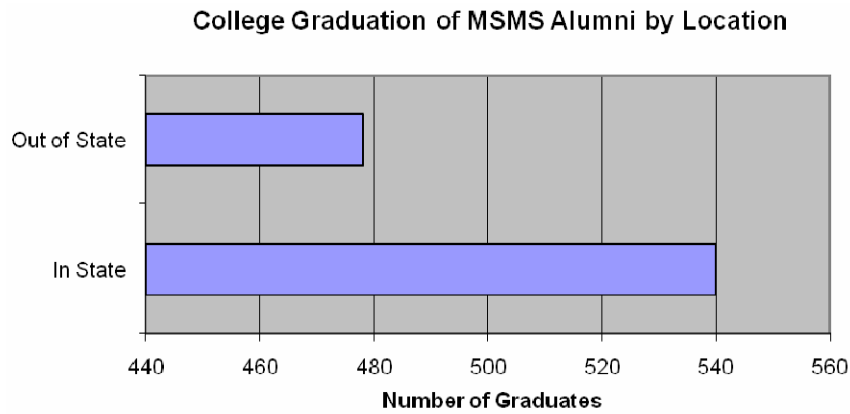
In the abstract, they are the hallmark of a thorough education—the sort of education that executives and workers at Toyota, Nissan, and Sevecorr would want for their children; parents who work at national defense institutions, such as Columbus Air Force Base and the Meridian Naval Air Station, and other federal institutions, such as the Stennis Space Center, currently send their children to MSMS. More specifically, such topics relate to the industries themselves. For instance, catalysts, which are studied in the unit on reaction rate and chemical equilibrium, are substances that increase the rate of a reaction. Catalytic converters in our cars make possible conversion of dangerous carbon monoxide and hydrocarbons into carbon dioxide and water.

Specific examples of student achievement in the sciences abound. Four graduates from the class of 2007 alone earned national recognition for their work. Hernando native Marshall Bartlett worked on the creation of a polymer that can be applied or removed with varying intensities of ultraviolet light. His idea could prove invaluable to burn victims, whose health and comfort are threatened by the mere application and removal of bandages to their wounds. Hallie Freyaldenhoven, of Meridian, studied the effects of carcinogens on fish hatchlings and cross-referenced her results to the effects of carcinogens on mammals. The implications of her study for Mississippi, the catfish capital of the world, are enormous. Her work placed in Environmental Science at the National Science Fair. Madhavi Gavini was a national finalist for the Seimens-Westinghouse Annual Science Competition. Miss Gavini’s research focuses on a natural product that is an anti-microbial compound that fights a virulent pseudomonas strain. Her work could save lives all over the world—and of course, in Mississippi—by helping people fight off infections that surpass the strength of our current antibiotics. Finally, Sumontro Sinha, of Oxford, studied minivan aerodynamics in an effort to ascertain the most practical ways to make such vehicles more efficient. He was invited to present his findings at the American Junior Association for the Advancement of Science. His efforts have immediate implications for a state trying to earn the attention of automakers from around the world.

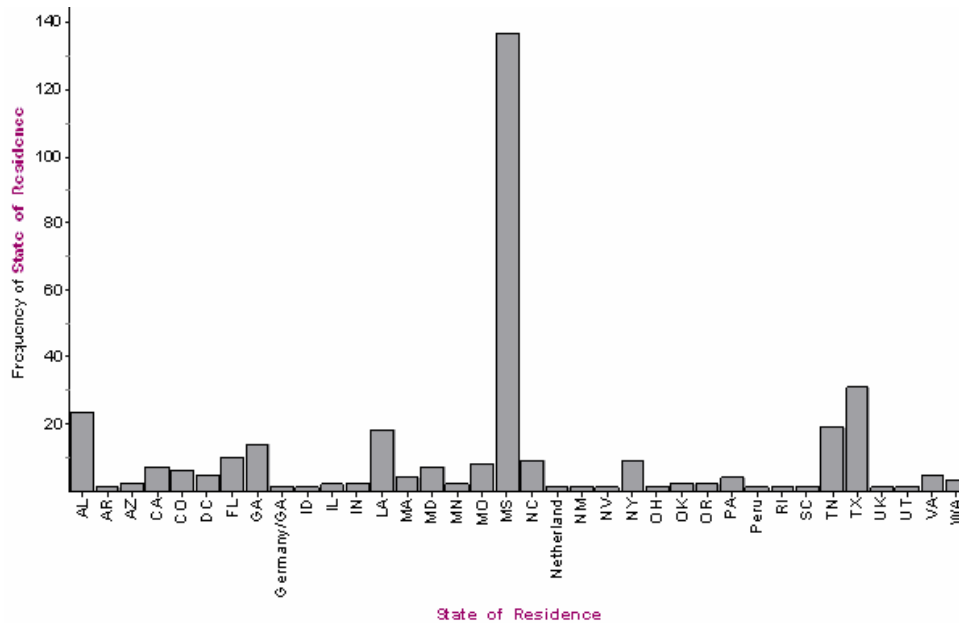
² Data for this chart reflects responses from graduates through the class of 1999.

MSMS and the Creation of Better Mississippi Citizens

Some critics of schools like MSMS charge that such programs result in “brain drain”—the departure of their state’s brightest students. However, recent research suggests that the opposite is true. According to data from the National Collegiate Clearinghouse, over half of all MSMS graduates through the class of 1998 stayed in Mississippi for their undergraduate coursework:



Better still, according to a survey of MSMS alumni given in 2006, more MSMS graduates choose Mississippi for state or residence than any other.³



³ Data for this chart reflects responses from graduates through the class of 1999.

A number of respondents from that survey expressed a wish to return to Mississippi should jobs ever open in their fields of expertise.

The alumni survey and the clearinghouse data make it safe to conclude that MSMS has taken a leadership role in preparing young people for the challenges of making Mississippi a better place. Its graduates do not race from the baccalaureate ceremony across the borders of Mississippi never to return. Rather, the faculty and staff of MSMS do what they can to make students better citizens of the great state of Mississippi and of this great nation.

For example, Mr. Chuck Yarborough, an MSMS history professor, has coined the phrase “community service and leadership ethic” to describe the goals he has for students in his charge. One of the courses he teaches, “Tales from the Crypt,” has been recognized on the national level for its innovative approach to bringing history to life, and for making its students better citizens. “Tales” requires students to conduct primary research on people buried in Columbus’ historic Friendship Cemetery and portray the lives of their subjects during the Columbus Pilgrimage. The students charge a small fee for the cemetery tours, which attract thousands of people each year. Half of the money they raise is returned to the Columbus Historical Foundation. Students vote on a project to which they will donate the other half of the funds.

The past two years, students voted to donate \$1,000 to the Mississippi Heritage Trust Katrina Fund and an additional \$1,000 to Beauvoir to assist with repair/restoration of that National Historic Landmark. MSMS students in Tales have also donated an historic marker at the childhood home of Richard Wright in Natchez; funds to purchase a slave record manual and other resources for the Columbus/Lowndes County Archives; and funds for an historic marker at the downtown Jewish business complex in Port Gibson. Additionally, student research opportunities have contributed to the community by developing the first-ever Eighth of May History program in Columbus’ historically African American Sandfield Cemetery; developing the first-ever dramatic walking tours of Columbus’ historic downtown; contributing research to the African American Heritage brochure created by the Columbus Convention and Visitors Bureau; and by contributing research used in local history tours with area 4th grade students.

Of course, “Tales” students are not the only ones who contribute to the community’s well being. All MSMS students are required to complete two hours of work service each week. Their duties range from cleaning bathrooms and hallways to helping professors complete research. Many MSMS students are involved with community service through volunteer tutoring at the Columbus Boys & Girls Club; volunteer Spanish instruction at Franklin Academy Elementary (Mississippi’s first public school); volunteer soccer clinics with area youth; the Science Carnival with area 3rd and 4th grade students; clean-up days along the banks of the Tennessee-Tombigbee Waterway; and clean-up efforts on Mississippi’s storm-ravaged gulf coast. MSMS students know very well that Mississippi has given them a fabulous education. Clearly, this appreciation has translated into strengthened citizenship and closer ties to the communities where they live and learn. Students graduate from MSMS with a community service and leadership ethic that will serve Mississippi well for years to come.

A quick look at the school’s alumni base affirms that the school is producing leaders in every field. Many of them have chosen to stay in Mississippi to pursue their careers; all of them lavish praise on the background and confidence imparted to them by the school. Alison Leslie Flint is an assistant district attorney in the 11th Circuit in Cleveland, and speaks glowingly of the great preparation she received at MSMS. Dr. Mindy Prewitt, an epidemiologist in Tupelo, writes that MSMS was “the turning point and stepping stone for my academic success.” Nathan Boggan is an architect based in Jackson. He writes that “MSMS provided an atmosphere of intellectual stimulation unlike anything I had experienced before. It was an environment that was not available to me previously, and would not have been available otherwise. Without this life-changing

experience, I would have lacked the proper motivation to work hard in college, and would have been less likely to remain in Mississippi after graduation.” Christopher Hicks, a Senior Naval Architect at Northrop Grumman Ship Systems in Pascagoula, writes, “Without the education and status that comes with graduating from MSMS, I would not have received the college education I did, which has led to the fulfilling career that I am now successfully leading.”

Other MSMS students, of course, leave the state after high school or college. Yet a number of those express a desire to return. Karen Graves Stewart is a reservoir engineer who works for a petroleum company in Houston, Texas. She writes that “The oil and gas upstream’s domestic business has largely consolidated to Houston, leaving very limited opportunities in other cities and states. This has been and will continue to be an area of disappointment to me, because I would love to return to the state I love and will forever consider home. . . . I find myself working in a global industry and have the opportunity to interact with people from all over the world. Through me, these global neighbors get a glimpse of the real Mississippi—a state proud of its heritage, yet unafraid of change.”

Improving Mississippi’s Graduation Rates

Although most students who do not complete high school do so because they lack remedial academic skills or positive parental influences, a significant portion of drop-outs quit school because it bores them. According to State Superintendent Hank Bounds, 80 percent of high school dropouts nationwide are passing their courses, and a significant percentage of high school dropouts score among the highest on the ACT and SAT exams. Many of these capable students would be well served by an MSMS education—and could be encouraged to stay in school if they knew about the opportunities they would have at MSMS.

Simply offering dual enrollment or internet courses will not be effective in retaining capable students who are considering dropping out. They already have access to such programs. Rather, they need to experience an environment where learning is the top priority—and where peers and mentors alike share an excitement about learning.

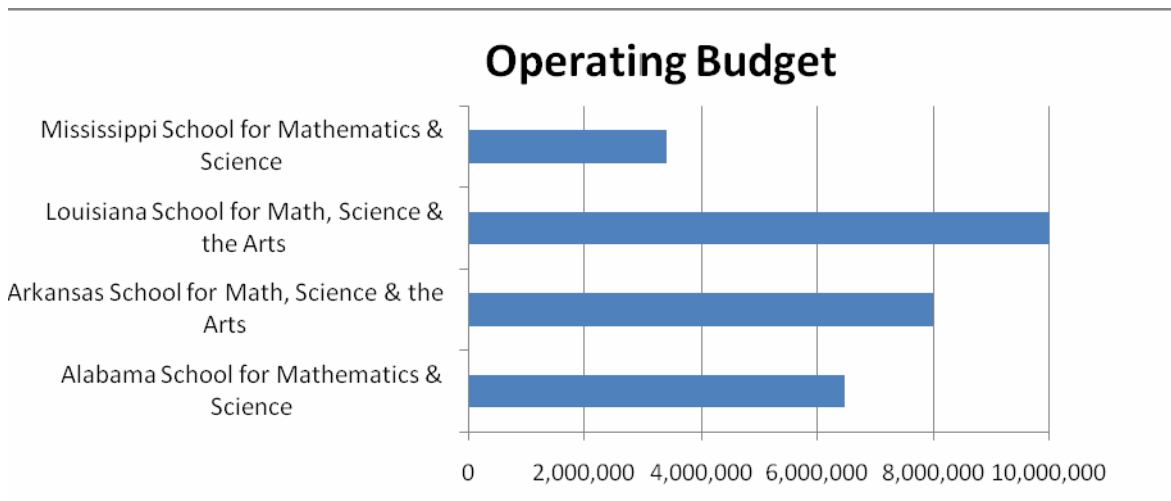
Helping MSMS Serve Mississippi

There is no problem at MSMS that more money would not solve. The school’s most immediate needs involve its infrastructure. MSMS currently lacks an auditorium large enough to hold school-wide functions. Its Student Activities Center sorely needs upgrades. Its dormitories contain furniture thrown away by universities. Its classrooms lack some vital lab equipment and computers, in addition to amenities such as smartboards that other public schools currently have.

Part of the problem of funding improvements involves the articulation of the school’s lease of property from Mississippi University for Women. MSMS’ relationship with MUW is generally good. However, the 20-year plan conceived by the university’s current president sequesters MSMS to the back of the MUW campus, and makes no specific references to improving the facilities used by MSMS students. MSMS administrators fear that Mississippi legislators do not understand that facilities upgrades to MUW do not translate to facilities upgrades to MSMS. MSMS administrators also fear that legislators do not know that MSMS pays for every service rendered by MUW—from paying a substantial portion of utilities in the student union, to footing the cost of routine maintenance to buildings used by MSMS students.

Another crucial issue facing MSMS involves the creation of positions for new administrators and faculty. Running MSMS is unlike running other high schools because it serves its students every hour of the day, every day the school is open. This means that an administrator must be on call every hour of the day to respond to students' needs. Currently, MSMS has only four administrators to share in the oversight of this important responsibility—and these four have additional responsibilities during the day. They are stretched too thin.

Fourteen other states have or are planning schools like MSMS, including Alabama, Arkansas, Illinois, Indiana, Kentucky, Louisiana, Maine, Missouri, North Carolina, Oklahoma, South Carolina, Tennessee, and Texas. Their levels of financial support empower them to hire enough administrators and faculty to keep student achievement on the front burner. Here are the state allocations for math and science schools in neighboring states:⁴



One related concern involves the allocation of funds for professional development. Teachers at MSMS are expected to provide college-level classes. However, with a 6:6 teaching load and negligible funding for attending seminars or conducting new research, MSMS teachers are hard-pressed to stay at the forefront of their disciplines. That they have managed to do so to this point speaks highly of their drive and resourcefulness. It is appropriate that they be rewarded and empowered to do more good work by funding their professional development. Moreover, doing so will be a necessity once MSMS attains SACS accreditation, which will stipulate that such opportunities exist.

Those who doubt the school's efficacy often charge that it is too expensive. It seems to us that it is too expensive not to have MSMS. Although per-student expenditures at MSMS already double those of most Mississippi high schools, MSMS is the most cost-effective way to meet the needs of intelligent, motivated, college-prep students. If a legislator were to take the school's annual budget, which has hovered for the last few years at the \$4 million mark, he would be incapable of effectively distributing it to high schools around the state so that they could offer the same courses—with faculty as qualified—as those at MSMS. Moreover, it is unfair to hold funding for the state's best students hostage in order to please those who favor conventional high schools.

⁴ This information was obtained from conversations and emails from officials at the respective schools. LSMSA raises about \$360,000 per year from tuition, room and board charges.

At current levels of funding, MSMS will be hard-pressed to maintain the levels of excellence it has already achieved. Costs for services from MUW have gone up nine percent in the last year alone. The only significant increase in funding allocated to MSMS during the same time period was used to cover what the school had taken out of its building fund, which amounts to robbing Peter to pay Paul. A quick look at the budgets of MSMS' sister schools affirms that excellence requires better funding than our legislature currently offers.

If MSMS is already achieving its goals, then why should the legislature consider funding additional initiatives for the school?

Although MSMS is currently achieving its mission, its administrators and faculty believe that Mississippi is entering a critical period for secondary education. Our state is trying to improve the scientific and technological capacities of its workforce in order to attract more industries like Toyota and Severcorr. MSMS can play a crucial role in this process if it is allowed to pursue the initiatives listed below.

- **Improving teacher quality statewide**

MSMS encourages its faculty to take leadership positions within their field. Dr. Fred McCaleb, for instance, is on the NCATE program review board for Colleges and Universities seeking accreditation for Secondary Social Science Education programs. Other faculty members play similar roles within professional and accrediting organizations, as well as institution that promote the public welfare. For instance, MSMS faculty members have served on the Mississippi Humanities Council for the last twelve years. However, MSMS could do more to enhance teacher training throughout the state if its outreach and professional development programs were funded more aggressively. MSMS faculty teach at the college level, but do not receive sabbaticals or release time as their college counterparts do. The school also lacks the budgetary wherewithal to pay for faculty to conduct or present their own research. Funding such measures would improve MSMS' ability to assist in the professional development of teachers from around the state.

MSMS already plays a role in enhancing teacher quality through summer workshops provided on our campus. MSMS is in the final year of implementation of a multi-million dollar Jacob K. Javits grant that has funded summer workshops for teachers of math and science as well as residential summer math/science academies for students from impoverished districts across our state. MSMS has partnered with MUW's Center for Creative Learning to provide facilities and instructors for workshops funded by Math Science Partnership grants for several summers. MSMS has also partnered with MUW to provide instructors for IHL math/science summer workshops for teachers. As follow-up to these summer programs, several MSMS teachers serve as mentors to teacher participants. This July, MSMS faculty ran a continuing education unit for North Mississippi educators on the state's new mathematics framework. The success of such workshops demonstrates MSMS' ability to help teachers statewide, not merely on the MSMS campus.

- **Increasing the rigor of curriculum and assessment**

MSMS' curriculum is one of the most rigorous in the state. The school shares its work through a number of workshops and summer programs. It hosts visits by school administrators and teachers from Mississippi as well as other states who are working on high school reform efforts. Through the JAVITS funded CHAMPS project, for example, students are provided opportunities to attend summer residential programs that provide laboratory-based mathematics and science instruction that includes Problem-based Learning and creative problem solving strategies to enhance critical thinking. MSMS can run additional programs if it receives proper funding for them.

According to the Information Technology and Innovation Foundation, schools like MSMS already offer a model for how a challenging curriculum improves capable students once they arrive on campus. They also create a “trickle up” effect: when younger students discern their interest in attending schools like MSMS, they seek out the most advanced courses available at their conventional high schools, thereby encouraging those schools to offer better classes. Funding curriculum development at MSMS helps set the curve by which all of Mississippi's conventional high schools can assess their own effectiveness in preparing their advanced students.

- **Increasing community involvement in education**

Through collaboration with community and business leaders in the Columbus-Lowndes County area MSMS has an extensive network of individuals who serve as mentors for students enrolled in our mentorship program. MSMS also places students in research labs at Mississippi State University during the school year and across our state (MSU, USM, Ole Miss, Gulf Coast Research Laboratory) and beyond for summer research programs. MSMS works closely with other organizations in the community (Columbus-Lowndes County Library, Columbus Municipal School District, Columbus Historical Society, Lowndes County United Way and others) where its students log massive community service hours.

MSMS also serves as a model for creating and nurturing a diverse student population—a veritable reflection of the population it serves. Minority students constitute about a third of the school's population; women, more than half. MSMS students also come from every corner of the state. The school clearly understands the importance of an environment where the opportunity to excel can be cherished by all.

- **Improving MSMS' infrastructure**

Although MSMS desperately needs more building space and renovations to its dormitories, less expensive improvements would help the school in its mission to attract and educate students who are interested in mathematics and science. The school needs dozens of new computers—the main building has only one writing lab with 25 computers and one printer for 250 students—in addition to new science lab equipment.

Such investments, while they might seem expensive, improve MSMS' ability to prepare students like Madhavi Gavini and Marshall Bartlett to continue their groundbreaking research at the college level. These investments are essential to the vision of the school.

- **Increasing the Presence of MSMS Students in Mississippi's Universities**

Most graduates of MSMS already choose an undergraduate program within Mississippi. Even more would do so if the school could imitate an initiative from another state. North Carolina recently passed legislation that promises a full scholarship to any public university within the state for graduates of the North Carolina School for Science and Mathematics. Doing the same in Mississippi would bolster MSMS' relationships with the universities it already serves.

As things currently stand, when the legislature allocates funds expended by the Mississippi Department of Education for its special schools, it should consider the importance of full funding for the Mississippi School for Mathematics and Science. In future years, the legislature should consider the importance of increasing funding for MSMS as the school not only fulfills its educational mission, but also helps Mississippi attract industry to the state.

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Lydia Quarles is a Senior Policy Analyst at the John C. Stennis Institute of Government, Mississippi State University. She received her *Juris Doctorate* in 1975 from Cumberland School of Law, Samford University, and her MA and BA from Mississippi University for Women, in 1972 and 1971 respectively, in political science and communication. After over a dozen years in the private practice of law in Alabama and Mississippi, she joined the Mississippi Workers' Compensation Commission as an Administrative Judge in 1993. Eight years later, in 2001, she was appointed Commissioner of the agency. In 2006, she resigned to join the Stennis Institute.

Quarles remains active in bar work, and currently chairs the Women in the Profession Committee, a standing committee of the Mississippi Bar. She also serves as co-chair of the Mississippi Supreme Court's "Gender Fairness Implementation Study Committee" and acts as the Chief Operating Officer of the Workers' Compensation Section of the Mississippi Bar. She is a fellow of the Mississippi Bar Foundation, a recipient of the Mississippi Bar's Distinguished Service Award, a member of the Mississippi School for Math and Science Foundation Board and a member of the MUW Alumni Board. Quarles was recently honored by the American Bar Association's Administrative Law and Regulatory Practice Section, receiving the Mary C. Lawton Award for lasting contributions to the Mississippi Workers' Compensation Commission in the areas of alternative dispute resolution and access for Hispanic workers.

In 2004, Quarles was named one of Mississippi's 50 Leading Business Women by the Mississippi Business Journal; the Journal recognized her service to the State as a Commissioner as well as entrepreneurial skills developed in her property management business in Starkville, Spruill Property Management, LLC

THOMAS EASTERLING, Ph.D.

Thomas Easterling is a member of the English faculty at the Mississippi School for Mathematics and Science, and will begin a term on the Mississippi Humanities Council this May. He received his BA from the Louisiana Scholars' College at Northwestern State University, and his MA and his PhD in English from the University of Mississippi. His work has appeared in *The Oxford American*, *Brightleaf*, and a number of scholarly publications. He graduated from one of MSMS' sister schools, the Louisiana School for Math, Science, and the Arts.

ABOUT THE INSTITUTE:

Elected to the United States Senate in 1947 with the promise to "plow a straight furrow to the end of the row," John C. Stennis recognized the need for an organization to assist governments with a wide range of issues and to better equip citizens to participate in the political process. In 1976, Senator Stennis set the mission parameters and ushered in the development of a policy research and assistance institute which was to bear his name as an acknowledgment of his service to the people of Mississippi.



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