

EXECUTIVE SUMMARY

“Rising Above the Gathering Storm: Engaging and Energizing *Arkansans* for a Brighter Economic Future”

Recommendations prepared by:
Arkansas Science, Technology, Engineering and Mathematics Coalition
(STEM Coalition)

Executive Summary and Recommendations

Background.

On September 5, 2007, four hundred leaders from throughout Arkansas gathered at the Statehouse Convention Center in Little Rock, Arkansas to address the topic, "Rising Above the Gathering Storm: Energizing and Employing *Arkansans* for a Brighter Economic Future." The conference, hosted by the Arkansas STEM Coalition, featured national and state leaders that provided a range of information related to the dilemma in STEM education, the economy from a national perspective, competition issues in a global economy, and state issues related to economic development. Arkansas leaders connected these central themes to similar concerns in Arkansas issues.

- Dr. Gail Cassell, Eli Lilly, reviewed the Executive Summary of the 2005 report from the National Academies which centered on recommendations for STEM education critical to preparing America's youth for global competition.
- Mr. Jerry Adams, Acxiom, gave an overview of the Accelerate Arkansas' strategic plan with focus on knowledge based job creation; raising capital for investment; and creation of venture capital funds.
- Dr. Ruth Wooden, Public Agenda, related that national surveys indicate that changing prevailing student attitudes or cultural opinions that relate to STEM education require influencing parents' existing perspectives.
- Governor Mike Beebe gave the keynote address at lunch and reiterated that education and economic development are interconnected.
- Ms. Mary Jo Waites, Pew Trust, explained that the states must focus on the areas where there are strengths and foster collaboration and cited the axiom, "It is not about how much you spend but how you spend it."
- The Arkansas Foundation roundtable had two summary points: Foundation funds must be used to both bring groups together and leverage partnerships and also to help define schools for the 21st Century.

As a result of the input sought from conference participants and information from STEM Coalition focus groups and data collection, the following is an overview of recommendations related to:

- I. Why STEM education is important
- II. How STEM education influences economic development
- III. Recommendations that resulted from the Conference and STEM Coalition research

Why STEM Education Is Important

There is growing concern that the United States is not preparing a sufficient number of students, teachers, and practitioners in the areas of science, technology, engineering, and mathematics (STEM). A large majority of secondary school students fail to reach proficiency in math and science, and many are taught by teachers who either lack adequate subject matter knowledge or lack passion for the subjects.

When compared to other nations, the math and science achievement of U.S. students and the rate of STEM degree attainment appear inconsistent with a nation

considered to be the world leader in scientific innovation. In a recent international assessment program of 15-year-old students from the top 57 advanced countries (30 OECD member nationals and 27 partner nations), the U.S. ranked 28th in math literacy and 24th in science literacy. Moreover, the U.S. ranks 20th among all nations in the proportion of 24-year-olds who earn degrees in natural science or engineering.

Arkansas, like most other states, faces a major dilemma in developing a workforce that meets the needs of economic development now and in the foreseeable future. The key to unlocking the progress lies in the preparation of students and other adult workers to be proficient in a workforce that is dependent on emergent skills from STEM disciplines.

Nationally -

- Only 40% of American workers have the technical skills and learning skills required by employers.
- U.S. Business spends \$62 billion per year to upgrade basic skills.
- American 12th graders ranked near the bottom of 21 nations participating in the Third International Mathematics and Science Survey.
- Congress has been forced to raise the ceiling on H1-B visas to allow skilled foreign workers to fill critical high-tech jobs in the United States.
- The U.S. faces a critical and worsening shortage of qualified science, mathematics and technology teachers and workers.
- All Americans need and deserve to receive the best possible education in mathematics, science, and technology for their personal and civic lives.

(From National Alliance of State Science and Mathematics Coalitions website, <http://www.nassmc.org/>)

In Arkansas –

- Almost 40% of 2007-08 freshmen entering Arkansas universities needed remediation.
- Over 75% of all 2007-08 freshmen entering two-year colleges needed remediation.
- Arkansas has an average per capita income just over \$30,000 (47th) and less than 20% of our population have a bachelor's degree or higher. (Correlate: No state with a low proportion of Bachelor's degrees has a high per capita income.) (Purcell, presentation, February 13, 2008)

STEM Education and Economic Development

Economic development at the local, state, national and international levels depends on the ability of workers to fill the current available positions and for entrepreneurs to develop jobs for the future. Up to 50 percent of America's adult population today lack the advanced skills that are the foundation for most future high-paying jobs in today's complex knowledge economy (Gordon, 2010 Meltdown). The skills and tools that must be possessed by workers trained in science, technology, engineering and mathematics include critical thinking coupled with content knowledge. The level of proficiency necessary depends on the individual placement of the worker into the economic

scheme. When addressing the needs of Arkansans, we must look at our current workforce, the present needed skills, and those needed for the economy of the future. The strengths of the current workforce cluster around skills necessary for an economy that is basically agrarian and manufacturing.

Dr. Gail Cassell pointed out in her address that future economic development depends upon how the U.S. resolves issues of competition in securing its place in the 21st Century. Four recommendations were made:

- a. Increase America's talent pool by improving K-12 science and math education.
- b. Develop and retain the best students.
- c. Strengthen the long-standing federal investment in basic research in the physical sciences.
- d. Ensure the United States as the premier place for innovation by modernizing the patent system and realigning tax policies.

Current Economy Needs. Most manufacturing and farm jobs now require skills that can best be described as college level mathematics with some computer skills. While these current jobs often resemble positions that have been around for many years, over the last few decades skill requirements have evolved, and tasks accomplished by manual labor have been replaced with more technological solutions. Such positions today most often require more technical training with a minimum of an associate's degree.

Dr. Jim Purcell, ADHE, recently unveiled a plan designed to increase the number of Arkansans with post-secondary training through advanced skill sets for a technology-driven Arkansas economy. His philosophy is built on "Speed to Market and Close to Customer." The components include:

- Implement a series of initiatives that expedite the number of degrees produced and the speed at which degrees are produced.
- Enhance the production of degrees in high-demand programs that are needed for the modern Arkansas economy.
- Create incentives for students to complete a degree and to work in Arkansas.

Future Economy Needs. Creating the jobs of the future will require entrepreneurs and innovation leaders. These are typically people with high achievement in mathematics, science and engineering. Coupled with financial support, the ideas of these creative minds will enable development of knowledge-based skills. The marketplace need for these skills calls for the coupling of education and economic development. It also calls for the creation of a culture that attracts creative people from outside Arkansas (and from outside the USA). Government regulation is necessary here for creation of more H1-B visas.

Universities are critical in economic development and entrepreneurial growth by establishing and maintaining the research environment that leads to new discoveries and coupling this creativity with business acumen that comes from our students and

faculty in business curricula. Arkansas is actively developing and supporting the collaborations between our higher education providers that are necessary to reach a “critical mass” of knowledge skills for economic development. Significant technology startups also come from spin offs in the private sector. These entrepreneurs also require the same higher education degree program skills. We also need a workforce in which people have higher quantitative and logic skills.

In a recent conference (University of Arkansas at Little Rock 4th Annual Regionalism Conference) Mr. C. Michael Cassidy of the Georgia Research Alliance stressed the need for collaboration of universities, business and government to build the necessary workforce for future growth. The Southern Growth Policies Board, in their March 2008 report *Supporting Sector Strategies in the South* (by Dexter Ligot-Gordon, Sandra Johnson, Ravinder Mangat, Jack Mills, and Ray Taylor), make the point that it is necessary to “engage political leadership to make sector workforce and economic development a priority” and that we need to select sectors of the economy most likely to lead to economic success. It is obvious that the “high tech” areas are among those sectors that need to be targeted in Arkansas now and well into the future.

Education Necessary to Produce Workers. The students in Arkansas currently are approximately average with regard to national ranking (see National Science Foundation Science S & E Indicators 2008). However, the long history of education in Arkansas has resulted in a relatively low level of college graduates. The percentage of Arkansans over age 25 who had a bachelor's degree actually dropped from 2002 to 2003 from 19.7 percent to 19.0, despite Arkansas having the fastest growth in college graduates from 2000 to 2003 (Black Issues in Education, Feb 10, 2005), and has continued to hover at just above 19 percent to present. Since 2001-02, a total of 2,912 additional baccalaureate degrees (+24.7%) have been awarded across the state system (Dr. Jim Purcell presentation, Possibilities for Success, Arkansas Legislature, January 17, 2008). However, during this same period, the enrollment increased 21% with state population growth, and Arkansas continues to lag well below the national average in college graduate as a percentage of total population, according to new U.S. Census estimates.

Recommendations

The basis for STEM education recommendations come from several sources.

- Arkansas' conference on Rising Above the Gathering Storm: Energizing and Employing Arkansans for a Brighter Economic Future in September, 2007, had breakout sessions by regions of the state to collect recommendations. This conference was sponsored by the Arkansas STEM Coalition. These recommendations were reviewed, categorized, consolidated and reported by a working committee of the Arkansas STEM Coalition.
- Accelerate Arkansas has recently completed work on STEM education in which a workgroup reviewed, added to, and prioritized recommendations made from

statewide strategic planning focus groups made up of a cross section of business, education, economic development, and other experts in the field.

- The Milken Institute, under contract with Accelerate Arkansas, performed a comprehensive baseline study of the economic status and future of Arkansas entitled “Arkansas’ Position in the Knowledge-based Economy”, September, 2004, in which significant emphasis was placed on STEM education.
- The Institute of Economic Advancement at the University of Arkansas at Little Rock conducted a study for Accelerate Arkansas concerning the characteristics of high growth and high achieving communities and states, as well as, best practices for rural development. The study was entitled “Closing the Gap, An Examination and Analysis of Per Capita Personal Income in Arkansas”. This report also addressed the importance of STEM education and correspondent characteristics that the state needs to accomplish for economic growth.
- The University of Arkansas at Little Rock sponsored the 4th Annual Regionalism Conference entitled “Help Wanted: Who will fill the jobs for Arkansas’ future?” in February 2008, that considered the economic future and certain needs for the central Arkansas region. A number of the topics discussed include STEM education and recommendations relative to improving STEM education.
- The Arkansas STEM Coalition organized six statewide STEM study groups in 2006. Each group studied different areas of STEM education needs and made associated recommendations.

This report takes the results of the Arkansas STEM Coalition’s Rising Above the Gathering Storm conference, includes information from these other sources and consolidates the most relevant parts into the following recommendations.

Enhance Excellence in the STEM Classroom:

- Pay high-quality STEM teachers an income competitive with other industries in order to:
 - o Encourage students to enroll in and remain in four-year STEM education degree programs,
 - o Encourage good teachers to stay in the classroom, and
 - o Demonstrate that Arkansas STEM teachers are an important economic development resource.
- Develop an elementary science STEM education degree program, subject to design and approval by the ADHE, and implement the program in Arkansas’ Education Colleges.
- Begin STEM education in early grades (K-6).
- Train and encourage teachers to facilitate exploration of STEM with hands-on project driven activities.

State Education Policy:

- Eliminate the “opt out” option currently available to parents and students to avoid the Smart Core Curriculum in Arkansas’ high schools.
- Give the Department of Higher Education the authority and budget control to organize and prioritize the scarce resources of the state to create specialized

campuses and focus resources on quality programs for economic development and reduce the emphasis of 'all programs for all campuses'.

Create More STEM Students and Teachers:

- Create an aggressive loan forgiveness program focused on four-year STEM education degree programs for graduates that teach in Arkansas independent of where a degree was earned.
- Establish a supplemental summer program for STEM teachers and four-year STEM students to work with industry and higher education in established research programs.
- Create need-based scholarships for STEM students, including STEM education majors.
- Support the funding of extracurricular education opportunities to expose students to opportunities in STEM occupations (e.g. Aegis).

Curriculum:

- Create a comprehensive, integrated STEM curriculum that encourages STEM to be taught across the curriculum. This means integrating concepts of quantitative reasoning and critical thinking, along with basic science and mathematical concepts, into non-STEM as well as STEM courses and programs.

Facilities:

- Provide STEM specific laboratories and laboratory equipment in middle and high schools to improve the learning opportunities and to encourage teachers to remain in teaching via providing them the tools that they need. STEM facilities are also needed at a simpler level for elementary schools.
- Insure all new school facilities, from pre-K through university, are built with technology infrastructure that insures availability of technologies in the classroom that support advancing STEM courses.

Funding:

- It is critical that appropriate and sufficient funding be appropriated and released in order to implement the recommendations in this report. This funding is needed at all levels of educational institutions (primary through graduate university) as well as at state agencies that support the STEM mission.
- It is important that significant funding be provided for implementing recommendations expected to be made by the Arkansas Research Alliance for centers of excellence in research that will lead to commercialization of innovations by new entrepreneurial companies, create high paying jobs, and rely on comprehensive STEM education programs to provide a globally competitive workforce.

Conclusion

Improved STEM education is critical to the economic future of Arkansas. Input was collected from numerous high quality studies, conferences and focus groups. The highest priority recommendations that were generated from these activities are presented here. The data strongly demonstrates the need for significantly improved STEM education, improved quality in the classroom, and funding for implementation of the recommendations for a 21st Century educational infrastructure.