

Center for Integrative Nanotechnology Sciences at the University of Arkansas at Little Rock

UALR - eSTEM:

A Model to Transform STEM Workforce Development in Arkansas

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EXECUTIVE SUMMARY

CHALLENGE

Arkansas is at a critical juncture and must address the disparities that oppress educational progress and economic vitality in the state. Arkansas students achieve below national averages; high percentages of children in the region live below poverty levels; the state has poor rankings in math and science; there is underdeveloped STEM education; minorities and women in STEM are underrepresented, and; the STEM workforce is underdeveloped. Each of these has a significant, negative impact on the state's economy.

As evidence of this distress, college degree attainment in Arkansas has continued to lag behind the rest of the country. While 65 percent of high school graduates in the state attend college, the majority never graduate (NCHEMS, 2015). In addition, over half of the students enrolling in college after high school require remediation and those who require remediation are less likely to graduate. In 2010, Arkansas was ranked 48 in the nation in the first-time, full-time undergraduate six year graduation rate at public 4-year institutions (ForwARd Arkansas, 2015). Specifically, in math and science, Arkansas ranks 41 in the nation (SERI, 2014) and less than 11 percent of students graduate with STEM majors (Jenkins, Butler, & Mitchell, 2015). The disconnect between curricula and educators in STEM from Pre-K through college must be bridged to change these numbers and the fate of Arkansas.

PROPOSED SOLUTION

The University of Arkansas at Little Rock (UALR) in partnership with eSTEM Public Charter School is proposing a systematic model to transform STEM workforce development. The model involves an integrated approach that promotes the development of the individual from early childhood to career. A key component of the model is a partnership with eSTEM Public Charter Schools (eSTEM). The model would provide an educational platform for the National Academy of Engineering (NAE) Grand Challenges for Engineering to promote the goal of "training more than 20,000 formally recognized 'Grand Challenge Engineers' over the next decade" (NAE, 2015). The elements of the proposed model that make UALR the right choice as a partner for eSTEM are the people, processes, programs, partnerships, and infrastructure (P4).

This proposal provides a framework for the creation of an integrated model with supporting infrastructure on the campus of UALR, that brings together three critical components for the development of a strong STEM educated workforce: a quality STEM preschool program, eSTEM's K-12 charter schools, and a high quality college education leading to a transition to an effective and fulfilling career. The academic philosophy that will inform the model is one that is the bedrock of UALR—Boyer's scholarship of discovery in which holistic education approaches include a blend of scholarship, teaching, and community engagement. The use of high impact programs within innovative and engaging learning spaces, such as the innovation center, the learning commons, and high technology facilities (e.g. UALR's Center for Integrative Nanotechnology Sciences and the Emerging Analytics Center) are critical to fostering the environment to grow STEM scholars. eSTEM students will gain the opportunity to graduate with both a high school diploma and an Associate of Science degree as a result of this proposed model.

Students will also have the chance to explore and apply the "e" in the eSTEM curriculum—economics. This concept will be integrated throughout the curriculum and students will be provided opportunities to examine the aspects of commercialization through activities like web and application design, invention patenting, and moving new products to market.

MODEL GOALS

The proposed model will accomplish the following goals:

1. Offer creative, innovative STEM learning opportunities for students from pre-K through college, while simultaneously providing professional development that is relevant to today's workplace.
2. Prepare graduates to immediately enter the workforce upon college graduation.
3. Integrate college coursework into high school curricula resulting in students obtaining an Associate of Arts in General Studies from UALR with their high school diploma.
4. Provide interdisciplinary, experiential curricula that sharpen multiple intelligences and appeal to various learning styles with a focus on STEM.
5. Implement STEM curricula that is economically centered and rooted in the liberal arts.
6. Increase the number of individuals with college degrees in the STEM discipline in the state of Arkansas.
7. Expand technological innovations that increase the attractiveness of the state of Arkansas and the city of Little Rock as a place for technology-based companies to grow the state's economy.

The proposed model would strategically meet the local, regional, and state needs and yield a stronger economic environment.

FINANCIAL SUMMARY

The full model will be implemented in four phases over the course of five years, with the first phase to be completed in 2017. The implementation cost of the model, which includes new construction, is \$98,860,918. UALR and eSTEM will engage in joint fundraising efforts to support the needed K-12 facilities on UALR's campus.

BENEFITS

There are a number of benefits for the students, eSTEM, UALR, the city of Little Rock, and the state of Arkansas that will result from the proposed model. These benefits include decreased time to college degree completion; closing the gap between college degree attainment and career readiness; increased STEM graduates with an emphasis on minorities and women; innovative and economically-centered STEM curricula that is rooted in the liberal arts; improved math and science scores; better prepared STEM teachers; easier transitions from high school to college; and an increased ability to attract technology-based companies to Arkansas.

SUSTAINABILITY PLAN

University of Arkansas at Little Rock is fully committed to work alongside eSTEM to ensure funding for a long-term self-sustaining collaboration. This funding will come from state funding, donations from private foundations, individuals, and external funding via federal agencies.

This document heavily relied and presents ideas from the White Paper: Exploring the possibility of a campus-based eSTEM K-12 charter school at the University of Arkansas at Little Rock produced in February 2015 by the UALR - eSTEM School Management Team: Dr. Bronwyn MacFarlane, Dr. Anindya Ghosh, Dr. Jeffrey Connelly, Dr. James Fetterly, and Dr. Darin Jones. A special thanks goes to this team of faculty for their diligent research and contribution to this project.

INTRODUCTION

The state of education in Arkansas is at a critical juncture – while the state public education system is slowly improving outcomes for students, the takeover of local school districts experiencing academic distress, low college graduation rates, high rates of poverty, the stagnation of the economy, and the need for innovation in science and technology suggest more must be done. The University of Arkansas at Little Rock (UALR) is well-situated academically, structurally, and geographically to provide an innovative solution to address this need in central Arkansas and beyond.

UALR in partnership with eSTEM Public Charter School is proposing a systematic model to transform STEM workforce development. The model involves an integrated approach that promotes the development of the individual from early childhood to career. A key component of the model is a partnership with eSTEM Public Charter Schools (eSTEM) (see Appendix A). Students will also have the chance to explore and apply the "e" in the eSTEM curriculum—economics. This concept will be integrated throughout the curriculum and students will be provided opportunities to examine the aspects of commercialization through activities like web and application design, invention patenting, and moving new products to market.

The model would provide an educational platform for the National Academy of Engineering (NAE) Grand Challenges for Engineering to promote the goal of "training more than 20,000 formally recognized 'Grand Challenge Engineers' over the next decade" (NAE, 2015). The elements of the proposed model that make UALR the right choice as a partner for eSTEM are the people, processes, programs, partnerships, and infrastructure (P⁴I).

The proposed model will accomplish the following goals:

1. Offer creative, innovative STEM learning opportunities for students from pre-K through college, while simultaneously providing professional development that is relevant to today's workplace.
2. Prepare graduates to immediately enter the workforce upon college graduation.
3. Integrate college coursework into high school curricula resulting in students obtaining an Associate of Arts in General Studies from UALR with their high school diploma.
4. Provide interdisciplinary, experiential curricula that sharpen multiple intelligences and appeal to various learning styles with a focus on STEM.
5. Implement STEM curricula that is economically centered and rooted in the liberal arts.
6. Increase the number of individuals with college degrees in the STEM discipline in the state of Arkansas.

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7. Expand technological innovations that increase the attractiveness of the state of Arkansas and the city of Little Rock as a place for technology-based companies to grow the state's economy.

UALR's state-of-the-art learning facilities will be utilized for educational engagement. These facilities include, but are not limited to, the Center for Integrated Nanotechnology Sciences (CINS), Emerging Analytics Center (EAC), Ottenheimer Library, research labs and extensive research facilities, robotics workshop spaces, art galleries, and a planetarium. Other facilities such as Stella Boyle Smith Concert Hall, Donaghey Student Center, Aquatics & Fitness Center, soccer field, track, and tennis courts all create opportunities for activities and events within the performing arts, physical activities, and sporting competition. New facilities to serve the partnership include the Innovation Center, the Learning Commons, UALR Department of Art and Design Building, and The Place for Civic Engagement and Reflection.

Despite the fact that 65 percent of high school graduates in the state attend college, Arkansas graduation rates are among the lowest in the country.

COMPELLING REASONS FOR THIS MODEL

Arkansas has made vast improvements in educational outcomes for its citizens over the past decade. A report titled *State of Education in Arkansas (2015)* details four major findings:

1. Arkansas has been successful in improving access to education and in increasing participation in higher-level educational activities;
2. Arkansas has established policies and standards that should support improved student outcomes;
3. Student outcomes are still far below aspirations across the state and opportunity exists to improve;
4. Despite recent gains, the achievement gap is still significant, and this is reflected in economic, racial, and regional disparities (ForwARd Arkansas, 2015, p.3).

To respond to the ForwARd Arkansas findings, the proposed model addresses seven compelling needs that, when it is implemented, will bridge the achievement gap, resolve disparities, and identify clear learning outcomes. The seven identified needs are: Arkansas students achieve below national averages; high percentages of children in the region live

below poverty levels; poor rankings in math and science; underdeveloped STEM education; underrepresentation of minorities and women in STEM; underdeveloped STEM workforce; impact on economic development in the region.

STUDENT ACHIEVEMENT IN ARKANSAS IS BELOW NATIONAL AVERAGE

Although Arkansas has increased spending on P-12 students, strengthened its core curriculum, and improved standards, student achievement is still far below national averages. Arkansas ranks in the bottom 20 states on 4th and 8th grade national tests in math and literacy. Arkansas ranks 40th in math and 42nd in reading on the 2015 National Assessment of Educational Progress (Ritter, et al., 2015). While Arkansas is among the top 20 states for students attending college, students are often not prepared to engage at the college-level. Nearly half of students enrolling in public universities require remedial coursework and are less likely to graduate from college.

Despite the fact that 53 percent of high school graduates in the state attend college, Arkansas college graduation rates are among the lowest in the United States (Arkansas Higher Education Coordinating Board, 2013). In 2010, "Arkansas ranked 48 in the nation for first-time, full-time undergraduate student six-year graduation rates at public 4-year institutions" (ForwARd Arkansas, 2015). The UALR - eSTEM partnership will increase graduation rates by providing high school students the opportunity to eliminate the need for remediation and obtain an associate's degree. This partnership will serve as a model for others across the state and region.

HIGH PERCENTAGE OF CHILDREN LIVING IN POVERTY

Arkansas has the 5th highest percentage of children in the U.S. living in poverty (United States Census Bureau, 2013) and the educational achievement gap for minority students is significant. This is especially true in Central Arkansas where many minority students live in poverty with limited access to a quality education and extracurricular activities. The implications of these findings are staggering since studies have shown that children living in poverty are more likely to face negative educational outcomes such as "poor academic performance, low vocabularies, lower reading and achievement scores, higher dropout rates, and lower college graduation rates" (Ritter, et al., 2015). Accessible early childhood education can make a significant impact on many of these educational outcomes and

serve as a bridge for students' preparation for high school and into college. With only 20 percent of Arkansans holding a bachelor's degree, (United States Census Bureau, 2013) the proposed model will move students to college graduation on an accelerated trajectory aimed to reduce poverty levels in Arkansas.

ARKANSAS RANKS 41 IN THE NATION FOR MATH AND SCIENCE EDUCATION

In 2014, the Science and Engineering Readiness Index (SERI) ranked Arkansas 41 in the nation for math and science education. Arkansas needs to increase its ranking by facilitating student interest in these subjects. A statewide partnership of leaders from the corporate, education, government, and community divisions aim to implement policies and programs that support STEM education (Arkansas Stem Coalition, 2014). The ultimate goal of the proposed model is to improve and expand the economy of Arkansas and produce more jobs throughout the state. Consequently, improving STEM education programs and increasing knowledge-based skills in the workforce will benefit the growing industries in manufacturing, aerospace, agriculture, biomedical/biotechnology, and energy sectors.

According to the American Institute for Research (2012), for every one unemployed person with a STEM degree there are 2.4 jobs available. However, for non-STEM employment, there is only one job opening for every 4.4 unemployed persons.

UNDERDEVELOPED STEM EDUCATION IN ARKANSAS YIELDS FEW STEM COLLEGE DEGREE SEEKERS

While the overall numbers of students in the U.S. who are pursuing a STEM education is increasing (National Student Clearinghouse Research Center, 2015), Arkansas STEM education is underdeveloped in comparison to other states. Arkansas is comprised of large urban areas as well as an appreciable rural community resulting in unique demographics. While many students may have an interest in STEM fields at an elementary age, the number drops by their senior year of high school. This leads to fewer collegiate degree-seeking students in STEM fields. According to Jenkins, Butler, and Mitchell (2015) since 2010 the

percentage of STEM-credentials at Arkansas institutions of higher education has not exceeded 11 percent; additionally, the number of adults entering STEM graduate programs following an undergraduate degree has steadily decreased over the past five years. In the proposed model, students will begin in Pre-K programs with integrated concepts of STEM; throughout K-12 education at eSTEM, students already receive reinforced learning that is centered on STEM. College coursework will be infused into the high school curricula to move students seamlessly into STEM college programs.

UNDERREPRESENTATION OF WOMEN AND MINORITIES IN STEM PROGRAMS

Both minorities and women are underrepresented in STEM education across the state (Jenkins, Butler & Mitchell, 2015). As of spring 2015, 44 percent of the UALR undergraduate student body self-identifies as a member of a minority group and more than 60 percent of the undergraduate students at UALR are women. This proposed model presents a significant opportunity to attract both women and minorities into the STEM fields and workforce through exposure to STEM related curricula due to the coexistence of the two entities and the academic philosophy bedrock of UALR.

UNDERDEVELOPED STEM WORKFORCE

While the central and northwestern Arkansas regions have a growing number of industries for the workforce, other parts of the state lack STEM opportunities. In order to expand the workforce and improve the economy statewide, large industries need entrepreneurial partners who will initiate business growth in all areas of the state. Currently there are six Fortune 500 companies and thousands of small- and medium-sized companies growing annually in Arkansas. To continue this growth, Arkansas colleges and universities must produce a larger number of STEM graduates in order to enrich the state economy. According to the American Institute for Research (2012), for every one unemployed person with a STEM degree there are 2.4 jobs available. However, for non-STEM employment, there is only one job opening for every 4.4 unemployed persons. Strong STEM programs, as the proposed model, will not only grow the workforce, but will also attract more businesses to the state.

IMPACT ON ECONOMIC DEVELOPMENT

For Arkansas' core industries to retain and create new jobs, the required STEM talent must be available. Furthermore, this talent will serve as a catalyst for the state to attract new technology-based companies. The proposed model will cultivate the workforce needed to bring new opportunities to Arkansas.

UALR THE RIGHT PARTNER: P⁴I

There are numerous reasons why the implementation of innovative, forward moving curricula should be offered to the students of the central Arkansas area. The P⁴I approach aims to increase STEM graduates in the state of Arkansas and to positively impact the economy by utilizing the strong body of **people** on the UALR campus, through existing and evolving **processes**, with nationally recognized **programs**, in conjunction with strong community **partnerships**, within a growing **infrastructure** (see Figure 1).

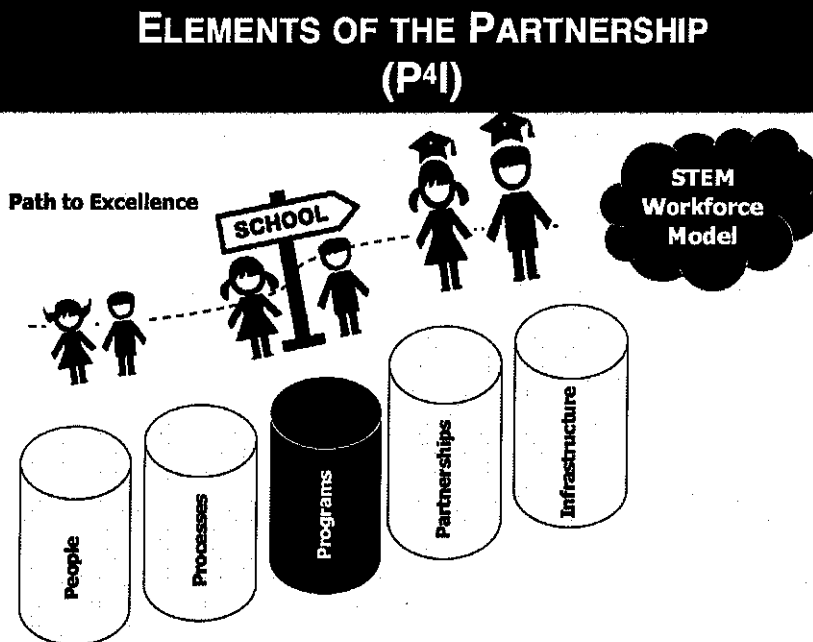


Figure 1: Elements of the Partnership P⁴I

UALR is a metropolitan, community-engaged, research university. UALR is uniquely positioned in the capital city of Arkansas. With a diverse population of more than 10,000 students, and approximately 1,000 concurrent high school students, UALR has taken a leadership role in Arkansas to promote research and education. As a university, UALR has the ability to impact students at all levels—from Pre-K to career—by providing and educating teachers in surrounding schools on the importance of STEM education.

eSTEM, public charter schools in Little Rock, works with students from K-12 to introduce problem-solving and collaborative work through critical thinking. The goal of eSTEM is to prepare students with interests in STEM fields, which can ultimately increase the number of degrees awarded to students in STEM-related education. eSTEM encourages students to take risks in rigorous learning environments that hold scholars to high expectations. The teachers are highly competent and are able to meet the needs and demands of the curriculum to engage students in an interactive learning environment. Both eSTEM and UALR offer expertise, flexibility in curricula, and a strong student focus for STEM education. The success of this merger hinges on the P4I approach.

PEOPLE

AWARD-WINNING FACULTY

With almost 500 full-time faculty members across UALR's campus, students will engage with leading minds within various disciplines. STEM faculty rise to the top as award-winning scholars and inventors. Among the leading faculty members are the co-inventor of the CAVE automatic virtual environment, Dr. Carolina Cruz-Neira; inventor of the co-robot cane, Dr. Cang Ye; Dr. Linda Dorn, founder of the partnerships in comprehensive literacy model; inventor of a tissue regeneration technique, Dr. Alex Biris, and Dr. Tito Viswanathan, who developed a nanomaterial-based process for purifying contaminated water.

Dr. Carolina Cruz-Neira, globally recognized as an international pioneer in the areas of virtual reality and interactive visualization, is the director of UALR's George W. Donaghey Emerging Analytics Center (EAC). Dr. Cruz is a Donaghey Distinguished Professor in Information Science and an Arkansas Research Alliance Scholar. Cruz said the center was founded to make a positive impact on large and small businesses in Arkansas. *BusinessWeek* magazine named Dr. Cruz a "rising research star" in the next generation of computer science pioneers. She has been inducted as an Association for Computing Machinery

Computer Pioneer and received the IEEE Virtual Reality Technical Achievement Award among other national and international recognitions. She has created and deployed a variety of technologies that have become standard tools in industry, government and academia, specifically the co-creation of the CAVE automatic virtual environment. Her work with advanced technologies, driven by simplicity and applicability, provides value to a wide range of disciplines and businesses. She has received multi-million dollar awards from the National Science Foundation, the Army Research Lab, the Department of Energy, and Deere and Company, among others. She serves on many international technology boards and government technology advisory committees.

Dr. Cang Ye is an Associate Professor in Systems Engineering. He received his B.E. and M.E. degrees from the Department of Precision Machinery and Precision Instrument from the University of Science and Technology of China. After working in industry for years, he spent four years at the University of Hong Kong where he obtained his Ph.D. in Electrical and Electronic Engineering. His research interests lie in mobile robotics, robotic assistive technology, and intelligent systems. His current projects include a Co-Robotic Cane for the Visually Impaired (funded by National Institutes of Health); New Computer Vision Methods for the National Aeronautics and Space Administration (NASA) Robotic Planetary Exploration; Towards Portable Navigational Devices for the Visually Impaired (funded by National Science Foundation); autonomous navigation of a mobile surveying system for automatic bio-signature detection (funded by NASA); 3D imaging sensor for 6-DOF localization of mobile robots (funded by Arkansas Space Grant Consortium); and development of algorithms to mitigate the effects of lunar dust on robotic exploration (funded by NASA).

Dr. Linda Dorn is a Professor of Reading Education at UALR and coordinator of the Educational Specialist, Doctoral, and Graduate Certificate in Reading programs. She has presented at over 300 state, national, and international conferences, including keynote addresses and featured sessions. Her publications include seven books, book chapters, media publications, journal articles, and teaching materials. She is the founder and lead trainer for the Partnerships in Comprehensive Literacy (PCL) Model and the Comprehensive Intervention Model. UALR's PCL model is a school-reform project dedicated to increasing student achievement. The model uses literacy as a tool for measuring school change in four interrelated areas: student learning, teacher knowledge, school culture, and school processes. The power of the UALR model is symbolized in a partnership design that acknowledges school change as a dynamic, continuous process that requires commitment and collaboration at many levels. The Center for Literacy at UALR is recognized as a

national leader in literacy reform. School districts and universities across the U.S. have partnered with UALR to influence literacy changes at the local, state, and national levels.

Dr. Alex Biris leads research at the Center for Integrative Nanotechnology Sciences (CINS) exploring the science of nanostructures that can be used to alter the properties of other substances at the atomic level. Through collaborations with private corporations, universities in the state and nation, and research institutes in the U.S. and abroad, Dr. Biris serves as Director and Chief Scientist to accelerate the development of applications of nanotechnology – which have the potential to revolutionize the way the next generation of products are manufactured. Key to Dr. Biris' vision for CINS is its aggressive outreach program to train and educate young people and other world class scientists who will serve and attract business and industry to Arkansas from the region and the nation. He is the inventor of a tissue regeneration technique. Dr. Biris is Professor in the Systems Engineering Department in the College of Engineering and Information Technology. Dr. Biris has collaborated on over 200 scholarly publications.

Professor Tito Viswanathan bridges the gap between theory and practice. While guiding students to make their own research discoveries, he teaches how to attack problems and analyze possible solutions, leading students to become wavemakers in their own right. Dr. Viswanathan's work is concentrated largely on conductive polymers, or materials that conduct electricity, and has brought the University international recognition, new equipment, and over \$2 million in funding in the past 10 years. His work has produced the only water-dispersible conducting polymers on a mass scale in the U.S., and eight patents have been issued on his work.

GRADUATE STUDENTS

In addition to a strong faculty, UALR enrolls several hundred graduate students in the College of Education and Health Professions (CEHP), College of Engineering and Information Technology (CEIT), and the College of Arts, Letters and Sciences (CALs). A majority of graduate students work as teaching assistants (TAs) in their respective departments, serve in community-engaged teaching opportunities through student teaching, or hold internships. Graduate students often serve as TAs in the classroom and assist in tutoring undergraduates in various fields. The graduate programs are nationally and internationally recognized and graduates secure prestigious positions, such as faculty members at universities, scientists in national labs, or industrial researchers. The total number

of graduate students in spring 2015 for CEHP, CALS, and CEIT was just under 1,300. Graduate students who wish to pursue a teaching career in the future will benefit immensely by working with the UALR - eSTEM partnership as a field site for teaching and learning.

UNDERGRADUATE STUDENTS

The presence of 3,300 undergraduate students with interests in STEM, education, and psychology presents a clear opportunity to enhance service learning for college students through mentorship. There are several successful mentorship programs on campus, and this partnership offers an opportunity to extend this impactful work to eSTEM students. College students can serve as tutors, teachers' assistants, camp leaders, or can work with students through after-school programming in the arts or sports. This real-world experience can prove invaluable for college students and help them understand the importance of giving back to the community.

PROCESSES

ACADEMIC SUPPORT

Students have various forms of academic support from tutoring at the Math Lab and the Writing Center to supplemental instruction for difficult classes. The Student Success Center provides numerous forms of academic support including test preparation. The Testing Center creates a low-distraction environment for students to have immediate results for many **standardized** tests, accommodated tests, and distance proctoring.

CAREER SUPPORT

Currently, UALR provides assistance to help students find internships, externships, jobs and professional development opportunities through the Office of Cooperative Education Internship and Placement (CEIPO). In Co-op courses, students are able to apply their classroom education to real-world experiences and gain credits toward their degree. UALR currently houses 58 co-op courses.

RESEARCH SUPPORT

Research is at the helm at UALR, which is validated not only by its award-winning faculty and research labs, but also by the numerous research grants currently in place. The Office of Research and Sponsored Programs (ORSP) serves as the grant administrator for the university. ORSP provides information, services, and support so that members of the UALR community may compete to conduct scientific research, create works of art, compose music, write books and articles, improve their performance in the classroom, and better serve their students, professions, and the public. Innovative thought is already being funded at UALR and is reflected in this list of current grants in the College of Education and Health Professions and the College of Arts, Letters, and Sciences:

- UALR AACTE NIC (Networked Improvement Community)
- Online training of orientation and mobility specialists for the blind
- STEM Starters Plus Award
- Integrated pest management and chemical use reduction in homes
- Society for Science and the Public and the Broadcome Foundation for the Broadcome Masters Fair
- Engaging in Excellence in Elementary STEM Education
- Investing in Innovation: Collaborative Regional Education (CORE) PK-20
- Improving Teacher Quality in Middle School Mathematics
- STRIVE program: Arkansas Department of Education

STUDENT SUPPORT

UALR has a contract with a third-party vendor to provide meal plans and catering services for the campus. This can easily be extended to include healthy and nutritious meals that meet guidelines for a K-12 school. Residential housing is available over the summers for camps, conferences and other overnight stays. The Office of Health Services has several advanced practice registered nurses (APRN) and an on-call physician to meet the students' medical needs. The Disability Resource Center works with students and faculty to reduce barriers to learning. Finally, the Donaghey Student Center provides a plethora of options for activities, meetings, conferences and special events like awards ceremonies and dinners.

ADMINISTRATIVE SUPPORT

The UALR campus has the infrastructure needed to support the academic mission of eSTEM schools. Information Technology Services provides technology solutions that enable student success; Facilities Management supports all electrical equipment, grounds maintenance, and custodial services; the Department of Public Safety provides a complete range of policing 24 hours a day, 7 days a week, and; the Bursar's Office provides full cashier services.

PROGRAMS

RESEARCH

UALR is among the most accessible and student-centered campuses in the University of Arkansas System. In keeping with its historic metropolitan mission, the Little Rock campus has a diverse student body, an impressive record of successful student outcomes, and stature as an emerging leader in technology transfer. UALR's research profile has experienced critical development in the last decade, generating almost \$30 million in 2013 in competitive extramural awards from federal, state, and private sources. The campus is known for excellent engineering and information technology programs along with research strengths that include advanced materials, nano-materials, bioinformatics, robotics, information quality, and data science. In addition to strong department-based research projects, UALR is home to a number of highly specialized centers and stellar colleges and schools that provide invaluable support for the university and the region.

ACADEMIC

Schools and colleges at UALR include: College of Arts, Letters, and Sciences (CALs); College of Business (COB); College of Education and Health Professions (CEHP); Donaghey College of Engineering and Information Technology (CEIT); College of Social Sciences and Communication (CSSC); the Graduate School, and the William H. Bowen School of Law (BSL). UALR is equipped with many colleges and departments that offer advanced education degrees that are related to STEM fields and can be beneficial in STEM education. A large pool of experienced and highly skilled faculty are the cornerstone of UALR; these faculty would collaboratively design and implement curricula for eSTEM students, especially for the upper level classes.

CALS has both Doctorate and Master's degrees in various STEM disciplines that include Chemistry, Biology, Physics and Astronomy, and Mathematics and Statistics. Additionally, CALS alongside CSSC offers a liberal arts education. CEIT has Master's and Doctoral programs in Bioinformatics, Systems Engineering and Information Sciences. CEHP enrolls the highest number of graduate students at UALR with both Masters and Doctorate programs in Adult Education, Gifted Education, Higher Education, Literacy Systems Technology, Literacy Intervention Specialist, Math Education, Reading, and Secondary Education.

SCHOLARSHIPS

UALR offers many scholarships to undergraduate students. The scholarships were established to attract and retain high caliber students. Students from eSTEM will have the academic requirements to obtain these scholarships. These scholarships include Donaghey Scholars, University Science Scholars, Chancellor's Leadership Corps, McNair Scholars, Science Scholars, Provost's Academic Excellence, Dean's Academic Merit, UALR Academic Achievement, Freshman Award, EAST Scholars, and the Louis Stokes Alliance for Minority Participation in STEM. These opportunities would provide a pipeline for eSTEM students to enroll at UALR and provide them with financial support.

OUTREACH

UALR is highly engaged in the community through educational programs for students in Arkansas. These programs provide unique opportunities for students and would create educational enhancements for the eSTEM curriculum.

PRE-COLLEGE DIVERSITY ENGINEERING PROGRAM

The Pre-College Diversity Engineering Program (PCDEP) was formed in 2007 primarily to increase the number of historically underrepresented students in grades six through twelve prepared to pursue engineering degrees. However, membership in the program is not restricted to only underrepresented students. The program is implemented through the formation of engineering clubs where activities and exercises are conducted that are unique to the needs of the students. Sponsors receive a merit-based stipend for sponsoring their PCDEP engineering club. The program's signature event is the Engineering Olympics. The Engineering Olympics is designed to introduce PCDEP students to engineering through

competitive team events and exercises. All participating schools receive all materials necessary to compete at no charge.

TSA TEAMS COMPETITION

During National Engineers Week, UALR hosts the Junior Engineering Technical Society's (TSA) Tests of Engineering Aptitude, Mathematics and Science (TEAMS) Competition. UALR is the only site in Arkansas hosting this national event. This event is designed to teach team development skills through students' participation as a group in an engineering problem competition. Competition problems cover mathematics, chemistry, physics, biology, visual interpretation, computer applications, and reading analysis and interpretation. The TEAMS method requires students to present the multidisciplinary aspects of engineering work by illustrating how the math and science concepts they are learning work together and are applied to solve real-world problems.

TEAMS is also aligned to national education standards. High school teams compete in groups of up to eight students. Students are encouraged to bring whatever reference materials they need during the three hour competition. Schools compete for state and national honors against schools that are similar in size and admission policies.

MATHCOUNTS COMPETITION

The MATHCOUNTS Competition Program is a national middle school coaching and competitive mathematics program that promotes mathematics achievement through a series of fun and engaging "bee" style contests.

CEIT partners with the Central Arkansas Chapter of the National Society of Professional Engineers to host the Central Arkansas Chapter Competition of MATHCOUNTS. Area teams and individuals compete at the UALR campus, and the top competitors advance to the state competition. The winners of the state competition will represent Arkansas at the national competition in Washington, D.C.

HIGH SCHOOL RESEARCH PROGRAM

The objective of the High School Research Program (HSRP) is to engage academic high achievers in a focused research environment by proactively mentoring them and helping them make informed choices on appropriate coursework for pursuing future careers in STEM disciplines. In addition, the three-week residential summer program provides informal peer

robotics competition. CEIT hosts the BEST Robotics Tournament. Teams are required to design and build a robot which must be able to accomplish certain tasks on a 24' x 24' competition area. In addition to robot performance, teams are judged based upon their engineering design notebook, team exhibit, marketing presentation, and other factors. The top teams from the Little Rock Hub will advance to the Regionals, which are held at the University of Arkansas at Fort Smith.

UALR SUMMER STEM CAMPS FOR KIDS

The Intel International Science and Engineering Fair (Intel ISEF), the world's largest international pre-college science competition, provides an annual forum for more than 1,500 high school students from over 70 countries, regions, and territories to showcase their independent research as they compete for more than \$3 million annually. The Intel ISEF is the premier global science competition for students in grades 9-12.

BROADCOM MATH, APPLIED SCIENCE, TECHNOLOGY, AND ENGINEERING RISING STARS

The Math, Applied Science, Technology and Engineering Rising Stars (MASTERS) program is the premier middle school science and engineering fair competition. The Society for Science & the Public science fairs around the country nominate the top 10% of 6th, 7th and 8th grade students to enter this prestigious competition. After submitting the online application, 300 semifinalists are selected and 30 finalists are brought to Washington, DC. Finalists present their research projects and compete in hands-on STEM challenges to demonstrate their skills in critical thinking, collaboration, communication, and creativity.

SCIENCE OLYMPIAD, SCIENCE FAIR

Science Olympiad is a nationwide organization dedicated to promoting science education through conducting competitive science tournaments held each year on the campus of UALR. As part of the Science Olympiad organization, Arkansas Science Olympiad is dedicated to inspiring a passion for science by providing hands-on activities, stimulating a creative atmosphere for science and technology education, and hosting tournaments in which students can showcase their skills. Arkansas Science Olympiad also has professional development opportunities for teachers and educators.

For over 30 years, Science Olympiad has led a revolution in science education. What began as a grassroots assembly of science teachers is now one of the premiere science competitions in the nation, providing rigorous, standards-based challenges to nearly 7,000 teams in 50 states. Science Olympiad's ever-changing line-up of events in all STEM disciplines exposes students to practicing scientists and career choices, and energizes classroom teachers with a dynamic content experience.

PARTNERSHIPS

UALR has worked closely with multiple stakeholders including: the City of Little Rock, University of Arkansas for Medical Sciences, Baptist Health, Arkansas Children's Hospital, The Winthrop Rockefeller Foundation, the University District Partnership, United Way, the Promise Neighborhood, The Windgate Charitable Foundation, Children International of Kansas City, and Community Colleges throughout the state, along with numerous other non-profit organizations, schools, and government agencies to address community needs. UALR demonstrates strength in the collaborative relationships, accessibility, research profile, and campus resources. These same partnerships will allow UALR and eSTEM students the opportunity to take part in addressing current and future economic and STEM challenges using an integrated approach.

INFRASTRUCTURE

EDUCATIONAL CENTERS & FACILITIES

UALR offers various educational centers and facilities that will foster the learning environments to cultivate a strong STEM program.

THE CENTER FOR INTEGRATED NANOTECHNOLOGY SCIENCES

The Center for Integrated Nanotechnology Sciences (CINS) is a collaborative research center open to researchers from universities, government laboratories, and industry by providing the opportunity to access major instruments in the areas of electron microscopy, scanning probe microscopy, X-ray diffraction, and optical spectroscopy. CINS is composed

of instruments with emphasis on the structural and chemical composition analysis of nanotechnology related materials. CINS is a unique resource in the state of Arkansas representing an outstanding opportunity to help solve nanotechnology related materials problems (see Appendix B).

THE EMERGING ANALYTICS CENTER

The Emerging Analytics Center (EAC) is a research center featuring advanced data visualization systems and a unique, campus-wide cross-discipline approach to help corporate clients, faculty researchers, and students with Data Visionary Solutions in the new era of BIG DATA (see Appendix C).

NSA/DHS DESIGNATED NATIONAL CENTER OF ACADEMIC EXCELLENCE IN INFORMATION ASSURANCE AND CYBER DEFENSE

The Internet has connected billions of lives all over the world by transporting huge amounts of information at dizzying speeds over the information superhighway. This has radically transformed our socioeconomics in a manner that was inconceivable even a decade ago. However, this transformation has been accompanied by serious challenges in keeping the information secure and being able to distinguish good information from spurious information (Information Assurance) as well as keeping the information superhighway free from attacks that can reach to people and institutions across cyberspace (Cyber Defense).

The Federal National Security Agency (NSA) has designated 105 National Centers of Academic Excellence (CAE) across the nation in Information Assurance/Cyber Defense (IA/CD) to prepare a growing number of IA/CD professionals to meet the need of mitigating threats to the nation's ever growing complex network and information technology systems. The CAE IA/CD at UALR is one of two centers in the state of Arkansas. Specific goals of the center at UALR are to:

- Serve as a coordinating organization to improve and expand IA/CD curriculum.
- Expand research in IA/CD by bringing together faculty to identify research topics and to secure funding.
- Assist students in obtaining scholarships and grants to support Information Assurance activities.
- Provide public visibility to the IA/CD educational and research efforts underway at UALR.

LITTLE ROCK TECHNOLOGY PARK

The University has joined with the University of Arkansas for Medical Sciences (UAMS) and the City of Little Rock to develop the Little Rock Technology Park, which is funded in part by a voter-approved tax that provides \$22 million. When completed the facilities and infrastructure will be a platform for launching technology-based startup companies formed around university research.

STELLA BOYLE SMITH HALL AND UNIVERSITY THEATRE

Stella Boyle Smith Concert Hall (see Figure 2) is located in UALR's Fine Arts building. The concert hall was recently renovated. Stella Boyle Smith Concert Hall is frequently used by the Little Rock community for various purposes. The concert hall will be easily accessible to eSTEM students, faculty, and staff, and can be used for concerts, assemblies, and annual events. In addition to the Stella Boyle Smith Concert Hall, the University Theatre located in the Center for the Performing Arts will be accessible for eSTEM events.

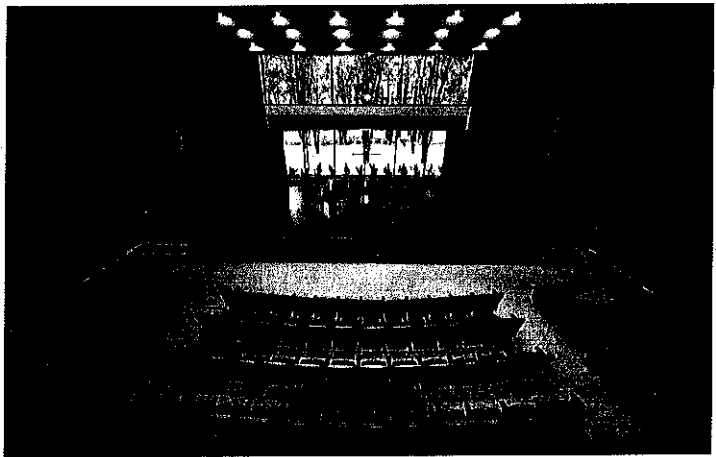


Figure 2: Stella Boyle Concert Hall at UALR

SPORTING COMPLEXES

UALR is equipped with an excellent fitness center, and it is available to students, faculty, staff and community residents. The fitness center offers an indoor track, racquetball courts, weights and cardio training equipment, aquatics, basketball and aerobics, table tennis, volleyball, and group fitness classes. eSTEM students will be able to take advantage of these excellent facilities both for recreational purposes and for any competitive events. The Coleman Sports and Recreation Center and the Jack Stephens Center may also be accessible to the school for sporting events and other activities.

UALR DEPARTMENT OF ART & DESIGN BUILDING

With a target date to open in fall 2017, the University of Arkansas at Little Rock's newest building will be among the finest higher education facilities in the country for visual arts education. The new building will integrate UALR's Applied Design, Art History and Studio Arts

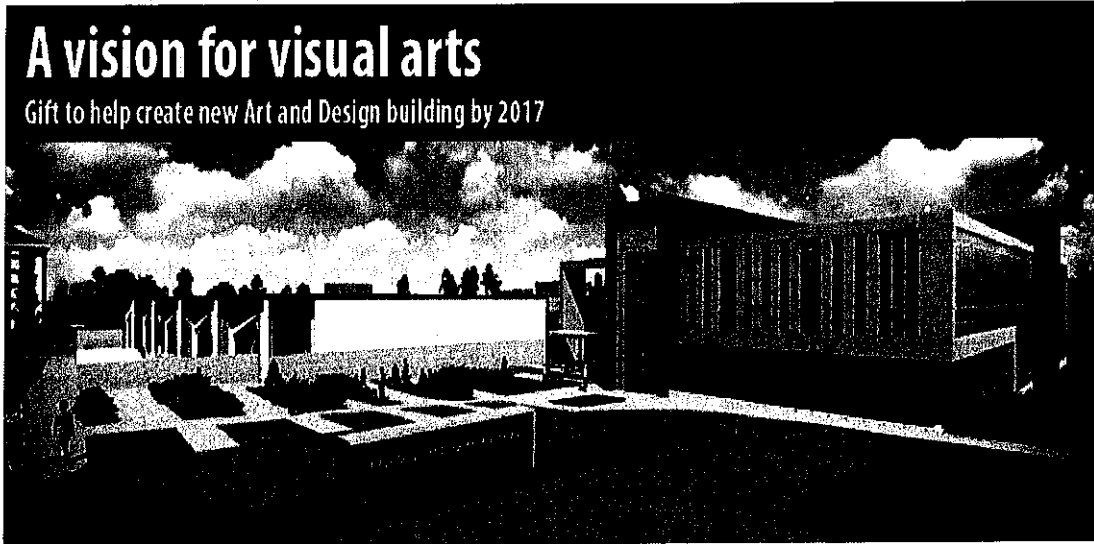


Figure 3: UALR Department of Art and Design Building Architectural Rendering

classes into a facility that promotes collaboration and creativity between students, faculty, and guests under one roof. Drawing/Painting/Printmaking/Art History and 2D Design and Illustration classrooms will be located on the north side of the building to make use of the large expanse of glass along 28th Street (see Figure 3).

OTTENHEIMER LIBRARY

The library is an important and essential part of any institution. UALR has an outstanding library system, which can be useful to eSTEM students and faculty. UALR faculty, students, and staff have 24 hours per day, seven days per week access to approximately 150 databases across disciplines. From the library's home page, located at <http://ualr.edu/library>, the university community can search electronic resources that include books, journals, conference proceedings, and government-issued reports. The UALR library also offers interlibrary loan services for obtaining any book or journal quickly. The eSTEM community will have access to the library facilities and resources across campus, which will supplement eSTEM's library.

PROPOSED MODEL

We offer the theory of change originally developed by the Central Little Rock Promise Neighborhood (CLRPN) which centers on the belief that in order for children to reach their full potential as adults it will take uncompromising intense efforts from early childhood to career attainment "to promote academic achievement; foster physical, social, and emotional development, encourage and support parental engagement and effective parenting; build healthy habits and environments, and nurture productive citizens" (Central Little Rock Promise Neighborhood Project, 2010, p.1).

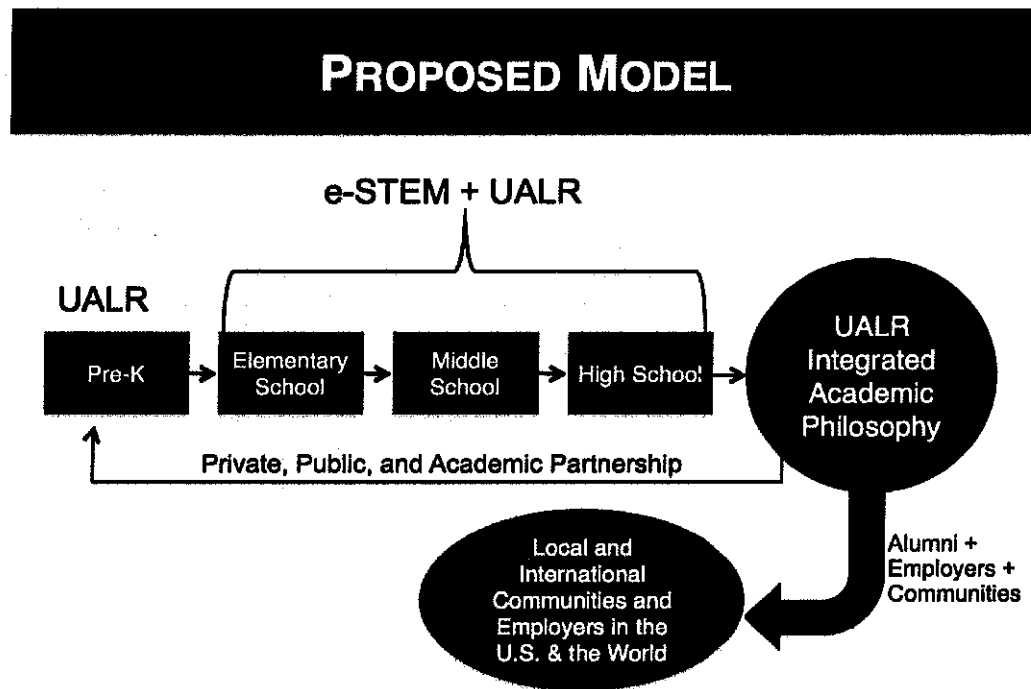


Figure 4: Proposed Model

To achieve this goal, and address Arkansas's challenges in STEM education, UALR proposes an innovative integrated approach: the establishment of a STEM preschool program, a partnership with eSTEM K-12 Charter public schools to be housed on the university campus, and access to a high quality college education that will serve thousands of students in Central Arkansas (see Figure 4). UALR is ready to bring together its many resources to provide a rich environment with cutting edge teaching techniques along with unique academic programs and community partnerships.

PRE-KINDERGARTEN

It is widely known that children who receive early childhood education intervention are more successful in school. According to H. Yoshikawa, et al., (2013) "the foundations of brain architecture, and subsequent lifelong developmental potential, are laid down in a child's early years through a process that is exquisitely sensitive to external influence" (p.3). Engagement in activities that focus on cognitive, social, and executive functions yield a lifelong learner who is advanced in both academic and employment settings (Yoshikawa, H., et al., 2013, p.4).

Partnership with existing UALR programs will provide opportunities to develop growing pre-K programs, along with expanding existing partnerships (see Figure 5). A strong UALR partnership currently exists with community engagement programs like Children International. The UALR preschool programming through the sponsorship of social work, health sciences, early childhood education, and developmental psychology will provide year-round early learning that promotes a STEM introduction through elements of play. Students will engage in foreign languages, mathematics concepts, and literacy fundamentals while exploring hands-on creative arts projects. Students will participate in culturally enriching research trips for exploratory development, including locations such as Heifer Village and The Museum of Discovery. These early childhood opportunities will develop the pipeline of students to enroll at eSTEM.

The UALR preschool programming through the sponsorship of social work, health and human performance, early childhood education, and developmental psychology will provide year-round early learning that promotes a STEM introduction through elements of play while developing the pipeline of students to enroll at eSTEM.

PROPOSED MODEL-PRESCHOOL (PRE-K)

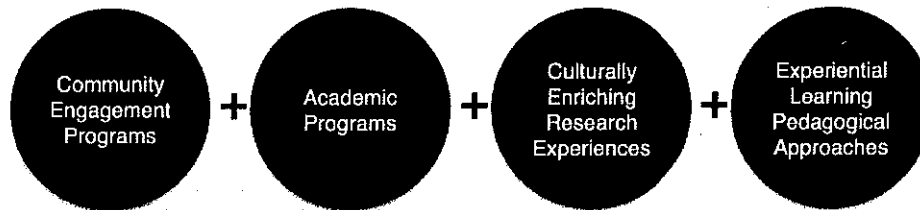


Figure 5: Proposed Model-Preschool

ELEMENTARY SCHOOL

Playgrounds are designed to keep children physically active and encourage social development through play. These predesigned play spaces, while colorful and energizing, could limit children's natural exploration when used in isolation. Research has shown that children's interaction with the natural world invokes curiosity that aids the learning process (Katz, 2010). STEM education in the early years of a child's life is more reflective of the language they are comfortable speaking—the language of play. Traditional forms of instruction may feel foreign to many children and lead to disengagement.

STEM, on the other hand, calls on parents and educators to give children chances to investigate an idea in a variety of settings for what educators call cross-contextual learning. Children can learn through environments that produce energy and allows them to connect to the material they are learning. For example, children can collect objects or plants that

reflect certain shapes, identify patterns in shells or rocks, and count clouds, trees or birds. The key is to lay the foundation for future STEM learning and challenge the child to ask questions about their environment (Sneideman, 2013).

In the proposed model, students will start with a quality pre-K program, and then progress to the eSTEM elementary school. The strong eSTEM curriculum, along with the dedicated teachers, will prepare students to take the next step in their journey through a model that is designed to help them succeed. As illustrated in Figure 6, the eSTEM curriculum will be supplemented by high impact activities and real-world problem solving. The UALR – eSTEM partnership will prepare students for career exploration through summer experiences, college curriculum, and mentorship and internship opportunities.

MIDDLE SCHOOL

As eSTEM students progress through middle school, they will engage in supplemental hands-on interactive, real-world problem solving through addressing societal and economic challenges using critical thinking and innovative strategies, which will be offered through the UALR – eSTEM partnership. Students will take the COMPASS in preparation for the ACT in order to qualify for college courses that will be taken during high school. In addition, students will gain skill sets that not only prepare them for the challenges of becoming an active contributor to their community, but also to be competitive in collegiate environments. Students will learn civic responsibility, engagement, and reflection through service learning, leadership training, and mentorship through individualized instruction. These skills support the NAE's Grand Challenges for the 21st Century (see Transition to Career on p. 49).

SUMMER PROGRAMS FOR K—12

During the summers, K-12 students will have the opportunity to explore STEM through highly interactive camps that expose them to different STEM areas. The students will experience three levels of summer camps: In elementary school, students will participate in the Young Engineer Camps that provide initial exposure to STEM concepts through life sciences and space voyager. In middle school, students may examine construction management, nanotechnology, and/or cinematic technology. High school students will manage projects that ask them to solve issues within society, such as how the economy and socioeconomic

PROPOSED MODEL-K-12

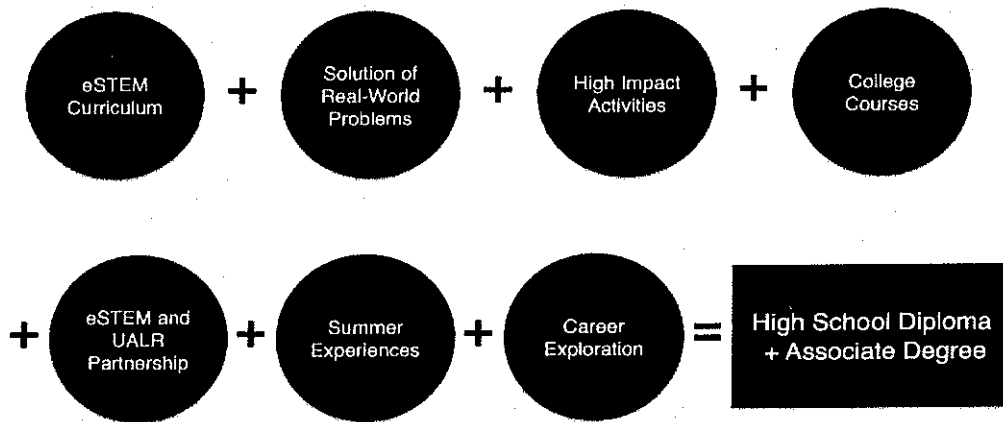


Figure 6: Proposed Model K-12

status impacts the access to clean water, high quality education, or technological tools and access. These "hands-on," "real-life," and "entrepreneurship and innovation experiences" grow the individual from elementary through high school under the National Academy of Engineering (2015). This approach not only aids in retention, but also aims to eliminate the overall frustration for students when moving from one level to the next without understanding the application of the STEM disciplines.

These "hands-on," "real-life," and "entrepreneurship and innovation experiences" grow the individual from elementary through high school under the National Academy of Engineering (2015).

HIGH SCHOOL

In high school, students will be challenged to create tangible solutions to real-world problems through managing projects from conception to deliverable. For example, students may be asked to confront new ways of increasing healthy, affordable eating options for urban students. Students will critically analyze a problem, brainstorm solutions, decide on

goals, present the proposal for acceptance, create a strategy to reach the goal and offer an innovative, tangible result (See Transition to Career on p. 49).

Because this partnership allows the integration of college coursework into high school curricula, students will obtain an Associate of Arts in General Studies by their high school graduation, and they will better understand the benefits and expectations of a STEM career. UALR faculty and eSTEM teachers will co-teach many of these courses to help students bridge the gap from high school to college. Students will learn how to manage projects, and it will also lay the foundation for them to become strong leaders with the confidence, STEM skills, and vision to critically assess problems and implement solutions. This model is what today's workforce so desperately craves in college graduates, but rarely finds. The model relies on heavy collaboration of college faculty and teachers from each level to bring together adaptable curricula for students throughout their duration from Pre-K through college.

ACADEMIC PHILOSOPHY: AN INTEGRATED APPROACH

UALR's metropolitan, community-engaged, research focus hinges on the work of E. Boyer's (1990) *Scholarship Reconsidered*. Specifically, Boyer's scholarship of discovery model, which is applied with the understanding that the holistic education of the student is required for students to gain fulfillment through college and into career through curricular application beyond the university (p. 75). Boyer's model states that the *integration* stage occurs when knowledge is used across disciplines or through field research. The *application* stage allows the student to utilize the knowledge to solve societal problems be it in a leadership role or service-learning project. The *teaching* stage challenges the refinement of this knowledge through advanced research and mentorship. The proposed partnership is based on this work and creates a unique opportunity to blend scholarship, teaching and community engagement in a way that inspires students (see Figure 7). The macro level describes this philosophical approach that directly influences the courses, or the micro level, and as a result will lead to community engagement.

ACADEMIC PHILOSOPHY: INTEGRATED APPROACH

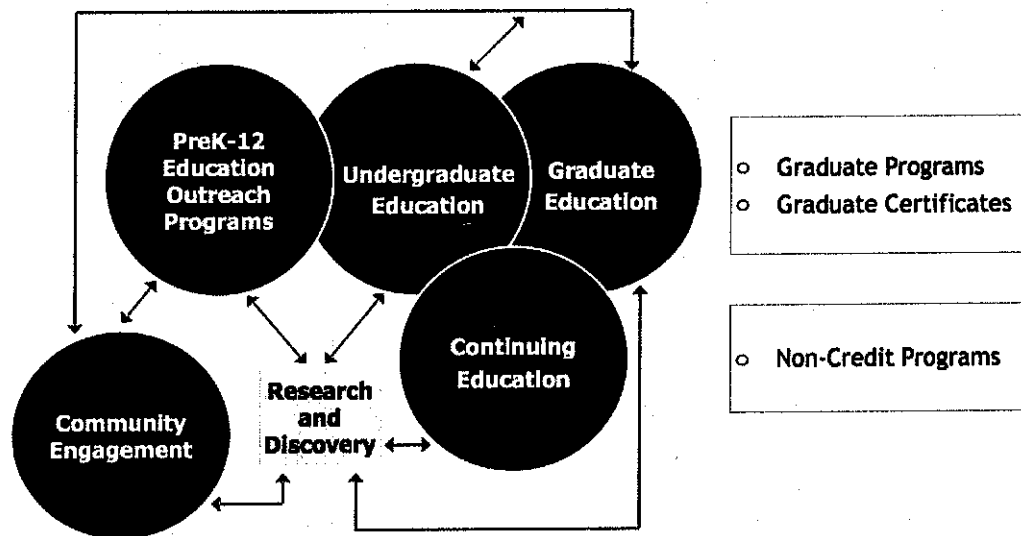


Figure 7: Academic Philosophy: Integrated

AT THE MACRO LEVEL

The implementation of an integrated framework that takes full advantage of UALR's location, academic programs, community engagement programs and partnerships, and concurrent enrollment will be the most unique aspect of this model. This philosophy is based on engaging the university community and using it as a classroom and a laboratory. These efforts will be enhanced by serving the professional development needs of the community through continuing education and through the integration of UALR outreach programs into the educational experience of the students.

In the proposed integrated approach, research and discovery informs teaching; teaching involves service or community/industry engagement; and service shapes, inspires and informs research and discovery. The UALR - eSTEM partnership represents a model for how to engage in the systemic improvement of K-12 education.

AT THE COURSE LEVEL

Engaging the student in learning requires relevance to their lives outside of the classroom. The integration of multiple disciplines, literacies, and intelligences creates a space that is conducive to innovation, creativity, and synthesis of knowledge. The UALR - eSTEM partnership allows students to develop mentoring relationships with university faculty, staff, and students. Through creative integration of team based learning, the arts, and STEM, students learn how to think critically and apply theory to practice. Students will learn across the curriculum and be challenged to make connections through the application of lessons from their course work to external experiences.

Moving away from traditional teaching methods, educational settings, and standardized curricula is critical to invigorate students in STEM disciplines. Students need opportunities to interact in hands-on learning situations. For example, companies like #YesWeCode “target[s] low-opportunity youth and provides them with the necessary resources and tools to become world-class computer programmers. By learning this highly valuable and relevant 21st century skill, these young people are shifting the trajectory of their futures and transforming their relationships with their communities and their country” (DreamCorps, 2015). The state hosts an on-going hackathon, which is located in the northwest region of the state. The premise of the workshop, 100 Girls of Code, is “to achieve gender parity in STEM fields by introducing more young women to coding and computer engineering at a young age. “We seek to inspire more girls to pursue a future in STEM by providing young women an opportunity to create and gain confidence in what they create” (DreamCorps, 2015).

Recreating and providing the opportunity for students to attend conferences where they engage in activities like hackathons or codeathons offer participants collaborative projects to develop websites or applications that solve problems in the community. A recent codeathon, co-sponsored by the Clinton Foundation, Ace Hotel, Tumblr, and Jawbone, challenged 25 students to develop apps to “help people sleep better” (Mansueto Ventures, 2015). Across the country high schools students are brought together to solve community issues with the innovative uses of technology. Activities and assignments such as these provide students to critically think through situations that improve their community, while applying, in this particular example, the impacts of health through the lens of technology.

Courses that combine multiple disciplines using research and community problem-solving bring to life the students' educational experiences and can more readily close the gap from the theoretical aspects of college and the application of job skills. A course that focuses on

film, history, and STEM brings students together to conduct research and work in production teams to develop documentaries on significant figures in the STEM disciplines and offers a venue to showcase the documentaries. Moving learning opportunities to capstone projects through exploration and collaboration will better serve active, engaged education. Students will experience an integration of the arts with various STEM topics. A few possibilities are detailed in the following:

ASSISTED LIVING: AN INTERACTIVE DANCE PERFORMANCE

Assisted Living is a dance performance that blends art with engineering research. A 3-D cityscape is projected onto the back of the stage to create a virtual set. Audience members wearing 3-D glasses feel they are immersed in the city environment together with the dancers. Dancers wear a network of wireless sensors to interact with graphics, music, and each other to create a unique dance performance in which all elements are dynamic and ever-changing. Taking advantage of the interactive bond between dancers and their supporting environment, the performance includes an improvisation segment in which live musicians and dancers create a new visual and aural space for the audience. The audience wears 3D stereo glasses as the visuals are projected with depth to create the illusion of virtual props around the dancers.

THE VIRTUAL HINDU TEMPLE

The Virtual Hindu Temple immerses the visitor in a devotional ritual for the Hindu deity Krishna. This temple is based on Radharaman Temple, an actual temple in Vrindavan, India built in the sixteenth century, and conveys the sights and sounds of contemporary practice. The use of an immersive digital storytelling approach opens up new areas of inquiry that reflect new research and teaching methods in the field of Religious Studies. This temple provides an integrated information environment that will allow students to learn through experience. In the Hindu tradition, "seeing" the divine is an important aspect of the human-divine encounter, and it involves a sensorial experience difficult to convey through verbal description. Immersive storytelling technology enables faculty to communicate in forms that better replicate an individual's experience of culture. This project was a collaboration between a Computer Engineering faculty, Dr. Carolina Cruz-Neira, and a Religious Studies faculty, Dr. Whitney Sanford. It was partially funded by the Miller Foundation, the National Science Foundation, and John Deere.

At both the macro and course levels students exercise Boyer's integration stage whereas the application stage of Boyer's model is utilized through community engagement.

COMMUNITY ENGAGEMENT: INTERNSHIPS AND SERVICE LEARNING

UALR is the only Arkansas university recognized by the Carnegie Foundation for the Advancement of Teaching for the elective classification as a Community Engaged Institution. Learning is not limited to the classroom. Community settings give students the opportunity to develop valuable skills that enhance their professional and personal lives. Academic experiences that integrate service into the curriculum also increase civic engagement by students while in college and after. The integration of service learning and internships into the K-12 curriculum will better prepare students for career as well as create a stronger connection to their learning. The Community Connection Center (CCC) works with campus constituents to integrate service learning in their curriculum.

The CCC facilitates outreach for campus and community partnerships, through the development of high impact programs that increase student engagement, learning and retention, enhance collaborative faculty and student research, and improve community outcomes.

The Center brings together:

- Cooperative Education
- Service-learning
- Community Engaged Scholarship
- UALR Children International

Since 1994 Children International and the University of Arkansas at Little Rock have been working in partnership to provide health and dental care, educational support, family assistance and other services to help empower children and families in their efforts to break through the barriers of poverty. To date, this partnership has benefited more than 16,000 children and youth living in Little Rock. Each year UALR CI sponsors 3,200 children and youth, ages 4-18, recruited from five partner schools serving the neighborhoods of Central and Southwest Little Rock

The CCC creates and promotes community-based learning experiences that offer reciprocal and substantial benefits for our community partners as well as co-curricular

UALR: 13-20 + TRANSITION TO CAREER (CONT.)

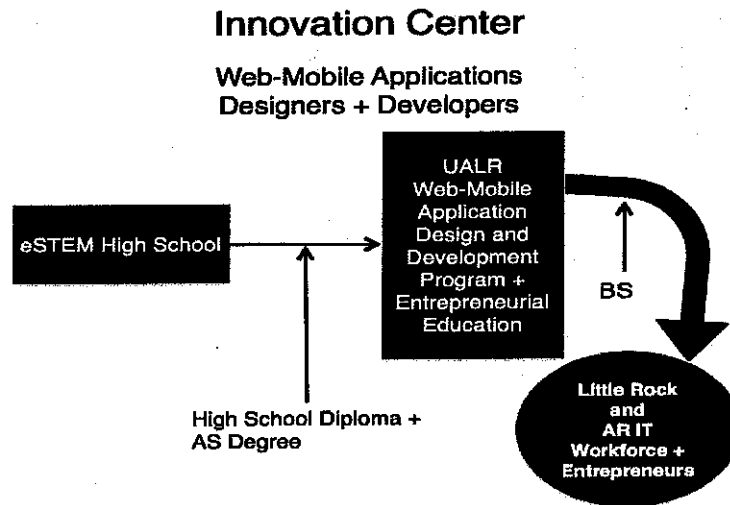


Figure 9: 13-20 + Transition to Career

THE INNOVATION CENTER

The Innovation Center brings together micro and macro integrated STEM learning opportunities linked to technology, economics, and entrepreneurship. Through the Center students will be able to participate in both undergraduate and graduate level research. It is a freestanding multi-use facility with focus on micro-nano technology and web mobile applications. It will house the multidisciplinary web/mobile device lab, co-working space, classrooms for web/mobile, entrepreneurship, and other interdisciplinary programs, an auditorium, wet and dry labs, a rapid prototyping facility, a small-batch manufacturing facility, a business incubation space and conference rooms (see Figure 9).

WEB-MOBILE APPLICATION DESIGN AND DEVELOPMENT PROGRAM

The Innovation Center will support an undergraduate degree program based on an existing certificate program that will enable students to develop technology-based business in Web

and Mobile Application Design and Development (see Figure 9). Through a multidisciplinary, team-based approach with classes drawn from Information Science, Fine Arts, Writing, & Business, students will engage in learning that will progress them through the completion of their Bachelor's degree two years after high school graduation. Students will complete curriculum offerings based on five core classes:

Computer applications in art (Department of Arts)

- Internet technologies (CEIT)
- Usability testing & design (Rhetoric & Writing)
- Digital marketing (College of Business)
- Capstone project (CEIT)

NANOTECHNOLOGY

The Innovation Center will also facilitate students completing an Associate's Degree in Nanotechnology only one year after graduating from high school. Students can engage in experiential learning through local industries that specialize in filtration membranes, cutting blades, turbine blades, mining equipment, cosmetics, fuel additives, electronic devices and computer chips. Graduates with this degree will be prepared to support manufacturing operations in the nanotechnology industry (see Figure 10). Students will also be able to complete a Bachelor's of Science (BS) degree in Engineering, Engineering Technology, Chemistry, Biology, or Physics only three years after graduating from high school.

UALR: 13-20 + TRANSITION TO CAREER (CONT.)

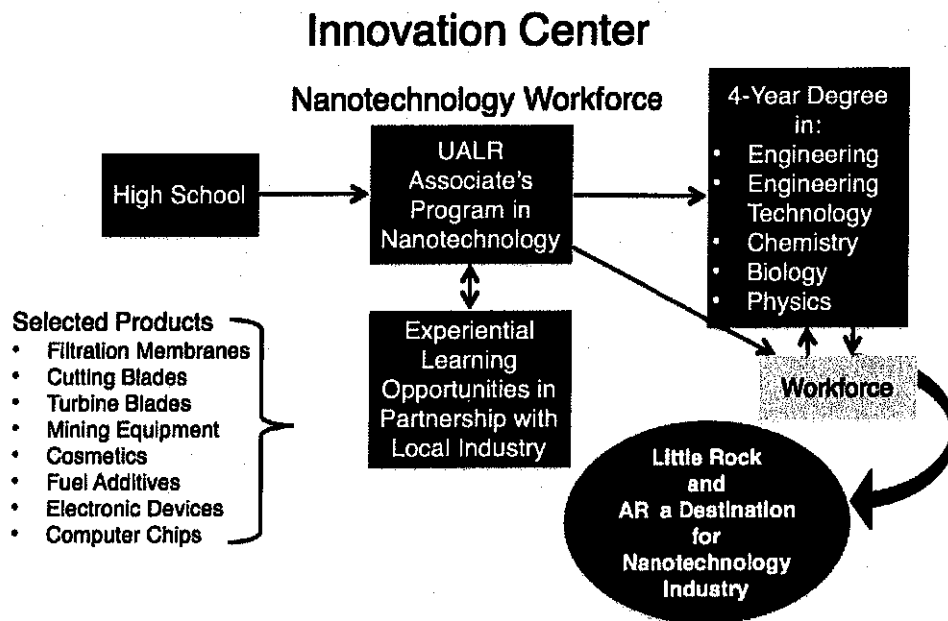


Figure 10: 13-20 + Transition to Career

BIOENGINEERING

Students will have a similar experience in the Bioengineering BS program, which will also be supported by the Innovation Center. They will complete the Associates degree upon high school graduation. By the time they graduate from college with their BS they will have completed a year of medical school or physical therapy, based on the UAMS curriculum (see Figure 11).

UALR: 13-20 + TRANSITION TO CAREER (CONT.)

Innovation Center

Bioengineers, Medical Doctors,
and Physical Therapists

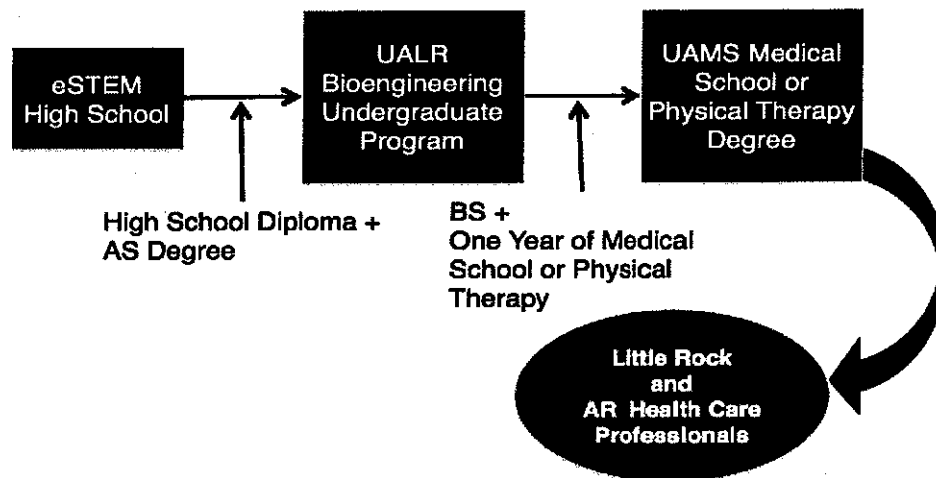


Figure 11: 13-20 + Transition to Career

ENTREPRENEURIAL EDUCATION

As part of their involvement with the Innovation Center, students will learn entrepreneurship in three ways: 1) entrepreneurship where students learn how to create a new business 2) corporate entrepreneurship which explores the innovation of products or introductions of new products or services or markets in existing areas, and 3) social entrepreneurship which is the creation of self-supporting charitable organizations. Students will take advantage of interdisciplinary courses brought together to engage faculty, students, and community members in entrepreneurship while providing the basic knowledge, skills, and resources needed to move an idea from concept to market, including all the phases associated with

the commercialization process and its economics. Courses will be offered as a part of interdisciplinary degree programs, and as electives, that use pedagogical approaches such as projects, workshops, and integrated modules.

THE UALR LEARNING COMMONS

The socio-emotional growth in college students must be understood and provided for in the spaces where they live, work and play. Chickering and Gamson's (1987) Seven Vectors of identity development in college students emphasizes the importance of providing holistic education for the students. The seven vectors illustrate a progression that many college students can relate to and provide a foundation for practitioners to better serve students. The seven vectors are as follows:

1. Intellectual, manual and interpersonal competence
2. Managing emotions
3. Movement through autonomy towards independence
4. Development of mature interpersonal relationships
5. Establishing identity
6. Developing purpose
7. Developing integrity



Figure 12: The UALR Learning Commons

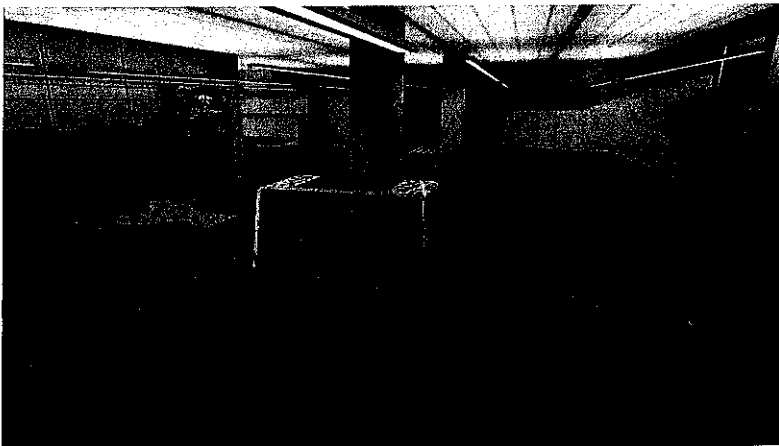


Figure 13: The UALR Learning Commons

The UALR Learning Commons provides a place for holistic student development (See figures 12 - 15). It will be a vibrant and unique place where UALR will produce graduates who are leaders, innovators, and responsible citizens, a place that demands students and faculty reflect not only on the present decade, but also on the next decade or century. This will be a place that invites collaboration and creative problem solving and helps develop the leaders of tomorrow. Today's students do not compartmentalize the social and academic sides of their lives, and the university must meet them there. By embracing a new, modern vision, UALR is doing just that. The new vision makes student success and a student-centered culture a top priority.

The UALR Learning Commons will

- Establish a space entirely devoted to helping students achieve success in their learning.
- Create a modern, welcoming, and energizing space where students can collaborate, explore, create, and learn.

With proximity to the Donaghey Student Center and the main campus walk, the UALR Learning Commons can be part of the natural flow of campus life. The space will not only be inviting and social, but it will empower students to engage with learning and to explore, create, and work in ways that fit their own needs. Students will say to their friends, "Meet me at the Commons." They will grab a coffee, print a paper, and learn how to create a YouTube video, chat with friends, find a journal article, and get advice on their next research paper — in one spot, on one day, every day.



Figure 14: The UALR Learning Commons

In many ways, the UALR Learning Commons will become the students' space, where they feel at home and encouraged and inspired to do their best work. They will see their peers in the commons and join them, building relationships and good study habits at the same time. In short, the UALR Learning Commons will be a space that is bright and inviting, flexible and engaging, supportive and instructional, full of "productive noise," activity, and traffic.

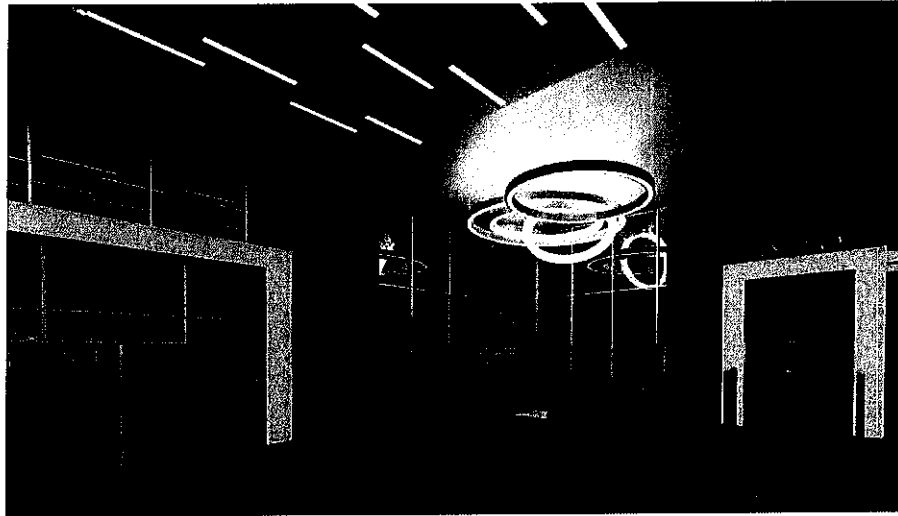


Figure 15: The UALR Learning Commons

A PLACE FOR CIVIC ENGAGEMENT

Central to the vision of UALR to become a top metropolitan community engaged research university is the design of spaces that will push the limits of creativity. UALR has the opportunity to establish unique places for civic reflection, collaboration, and problem

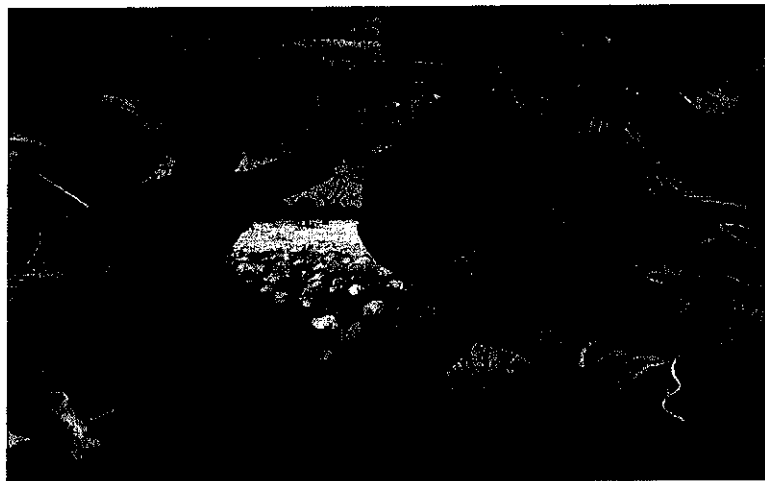


Figure 16: An Image from the Joe Jones Mural

solving by fusing two dynamic, interrelated initiatives at one location: the Institute on Race and Ethnicity and the Joe Jones Mural Exhibit (see Figure 16).

THE PLACE

The Ottenheimer Library is the geographical center of campus and the logical venue for students, faculty, and community patrons to access and use space, information, and technology. Its dramatic size, high ceilings, and multiple levels provide an excellent opportunity for redesign and repurposing.

The mezzanine floor offers the perfect location to house the offices, seminar rooms, and meeting venues for the Institute on Race and Ethnicity (IRE), its students, faculty, and community constituencies (see Figure 17). The IRE's mission is to seek racial and ethnic justice



Figure 17: Students engage in civil reflection.

in Arkansas by remembering the past, informing and engaging the present, and shaping and defining the future. The same floor provides open space into which a climate-controlled, glass-walled room could be constructed to display and protect the finished mural. The Joe Jones Mural exhibit will provide a place that demands that students and faculty reflect not only on the present decade, but also on the next decade or century. A place that invites collaboration and problem solving, the mural space would include interactive informational panels that tell the Joe Jones story as artist and social reformer as well as describe the Arkansas context in which he worked.

This newly renovated place would bring together the historic imagery and legacy of social justice struggles with contemporary interdisciplinary research, experiential learning, and community programs that continue to contribute to an improved community through civic reflection. The Place will:

- Host community and university conferences on a wide range of civic issues.
- Provide a home space for the Minor Program on Race and Ethnicity and a Certificate for Civic Reflection and Leadership.

-
- Give students and faculty access to materials and databases on interdisciplinary issues related to social, economic, and political justice concerns.
 - Offer a location to study and reflect upon the art of the early twentieth century and its historical context.
 - Afford students and faculty an opportunity to have classes in an inspirational setting that provokes reflection and discussion.
 - Attract visitors from in and out of town to view the mural.

THE IMPACT

The design of space can influence the outcome of initiatives. This place, housing the IRE and the Joe Jones Mural, makes a statement about the values UALR brings to community discussions, as well as about the interests and leadership of the students interacting within the space. Students will:

- Develop leadership capacity, increase understanding of different perspectives, and build skills in facilitation, dialogue, listening and critical thinking.
- Participate in peer learning and networking.
- Study the painting technique of the artist and the impact of historical context on inspiration.
- Interact with community and national leaders in a place that prompts thoughtful reflection.
- Participate in community building.
- Apply classroom learning to complex societal issues.
- Become productive, thoughtful citizens and inspiring leaders in their communities and professions.

TRANSITION TO CAREER

For career development, students will be working with alumni and employers that will mentor and guide them through their career options, including internships and externships. The student-faculty connection is at the forefront of the academic mission. UALR is dedicated to ensuring that the academic life of its students is a rigorous and inspiring one, offering students the opportunity to discover the world and their calling in it.

THE CAREER DEVELOPMENT CENTER

The National Association of Colleges and employers conducted a survey wherein they asked employers what they most looked for in the class of 2015 college graduates. S. Adam's 2014 Forbes article, "The Top 10 skills that Employers Most Want", indicates employers want their employees to be able to:

1. Work in a team structure
2. Make decisions and solve problems (tie)
3. Communicate verbally with people inside and outside an organization
4. Plan, organize, and prioritize work
5. Obtain and process information
6. Analyze quantitative data
7. Exhibit technical knowledge related to the job
8. Demonstrate proficiency with computer software programs
9. Create and/or edit written reports
10. Sell and influence others

Additionally, Adams (2014) noted that business, engineering and computer sciences degrees are currently the most sought after by employers. In order for these skills to be thoroughly developed by college graduation, training should be skillfully woven into the curricula. Throughout the eSTEM - UALR students' educational journey, they will engage in an interactive experience that builds skill, confidence, presence, and professionalism.

UALR plans to develop a center that will support and encourage students to participate in high impact programs that provide learning for career development. The Career Development Center (CDC) will provide access to a full range of innovative programs and resources to assist students in exploration of academic and career alternatives, investigating and preparing for professional and graduate school programs, learning job search skills and strategies and locating internships, and part-time employment and career opportunities. CDC staff members will be dedicated to meeting the unique needs of every student through all phases of their career development. The center will encourage individual personal discoveries, including those learned from a range of life experiences and the academic world. The CDC recognizes that parents also have an integral role in assisting their student in making successful academic and career decisions. For STEM students, there will be numerous opportunities to participate in internships and mentorship with UALR alumni, business, CEIT, and CALS partners as well as on-campus resources. The Career Center aims to accomplish the following goals:

-
- Assist students in their exploration of career alternatives
 - Prepare students for professional and graduate school
 - Guide students in professional development and relevant workplace skills to make them career-ready at time of graduation
 - Pair students with internships, externships, service learning, part-time employment, and career opportunities
 - Connect students with mentors and professionals
 - Introduce K-8 students to STEM professions and role models

Students will be regularly challenged, as part of required coursework, to solve problems throughout the curriculum through the NEA's Grand Challenges Program. This illustration will show how, through interactive, action-oriented learning, students will develop critical career skills.

1. STUDENTS ARE INTRODUCED TO THE GRAND CHALLENGE:

- Students explore the problem. They analyze the impact locally, regionally, nationally and globally as it relates to the economy.
- Students participate in field research trips that provide greater insight.
- Students participate in a service experience that provides hands on understanding.
- Students are exposed to how others have solved the problem and report on those solutions through a critical lens wherein they discuss the positives and negatives of the solution.

2. STUDENTS DEVELOP A SOLUTION TO THE GRAND CHALLENGE:

- How can they help create solutions for the problem?
- Students conceive an idea.
- Students create a goal.
- Students work together to create a plan.

3. STUDENTS PROPOSE THE SOLUTION

Students create a proposal/ presentation for funding or support for their idea after which they are provided a budget and parameters to create. This may be anywhere from \$100 for materials, or just space to have an event or more funding. Regardless, the students are challenged to persuade leaders (teachers, staff, and professional mentors) to believe in their idea enough to commit resources.

4. STUDENTS EXECUTE THEIR PLAN TO SOLVE THE PROBLEM

Students now have the opportunity to test their solution to see what outcomes they will receive.

The integration of the NEA's Grand Challenges Program helps create a curriculum that uses experiential learning and uniquely designed spaces, such as the Innovation Center, Learning Commons, and A Place for Civic Engagement, that are conducive to professional growth for this career development to take place by placing emphasis on developing the following critical concepts:

TEAMWORK/ COLLABORATING WITH OTHERS

When people work well together, everyone benefits. This skill is not something that should be left to chance. STEM collaborations often require team environments and one's ability to interact well with others can have a great impact on their professional career. Students will actively engage with other students to complete various assignments, projects, presentations, artistic expressions (theatre, dance), and solve problems through blending the group's ideas to achieve the best results. Through the Grand Challenges exercise illustrated above, students have to work with each other in groups to figure out the best solution to the problem. In addition, students have to learn to deal with complex personalities without losing sight of their goal.

COMPLEX PROBLEM SOLVING

Students will be challenged to critically analyze problems in order to create innovative solutions. Critical thinking skills are essential to the success of tomorrow's rising professional. While it is important to have the skills to do a job, solving problems has become a critical component of any job requirement. Exercising these skills early will not only improve students' performance on the job but also throughout their academic journey. Through Grand Challenges activities, students are faced with real-world problems and must analyze possible solutions from varying viewpoints. However, students are not just required to think about the problem, but to also create a solution. This activity allows them to bring a solution to life.

STRONG WRITTEN & VERBAL COMMUNICATION SKILLS

With the increased use of technology, writing has become an even more important skill. Email etiquette, business letter writing, memorandums, and reports are often regular requirements in the workplace. Professionals must understand how to deliver effective, persuasive written texts and execute verbally articulate presentations. Students will complete proposals that require them to make presentations in order to gain approval, obtain a budget or deliver content for a report. Through the Grand Challenges, students will have to learn how to communicate effectively with their team through formal presentations that are submitted to experts.

ORGANIZATIONAL & PRIORITIZATION SKILLS

Organization of information, spaces, and materials is important to the success of not only the individual, but also the team. Understanding how to prioritize tasks can be the difference between a mediocre employee and an excellent one. These lessons start as early as kindergarten, when students are taught and expected to keep an organized desk or play area. As students progress, they are taught more complex strategies for time management, organizing reports, and prioritizing responsibilities. This expectation increases the likelihood that these developing professionals will possess the ability to effectively organize information and prioritize tasks. The Grand Challenges will allow students to organize large amounts of diverse information from numerous sources. In addition, students will have to determine which aspect of the problem should have the most or least priority. This real-world practice allows students to improve their skills in a way that they can see a direct benefit.

DIGITAL LITERACIES

Our ability to interact with text requires technological skills that exceed the knowledge of how to use the machine. This knowledge base encompasses an understanding of what one can do in digital spaces as opposed to defaulting to print texts. Obviously computer skills are very important to developing digital literacies, but understanding the purpose of certain types of communication and responding appropriately are key to an individual's success in the modern workplace. For example, it is important to know how to read a rhetorical situation and determine when it is appropriate to request a meeting, send an email, or pick up the phone when communicating with a client. Likewise, knowledge of what software is appropriate for which tasks is determined by one's digital literacy. Students will increase their digital literacy through project based learning, including real-world situations, service learning, internships, and projects. The Grand Challenges presentation to the experts (teachers, professional mentors, etc.) will task students to determine the best methods for illustrating their idea. These digital formats vary, but the student will be expected to make the most persuasive choices for their solution. Once again, the student has the opportunity to learn from doing.

It is imperative that career development begins early. The career skills previously identified are taught as early as pre-k and continue through college graduation. For example, teamwork is taught in pre-school through working together to play a game, in junior high through team sports, and in high school through solving a complex math problem. Students will begin a structured approach to career choice as a junior in high school so that they will be better prepared to declare a college major or enter the workforce after high school

graduation. Their progression through the CDC begins in high school and continues through college graduation.

CDC FIRST YEAR: HIGH SCHOOL JUNIOR/ CONCURRENT COLLEGE FRESHMAN

In their first year students will register with the CDC and complete a check-list for planning their undergraduate education. This will allow students to explore and understand what matters most to them and to learn as much as possible about the potential majors and careers available in their fields of interest. Here students can check out career assessments, relevant career events, and opportunities. They can also look into and apply for internships. During their first year, they can explore international experiences, or take part in volunteer projects. In the first year experience course they will participate in a service-learning project.

CDC SECOND YEAR: HIGH SCHOOL SENIOR/ CONCURRENT COLLEGE SOPHOMORE

In their second year, students begin discussions with the CDC about possible majors. They may complete an assessment to confirm their decision or learn about other career paths. They will update their profile and look for events and opportunities available on campus that will give them greater insight. This is time students learn about their field of study and gather information about shadowing alumni, or conducting informational interviews with others in their field of study. The CDC offers workshops and mock interview seminars.

CDC THIRD YEAR: COLLEGE JUNIOR

During the third year, students need to narrow down their career choice and should participate in additional high impact activities; service learning courses, internships, undergraduate research projects, study abroad, or cooperative education. There are scholarships available for students wanting to explore this opportunity. Students need to update their profile, and meet with the career counselor. It is never too early to think about graduate school and attend on-campus career and graduate school fairs. This is the time students can learn about potential employers and seek out additional job site internship opportunities.

CDC FOURTH YEAR: COLLEGE SENIOR

During their senior year, students should be dedicating themselves to securing a job or gaining admission to graduate school. The CDC will assist students in their job search through their career services and employment database, and providing interviewing techniques and job seeking skills. Students will have acquired experience through their participation in the high impact activities available through the university and this will allow them to talk about their experience in job interviews. Students will have the opportunity to

attend career fairs, networking events, or explore graduate school. Students will have access to a counselor to discuss post-graduation plans or to seek out advice.

GRADUATE SCHOOL

The UALR Graduate School serves the needs of graduate students, faculty, and staff in the wide range of programs offered in the College of Arts, Letters, and Sciences; the College of Business; the College of Education and Health Professions; the Donaghey College of Engineering and Information Technology; and the College of Social Sciences and Communication. In addition to the Bowen School of Law, UALR has a strong relationship with UAMS.

For those students seeking to further their STEM education UALR offers multiple opportunities. The George W. Donaghey College of Engineering and Information Technology offers graduate degrees in Computer Science, Construction Management and Civil and Construction Engineering, Engineering Technology, Information Science and Systems Engineering. Students have the opportunity to receive funding through assistantships, fellowships and scholarships and to participate in cutting edge research in the many innovative centers on campus with well-respected research faculty.

Students interested in the hard sciences such as Biology, Chemistry, and Physics, the College of Arts, Letters and Sciences offers opportunities for graduate level research and discovery. CALS melds the classic arts and letters disciplines with science programs to expose students to an interdisciplinary approach to education. This unique approach allows students to visualize their field of study in a new way.

BENEFITS OF PROPOSED MODEL

The expansion of eSTEM at UALR will create vast opportunities for UALR faculty and the institution's growth not only in the expansion of the innovation center, but also for UALR to be seen as a leader in STEM workforce development. This opportunity for collaboration creates the possibility of a life changing experience for students in the greater Little Rock area. The proposed model, with the UALR – eSTEM partnership at the center, is exactly what the community needs to create leaders that are well prepared to have a positive impact on society through innovating ideas that advance humanity. With six of the Fortune 500 companies headquartered in Arkansas, the state will greatly benefit from the proposed model.

The benefits of the model and the UALR – eSTEM partnership include:

- **Decrease the time to college degree completion.**

Concurrent classes would allow eSTEM high school charter students to graduate with an associate's degree.

- **Close the gap between college degree attainment and career-readiness**

- **Increase STEM graduates with an emphasis on minorities and women graduates**

The development of infrastructure at UALR will attract more students to eSTEM and increase the student population. This will allow for a greater outreach of STEM education to more students in Arkansas and help to increase the number of students pursuing STEM degrees and careers.

- **Offer innovative, economically-centered STEM curricula rooted in the liberal arts**

- **Increase math and science scores in Arkansas**

- **Produce better prepared STEM teachers**

eSTEM will serve as a laboratory school (lab school) for multiple programs including Teacher Education, Educational Leadership, Counseling, Health, Nursing, Audiology and Speech Pathology, Social Work, and others. For example, Teacher Education candidates will use the lab school for both instructional innovation and internships/field placements. Teacher Education candidates will use the lab school for innovation and internships/field placements. In this way prospective teachers can be properly trained for teaching STEM.

- **Ease transition for high school students into college**

The new partnership could assist with college readiness and college enrollment. This will better prepare the students for the critical-thinking and problem solving skills required to successfully complete their degree. Consequently, the number of graduates in these STEM fields is hoped to also increase, thereby providing Arkansas employers with candidates ready to fill high-skill positions for hire.

- **Make Little Rock, Central Arkansas, and the state more attractive to technology based companies**

On a statewide basis, the workforce will benefit due to improved and increased STEM field graduates. This will produce higher quality and paying jobs. Ultimately, more jobs will become available for Arkansans, further improving the state economy. Attract local businesses and help to improve the economy in Central Arkansas. Increased population at UALR from eSTEM can promote the development of more businesses such as restaurants and entertainment centers. Also, the housing market in Central Arkansas will benefit with more faculty members moving to the area.

POTENTIAL SITE FOR THE ESTEM SCHOOLS

The corner of Fair Park and 28th Street is proposed as the site for a new building that will house 1,592 students in grades K-8. This building will occupy 115,013 gross square feet (GSF). The estimated cost of this new building is \$28,351,229.

Further, a second new building located on Campus Drive, south of Larson Hall would house four grades, 9-12, with an estimated cost of \$25,809,689, will serve 1,600 students, and would occupy 111,113 GSF.

COST SUMMARY

K-8 New Building	\$28,351,229
9-12 New Building	<u>\$25,809,689</u>
Total	\$54,160,918

BUDGET & TIMELINES

TABLE 1: COST OF PHASE I

The implementation of the full proposed model could take up to five years. Therefore, it is proposed that the project be implemented in phases. The first phase (Phase I) will involve the move of the eSTEM schools to the UALR campus. This phase should be completed for the school to start operating at the new location by Fall 2017. As described in the previous section, two new buildings for eSTEM schools are proposed. Table 1 details the associated construction costs. The budget for Phase I also includes \$5,000,000 that will be needed for UALR to implement K—12 programmatic initiatives to support eSTEM students, and \$2,500,000 for student scholarships to ease the transition to college.

Table 1: Phase I	Total Cost	eSTEM Contribution	UALR Contribution	To Be Raised
eStem Facilities	\$54,160,918	\$33,000,000	TBD	\$21,160,918
Programmatic Initiatives (K-12)	\$5,000,000			\$5,000,000
Scholarships	\$2,500,000			\$2,500,000
Total	\$61,663,918	\$33,000,000	TBD	\$28,660,918

TABLE 2. COST OF PHASE II

The construction of the Innovation Center will be a part of Phase II as well as the implementation of programmatic initiatives to build the pipeline of eSTEM students, and scholarship funds. The additional programmatic initiatives for career development will be a part of Phase II. The complete budget for Phase II is presented in Table II and this phase should be completed by Fall 2018.

Table 2: Phase II	Total Cost	To Be Raised
Innovation Center	\$8,000,000	\$8,000,000
Programmatic Initiatives (P-K)	\$5,000,000	\$5,000,000
Scholarships	\$2,500,000	\$2,500,000
Total	\$15,500,000	\$15,500,000

TABLE 3. COST OF PHASE III.

Converting the Ottenheimer Library into the Learning Commons is a part of Phase III. Programmatic initiatives associated with 13-20 will support the career development of undergraduate and graduate students. The Career Development Center will be enhanced in this phase, and additional funds will be raised for student scholarships. Table 3 includes the budget specifications for this phase.

Table 3: Phase III	Total Cost	To Be Raised
Learning Commons	\$5,700,000	\$5,700,000
Programmatic Initiatives (13-20)	\$4,000,000	\$4,000,000
Scholarships	\$2,500,000	\$2,500,000
Total	\$12,200,000	\$24,400,000

TABLE 4. COST OF PHASE IV.

This phase includes the construction of The Place For Civic Engagement along with additional programmatic initiatives and student scholarships that will benefit undergraduate and graduate students. Table 4 includes the budget specifications for this phase. The expected completion date will be Fall 2020.

Table 4: Phase IV	Total Cost	To Be Raised
A Place for Civic Engagement	\$4,000,000.00	\$4,000,000.00
Programmatic Initiatives (13-20)	\$3,000,000.00	\$3,000,000.00
Scholarships	\$2,500,000.00	\$2,500,000.00
Total	\$9,500,000.00	\$9,500,000.00

TABLE 5. GRAND TOTAL

Table 5 presents the grand totals for the implementation of the proposed model.

Table 5: Grand Total	Total Cost	eSTEM Contribution	UALR Contribution	To Be Raised
Project Total Cost	\$98,860,918	\$33,000,000	TBD	\$65,860,918

SUSTAINABILITY PLAN

University of Arkansas at Little Rock is fully committed to work alongside eSTEM to ensure funding for a long-term self-sustaining collaboration. This funding will come from state funding, donations from private foundations, and external funding via federal agencies.

STATE FUNDING

eSTEM will continue to seek funding from the State of Arkansas. The funding will be based on the number of students enrolled at eSTEM and the funding mechanism for charter schools. The state offers \$6,250/student for public schools.

INDIVIDUAL DONORS

The institutions will seek donations from individuals who are excited about this model and the programmatic goals. The identification of these individuals will be a collaborative effort with UALR's Office of Development.

DONATIONS FROM PRIVATE FOUNDATIONS

The two partners will target private foundations that have a history of supporting STEM education, workforce development, and economic development. Some examples include The Rockefeller Foundation, The Kaufman Foundation in Kansas City, and The Alfred Sloan Foundation.

EXTERNAL FUNDING

The partners will also seek funding from various agencies at the federal level. In order to successfully apply for funding support, the grant goals must meet the mission of the funding agency. STEM education and research have been a major focus in recent years and federal agencies such as the Department of Education, National Science Foundation, Department of Defense, Environmental Protection Agency, NASA, National Institutes of Health, and Department of Energy provide funding in different categories.

CONCLUSION

The proposed model and UALR – eSTEM partnership is an innovative plan that will serve as a blueprint for other institutions who wish to infuse STEM throughout the curriculum and close the gaps that exist in the K-career pipeline. Specifically, this joint venture will benefit the students, the institutions, and the state.

1. The partnership between UALR and eSTEM will allow students to receive enhanced educational experiences that focus on engagement with college faculty, staff, and mentors; the curriculum will “integrate five educational elements: (1) a hands-on research or design project connected to the Grand Challenges; (2) real-world, interdisciplinary experiential learning with clients and mentors; (3) entrepreneurship and innovation experiences; (4) global and cross-cultural perspectives; and (5) service-learning” (NAE, 2015).

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2. The proposed model is transferrable and can be implemented across disciplines. Innovations, such as the Career Development Center will benefit all UALR students and will provide a bridge to a rewarding career.
 3. eSTEM and UALR will benefit from shared resources and an increased student population. Shared space and student services will increase efficiencies for each and allow for a seamless experience for the student.
 4. The state of Arkansas will see an increase in career-ready, STEM graduates who are prepared to make an immediate impact. These highly sought after graduates will attract more technology-based companies that provide higher salaries and benefits to employees.

Ultimately, the proposed model and partnership is a win for all involved and will leave a lasting and measurable impact on the state and its citizens. It will help address the educational gap that Arkansas has long faced, and be a catalyst for new ideas and innovations.

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College-going rates of high school graduates - directly from high school:

<http://www.higheredinfo.org/dbrowser/?year=2010&level=nation&mode=data&state=0&submeasure=63>

APPENDIX A

eSTEM Public Charter School in Little Rock, AR

School website: <https://www.estemlr.net/index.html>

CEO/Principal John Bacon

Principal email: jbacon@estemlr.net

Principal phone: (501) 748-9335

What is eSTEM Charter School?

eStem Public Charter Schools, Inc., is a non-profit charter school management organization dedicated to improving public education in Arkansas. eStem established eStem Elementary Public Charter School, eStem Middle Public Charter School, and eStem High Public Charter School in downtown Little Rock under a five year charter granted by the Arkansas State Board of Education in December 2007. All three schools are open enrollment, publicly funded schools, meaning that any school aged child in Arkansas is eligible to attend. All eStem schools are tuition free.

eSTEM History

eStem Public Charter Schools, Inc., is a non-profit charter school management organization (CMO) dedicated to improving public education in Arkansas. eStem Public Charter Schools established eStem Elementary Public Charter School, eStem Middle Public Charter School, and eStem High Public Charter School in downtown Little Rock for the 2008-2009 school year under three separate five-year charters granted by the Arkansas State Board of Education in December 2007. Each school is an open-enrollment public charter school meaning it is open to any student residing in Arkansas. The charters cap enrollment in the three schools at 856 students, making eStem larger than nearly half of the public school districts in Arkansas. eStem is the only CMO currently operating in Arkansas.

In our first school year, eStem Public Charter Schools is taking on the challenge of preparing tomorrow's workers and leaders in today's schools by equipping students with the skills they will need in the 21st century.

Only eStem provides:

- a challenging instructional program
- interactive teaching/engaged learning
- a longer school day

-
- an extended school year
 - competent teachers
 - teacher pay for performance program
 - strong school leadership

Our promise to students, parents and our community is that eStem graduates will be *College Ready, Career Ready, World Ready*.

The school website includes the following tabs.

Some of the information that follows about eSTEM is contained within these tabs.

- About
- Schools: Elementary, Middle, High
- Parents: Handbooks, Calendars, Menus
- Apply
- State Required Information
- News
- Contact Us
- Home
- School website: <https://www.estemlr.net/index.html>

Performance Results found on the school website, under the Parent tab

Academic performance was last posted for the 2008-2009 academic year.

<https://www.estemlr.net/parents/results>

Excerpt: The focus at the eStem schools is on **academic growth for every student**. This means that the academic progress of each student is assessed regularly during the school year. eStem uses academic assessment tests provided by the Northwest Evaluation Association (NWEA). These tests are matched to the standards set by the Arkansas Department of Education and are administered quarterly. eStem teachers use the results to adapt their instruction to meet a student's academic needs. Assessment results also are shared with parents during regularly scheduled conferences.

eStem students also will be taking annual Arkansas Benchmark exams which will be administered in April of this year. Those results will be posted here when they are available. Teachers report student progress in the classroom every week through the Edline program. Using Edline, parents can go online to view classroom test grades, student homework assignments and other classroom information.

The eStem Schools Mission & Vision

Mission

Our mission is to develop students who are critical thinkers, problem solvers and collaborative members of a learning community and society. We will encourage students to be risk takers and enthusiastic life-long learners who are versed in engineering, science, technology, economics, math and literacy.

Vision

We recognize that all learners require individualized, differentiated, high level instruction. We will provide data driven, rigorous instruction that holds all learners to high expectations. We will create a learning environment where all students feel safe to take risks, collaborate and problem solve.

The eStem Charter Management Organization

Our Reason for Being

The eStem Charter Management Organization (CMO) recognizes that quality educational opportunities for all families in central Arkansas will enable students to compete and excel, both nationally and internationally. By raising the bar among all educational providers in central Arkansas through competition, students will leave high school "college ready," and the state and region will be able to attract, retain and sustain increasingly strong economic growth and vitality.

The eStem CMO also recognizes that quality educational choice is available for some families in the area, but not for others. Families of more affluence do have choices by simply choosing to buy houses in neighborhoods that are zoned for high performing schools, or pay tuition and place their children in private, high-quality schools.

For families residing in neighborhoods that offer housing to meet their struggling financial situations, however, neither of these is an option in many instances. They are often forced to send their children to the districts lowest performing schools, which not only deprive these children of quality educational opportunities, but continues to feed the generational cycle of poverty and missed opportunity for students who might have tremendous potential. With the belief that all children can and will learn at high levels "with high standards and a rigorous curriculum," there are three alternatives for these students. eStem Elementary Public Charter School (K-4), eStem Middle Public Charter School (5-8) and eStem High Public

Charter School (9-12) which are separate charter schools with a combined goal of teaching Science, Technology, Engineering, and Mathematics, infusing the principles of economics in public charter schools for underserved families in central Arkansas public schools. These schools will provide proof that all children, regardless of background or circumstance, can and will succeed in a rigorous educational setting.

With these core beliefs guiding everything we do, we offer the following Mission Statement: The eStem Charter Management Organization will offer assistance to all charter schools in developing a different and rigorous curriculum in a disciplined environment and to use the latest educational techniques, with the ultimate goal to attain the highest performing schools based on improvement in individual student achievement.

What Our Mission Entails

The eStem Charter Management Organization will work with all charter schools to offer these services. The schools will offer a choice for all students in central Arkansas, including students from families who would not be able to afford private schools or homes in attendance zones of higher performing public schools.

The schools plan to compete for students, for teachers, for administrators, and for private funding with both private and other public schools. They will use the latest educational techniques, such as longitudinal tracking, to measure improvements for each individual student from quarter to quarter and year to year. Their student's performance will be compared with other students throughout the United States, and the schools will make these results available and transparent for families and the community to see. The ultimate goal is to have the highest performing schools in Arkansas based on improvement in individual student achievement from year to year.

The eStem Public Charter Schools Are Unique in the Little Rock Region

eStem Elementary Public Charter School is the introductory school for the study of economics related to the fields of science, technology, engineering and math (STEM) for students in kindergarten through fourth grade. eStem Middle Public Charter School and eStem High Public Charter School advance the study of the STEM curriculum and its relationship to economics. eStem Middle serves students in fifth through eighth grade. eStem High initially serves ninth grade students with an additional grade being added each year. While each school operates independently under the umbrella of the eStem CMO, the curriculum is designed to flow smoothly from kindergarten through 12th grade.

The eStem Public Charter Schools Are Not Your Ordinary Public Schools

The eStem public charter schools differ from traditional public schools in a number of ways. The eStem public charter schools use a longer school year, an extended school day and a highly focused curriculum to improve the academic success of individual students. If students are successful, teachers and staff are financially rewarded through the eStem pay for performance plan. Students, parents, teachers and administrators are required to sign the eStem Learning Compact which outlines the code of conduct and the role each plays in bringing about improved individual student academic achievement.

The Five-Point Difference from Traditional Public Schools

The eStem public charter schools use challenging instruction in a safe and structured school environment to focus on individual student academic growth.

- 1. Achievement** Student learning and achievement is our core business. Teachers are focused on individual student academic growth. An ongoing assessment program enables teachers to evaluate a student progress.
- 2. Discipline** The best learning takes place in a safe and orderly school environment. eStem students adhere to a dress code and are required to sign a learning compact in which they agree to behave in a manner conducive to learning.
- 3. Efficiency** The eStem CMO and its staff provide all of the back office services for the eStem schools. The schools enjoy strong academic leadership focused on student achievement without the burden of a large, expensive bureaucracy.
- 4. Professionalism** Every eStem teacher teaching a core curriculum subject is certified by the state of Arkansas to teach that subject. Seven percent of eStem full-time teachers have received certification from the National Board for Professional Teaching Standards, a rigorous measure of teaching skills. In addition, nearly half of eStem full-time teachers hold a master's degree.
- 5. Service** eStem public charter schools are schools of choice. Unhappy customers will choose to take their business elsewhere. eStem is operated like every successful business satisfied customers mean growth. Success means competition which makes organizations better.

Charter School FAQ

What is a charter school? A charter school is a form of public school that is free from most of the restrictive laws that govern traditional public schools. This allows a charter schools more flexibility to implement creative and innovative programs and policies. In return for this freedom, a charter school is held more accountable for student success. Funded like other

public schools, a charter school operates under a contract detailing the school's mission, program, goals, students served, methods of assessment, and ways to measure success.

Who operates the three eStem public charter schools? The eStem schools are operated by eStem Public Charter Schools, Inc., a non-profit charter school management organization (CMO), dedicated to improving public education in the state of Arkansas. eStem Elementary Public Charter School, eStem Middle Public Charter School, and eStem High Public Charter School opened in downtown Little Rock for the 2008-2009 school year under three separate charters granted by the Arkansas State Board of Education in December 2007. eStem is the only CMO currently operating in Arkansas.

How are the eStem schools funded? The three eStem schools are funded with public money appropriated by the Arkansas Legislature just as any other public school. In addition, the eStem schools rely on gifts and grants from private and philanthropic organizations and funds received from the federal government.

Are the eStem schools held accountable for use of the public funds? Yes. eStem and all other open-enrollment charter schools are audited in the same manner as traditional public schools. All financial and student data is reported through the Arkansas Public School Computer Network in the same way as public schools.

Who attends the eStem public charter schools? eStem currently has 1,227 students enrolled throughout all three schools. When eStem first opened its doors, more than 2,300 student applications were received and eStem currently maintains a waiting list of more than 3,000. On average, 38 percent of eStem students qualify for the National School Lunch program. In addition, eStem serves hot lunches to 400 students daily and hot breakfasts to 100 students daily. Approximately 100 eStem students use Central Arkansas Transportation buses to and from school daily with a student pass provided at no cost to them by their schools.

Who teaches eStem students? All of eStem's teachers who are teaching a core subject class are certified by the state of Arkansas to teach that subject. Seven percent of eStem full-time teachers have received certification from the National Board for Professional Teaching Standards, a rigorous measure of teaching skills. In addition, nearly half of eStem full-time teachers hold a master degree. Resumes of 250 teachers who have applied for a position at eStem remain on file.

Are the eStem schools really different than traditional public schools? Yes, in a number of ways. The eStem public charter schools use a longer school year, an extended school day and a highly focused curriculum to improve the academic success of individual students. If students are successful, teachers and staff are financially rewarded through the eStem pay for performance plan. Students, parents, teachers and administrators are required to sign the eStem Learning Compact which outlines the code of conduct and the role each plays in bringing about improved individual student academic achievement.

Are the eStem schools held accountable for student performance? Yes. The three eStem schools measure student academic performance through periodic assessments provided by the Northwest Evaluation Association (NWEA). These assessments are aligned to the student standards set by the state of Arkansas and are administered quarterly. The NWEA results enable teachers to adapt their instruction to meet a student needs. Assessment information is shared with parents during regularly scheduled conferences. In addition, eStem students, along with all students enrolled in traditional public schools, take the annual Arkansas Benchmark exams. Teachers report student progress weekly through the Edline program, which parents access online for test results, student homework assignments and other classroom information.

How long have charter schools been around? In the 1970s an educator in New England proposed giving small groups of teacher's contracts to allow for innovative teaching strategies to be put in place. In the early 1980s schools in Philadelphia began creating schools within schools and called them charters. Minnesota refined the idea, passing a charter school law in 1991. Arkansas passed a charter school law in 1995 and revised it in 1999. As a result of the legislative revision, the State Board of Education approved four charter schools to open in the fall of 2000. Arkansas currently has 27 charter schools operating.

Are there different types of charter schools? Yes. In Arkansas there are two types. A conversion charter school is a public school that is converted to a charter school. Conversion charters can only serve students from within the school district's boundaries. The eStem schools are the second type of charter school: an open-enrollment charter school. Open-enrollment charters are public schools that have not been established by a school district. Open-enrollment charter schools can serve students from across district boundaries.

Who can start a charter school? Arkansas law establishes the eligible entities as a public institution of higher education, a private nonsectarian institution of higher education, a

governmental entity, or an organization that is nonsectarian in its program, admission policies, employment practices and operations, and is exempt from taxation under Section 501(c)(3) of the IRS. eStem Public Charter Schools, Inc., falls into that final category.

Who can grant a school a charter? In Arkansas, only the State Board of Education can grant a charter.

Can a private school become a charter school? No private or parochial school in existence on July 30, 1999 is eligible to become an open-enrollment charter school. In addition, private and parochial schools are not eligible for conversion charter school status.

Can a charter school be affiliated with a church? A charter school cannot be sectarian in its practices. Although it is allowable under the law for a charter school to be housed in a church owned facility, the facility must be free from religious symbols and the charter school must have exclusive use of the facility during school hours. A church is not an eligible entity to sponsor a charter school.

(Some information provided by the Arkansas Department of Education)

APPENDIX B



UALR's Center for Integrative Nanotechnology Sciences (UALR-CINS) is a research unit that plays an integral role in the university's mission. UALR-CINS has produced a strong record of research discoveries since its establishment in 2006, generating over 200 publications to date. It has extensive collaborations with Arkansas, national and international partners in academia, government, and industry. UALR-CINS offers students hands-on laboratory research experiences that contribute to their academic success as they complete undergraduate and graduate degrees, produce a record of scholarly publications and conference presentations, and participate in research that generates invention disclosures. UALR intellectual property that UALR-CINS generates is available for license to companies to further develop and market to solve real-world challenges. UALR-CINS is actively engaged with the community via a variety of outreach activities; examples of community engagement include mentoring of high school students for science fair competitions, laboratory tours for K-12 students, and participation in science museum outreach events for the general public.

UALR-CINS' current research agenda focuses on the intersection of nanotechnology-based materials science with medicine/biology, engineering, materials science and chemistry. Uses of nanomaterials being explored include:

- Synthesis and study of multifunctional nanosystems
- Tissue engineering – with a focus on bone and nerve regeneration
- Cancer – detection and treatment using various complex nanomaterials
- Toxicity evaluation – focus on standards development
- Sensors – biochemical / biomolecular detection,
- Coatings – multifunctional structures for military and civilian aviation, aerospace, photovoltaics, transportation

UALR-CINS has received significant external (federal, state, small business innovation research) funding to support its scientific investigations. The center's work is made possible

by an outstanding pool of scientific instruments, many of them obtained with the State of Arkansas funds that established the center. The instrumentation infrastructure has supported research benefitting academic and industrial collaborators within CINS, UALR, the State of Arkansas and the nation. CINS has helped 20 companies that have either used UALR-CINS' instrumentation services or sponsored joint research projects.

UALR-CINS research discoveries have led to 21 patents and another 16 patent applications that are pending. UALR has licensed some of the intellectual property portfolio to start-up companies based in Arkansas. Two more recent spin-off companies that are current licensees of UALR-CINS discoveries are PolyAdaptive LLC and NuShores Biosciences LLC. PolyAdaptive is commercializing technologies in the area of dust mitigation, solar energy, and surface science with funding from NASA and DoT (SBIR awards) as well as Arkansas Science and Technology Authority and Arkansas Development Finance Authority. NuShores Biosciences is working to further develop and commercialize discoveries relating to tissue engineering and cancer detection/treatment. Both companies are in discussions with major corporations and/or medical universities who offer substantive collaborations to advance their licensed technologies.

High school students have achieved significant results in science fair awards at various competitive levels. During the 2014-2015 academic year, 7 students working with UALR-CINS' mentors have received 30 regional and state awards; some students will compete in the Intel International Science and Engineering Fair 2015 in May. Undergraduate research assistants are enrolled in various UALR academic programs, seeking degrees in engineering, biology, chemistry or physics. Several of them have been accepted to medical universities or have entered doctoral programs at other universities in the country. A total of 23 graduate students have completed degrees or are in the process of doing so while working in UALR-CINS. Two graduates are recipients of postdoctoral research fellowships in national laboratories in the U.S.

APPENDIX C

The Emerging Analytics Center at the University of Arkansas Little Rock

Carolina Cruz-Neira, Director

HIGHLIGHTS

The Emerging Analytics Center (EAC) at the University of Arkansas Little Rock is a new research center focused on applied research in visualization for a wide range of disciplines. The center has a strong multi-disciplinary base of faculty, researchers and students addressing a diversity of challenges through the application of virtual reality, mixed reality and visualization. One of the unique aspects of EAC is that it acts as a "knowledge-broker" between faculty expertise and industry and government R&D needs. EAC has a core group of 12 faculty members, but it also draws faculty from the entire campus as needed for each project opportunity.

As a consequence, another unique aspect of EAC is its ability to perform highly multi-disciplinary research towards the design, development, and deployment of applied research products to be utilized outside the research community and integrated into industry workflows. EAC is a focus of expertise as well as a focus of technology transfer. Research results are disseminated through traditional venues such as publications as well as through Open Source products and an expertly-trained workforce targeting specific industry segments.

INTRODUCTION

The Emerging Analytics Center at the University of Arkansas Little Rock is a new research center created in 2013 with the support of a \$5 Million grant from the George W. Donaghey Foundation. EAC's roots are set in the growing need of innovative interactive visualization tools for big data analysis. Its main mission is to be a focus of expertise and technology in the areas of immersive and interactive visualization applied to practical problems in industry, government, and research organizations.

To fulfill this mission, the UALR EAC houses a complete suite of technological resources including a 26-projector CAVE immersive visualization system, a 25-foot diameter stereoscopic dome, two Oculus Rift helmets, two Virtuix Omni treadmills (delivered summer 2015), a large touchable table and reconfigurable wall, several auto-stereo tablets and

mobile devices, several ground and air drones, and many other "gadgets." The EAC also has High- Performance Computing capabilities, having direct access to a 512-core system and to a 4TB, 80-processor system, both located at the UALR Computational Research Center. Furthermore, EAC is connected to the nation's high-speed fiber optic backbone with four dedicated 10Gb lines. This entire infrastructure provides EAC, its collaborators, and its partners with a rich and diverse environment covering the entire technology spectrum for modeling, simulation and visualization ranging from one-of-a-kind large scale systems to commodity field-deployable devices.

At the time of writing this document, EAC is going through a significant expansion phase with the addition of Dr. Carolina Cruz-Neira as its first director, and her research team, formerly at the University of Louisiana at Lafayette, also being relocated to Little Rock, and the addition of over 2,000 sq. ft. of new development lab space. The expansion increases EAC's people to a team of over twenty people with room to grow up to 40 people in the next 3 to 5 years. The operation of EAC is partially supported through internal University of Arkansas funds, but most of its self-sustainability and personnel increase depends on the generation of externally Figure 1: Physicians discussing surgical procedure in the CAVE.

PROJECT HIGHLIGHTS

The EAC is a new center and it is currently developing a set of exciting projects and partnerships with a number of local, regional, and national collaborators. All these partnerships are rooted in the EAC's expertise on investigating and developing interactive visualizations for large, complex, and unique data. Below there are some highlights of projects currently underway:

Power Grid Analysis and Visualization: The EAC is joining the power grid community as an applied research player and partner bringing an extensive focus on multidisciplinary collaboration among academic research, government labs, and industry needs. The EAC leverages its expertise on immersive visualization, analytics modeling, human-computer interaction, and emerging visualization technologies with the critical data-related challenges facing all segments of the USA power grid infrastructure. The EAC brings a holistic approach to the understanding and analysis of the grid by looking at the grid as a whole embedded in its operational context. The EAC's research integrates our recent work on innovative visualization paradigms with current models, and best practices for the analysis of the grid targeted to the diverse stakeholders and decision makers involved in the short- and long-term management of the grid.

Collaborators: Southwest PowerPool and University of Arkansas in Fayetteville. Pending proposal submitted to the DoE for \$2.5 Mil (December 2014)

Training Healthcare Professionals: The University of Arkansas has a Medical Science campus located also in Little Rock, which has enabled EAC to work on the development of exciting and creative collaborations with faculty in both campuses. One of these collaborations is leading to the development of a set of visual training tools targeted to practicing physicians. One of the concerns expressed by our faculty physicians is how to train seasoned physicians on new surgical techniques and procedures. Although these physicians are highly skilled they still need training in order to perform these new procedures. But, at the same time, since they have an established practice, they need to be able to train with a minimal impact on their regular schedule with patients. We are starting to explore the use of advanced mobile devices, such as our autostereo tablets as the platform for the training tools, combined with Virtual and augmented reality techniques for a hands-on training environment.

Collaborators: University of Arkansas Medical Center. Developing a seed grant proposal for about \$200K to the Blue Cross/Blue Shield Foundation (proposal invited by chairman of the board)

Understanding the Power of Social Media: Part of EAC's mission is to support the economic development of the region. As part of that mission, we are starting a set of new projects investigating three-dimensional visualization paradigms to understand social media and how it can be analyzed to help small and medium companies to improve their businesses.

Collaborators: Other faculty members at UALR. We are exploring the development of a proposal to the NSF Big Data program.

Improving Visual Quality of Virtual Environments: EAC's research team is very interested on improving the visual quality of virtual environments. To that end we have developed a GPU-based interactive Ray Tracing software framework for our virtual reality systems. We have also incorporated the ability to render omnidirectional stereo as well as spherical display capabilities, such as Domes. Our real-time ray tracer has recently won the Sikorsky Entrepreneurial Challenge as it has the potential to change how rotary wing simulators are built. We are now extending the framework to support cluster-based rendering to drive our CAVE system.

Collaborators: Micoy Corp & Sikorsky. Pending proposal for \$5Mil submitted to a venture capital firm to spin-off a company to commercialize results. Preliminary letter of intent to fund from venture capital firm obtained March 2015.

On its first year of this effort, the EAC has been able to provide scholarships to UALR to six freshmen students and to offer a graduate scholarship to a talented STEM academy alumnus that was considering leaving UALR for his graduate work. These students, although undergraduate, they are involved in research activities with the same level of responsibility as graduate students. Accordingly, they are mentored in research including developing contributions to the scientific community in the form of publications and presentations. Several of them have already had the opportunity to present their findings at international conferences. The EAC is committed to grow this effort and expand it to more academies in the State and also to support a wider range of academic programs with its increasing number of faculty involvement. At the same time, the EAC is recruiting internationally talented graduate PhD candidates to lead the work in the projects mentioned above.

On the long-term, the EAC plans to have a seamless pipeline of students focused on research aligned with their academic interest starting at the freshmen level with the hopes they will stay at UALR until they complete their graduate work and have develop a strong portfolio and name recognition. As part of this plan, we are also involving local and regional industry, such as Walmart, Southwest Power Pool, Tyson Foods and others to fund the EAC scholarships, so students perform research on topics of interest for these industries and therefore become a highly trained work force on the latest technology trends. This is also a novel strategy for tech-transfer with potential for high impact on the local economy by providing local workforce trained specifically for our community.

DISCUSSION

EAC is a new exciting research initiative that is growing rapidly to become a strong player in the research areas of virtual and mixed reality. The applied research focus and multidisciplinary teams of faculty, researchers, and student opens a wide range of opportunities to tackle interesting research challenges and to deploy new tools to be shared and used to support and expand the use of virtual reality technologies.