Alabama EPSCoR RII3

Diversity, Education, Outreach and Cross-Cutting Initiatives

Dr. Karen Boykin
AL EPSCoR
Research Education Outreach Coordinator
AEOI as Part of RII-3

ALEPSCoR Education Outreach Initiative (AEOI)

• AEOI Purpose:
  Ensure RII3 Complies with NSF Broader Impact Requirements Efficiently!

• AEOI Functions to:
  – Coordinate Management of Broader Impact Activities
  – Consolidate Broader Impact Data and Perform Research
  – Develop and Maintain Clearinghouse

• AEOI Participants:
  – Coordinator: Dr. Karen Boykin, UA
  – Assisted by: Dr. Jim Gleason, Dr. Aaron Kuntz, Dr. Sam Evers
  – Institutional Activities: Dr. Shaik Jeelani (TU), Dr. Vasily Prokorov (USA), and Dr. Zhigang Xiao (AAMU)
## Broader Impact Activities

<table>
<thead>
<tr>
<th>RII3 Proposed AEOI Components</th>
<th>Budget</th>
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<tbody>
<tr>
<td>1. Diversity Component (Tuskegee)</td>
<td>$138,800</td>
</tr>
<tr>
<td>1a. REUs, RETs, REHs</td>
<td>$118,300</td>
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<tr>
<td>1b. Science on Saturdays</td>
<td>$10,500</td>
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<tr>
<td>1c. Grad Student Workshop</td>
<td>$10,000</td>
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<tr>
<td>1d. EPSCoR Open House</td>
<td>$10,000</td>
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<tr>
<td>2. Math Science Circles (U. South Alabama)</td>
<td>$60,000</td>
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<td>3. AAMU EMAP (AAMU)</td>
<td>$25,000</td>
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<tr>
<td>4. Coordination, Research, Clearinghouse (UA)</td>
<td>$76,200</td>
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Strategic Plan

- Promote STEM educational and outreach programs and curricula relevant to nano/bio science and sensors.
- Identify and recruit students to STEM education and research fields.
- Utilizing available human and institutional resources in pursuit of the project’s science and technology plans, including institutional, disciplinary, and demographic/individual diversity.
- Determine reasons why students do not enter Nano/Bio and Sensor STEM fields, leveraging additional NSF funding.
- Conduct workshops, conferences and seminars.
- Dissemination of broader impact component.

ALSO Available to...
- Assist with Integrating Centers with Other Centers (e.g., Partnering)
Diversity Component

• Initial Research Shows:
  – Not Adequately Reaching Certain Groups
    • Women, Native Americans, Hispanics
    • Disabled Populations
  – Doing Well Reaching African American Groups
Diversity Component

• REUs, RETs, REHs
• Recruitment Tools for Centers
  Coordinator: Dr. Shaik Jeelani, TU
  • Assisted by: Dr. Albert Russell and Dr. Melissa Reeves
  • To work with Centers and LSAMP Campus Coordinators
  • Responsibility of TU, assisted by UA AEOI team and RII Centers
• Starts Summer 2009
• Participant Identification NOW
• Based on 7 Campuses

<table>
<thead>
<tr>
<th></th>
<th>REH Program:</th>
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<tbody>
<tr>
<td>21 Students @ $1,000 ea. – 2 weeks</td>
<td>$500 stipends, $100 travel, $400 research supplies</td>
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<tr>
<td>REU Program:</td>
<td>21 Students @4,300 each – 8 weeks</td>
</tr>
<tr>
<td></td>
<td>$3,000 stipends, $100 travel, $1,200 research supplies</td>
</tr>
<tr>
<td>RET Program:</td>
<td>7 Teachers @1,000 each – 2 weeks</td>
</tr>
<tr>
<td></td>
<td>$800 stipends, $200 supplies</td>
</tr>
</tbody>
</table>
Diversity Component

- **REU and REH Goals:**
  - Introduce minority students to RII-3 labs.
  - Target nano /bio programs at 4 YR & 2 YR institutions.

- **Milestones/Objectives:**
  - LSAMP campus coordinators to ID students and ensure Center fit
  - Nano/bio programs to ID students

- **Metrics/Deliverables:**
  - Participation numbers, demographics, institutional diversity, geographic diversity.
  - Track did student enter nano/bio & graduate, was graduation in STEM field, particularly nano or bio.
  - Perform post graduate surveys for career choices.
  - Did researchers find these REUs/REHs useful or burdensome?
Diversity Component

• REH Issues Discussed:
  – Supervision Important
  – Placing Graduate Student in charge
  – Restrictions on leaving campus
  – Suggest REH paired with Teacher
  – Follow TEA program model
  – LSAMP campus coordinator to be responsible for students
  – If centers did not believe high school students appropriate, look at involving other related nano or bio groups
Diversity Component

• **RET Goals:**
  - Excite teachers about nano/bio/sensors
  - Identify areas for BRIDGING.
  - Target minority RETs first.

• **Milestones/Objectives:**
  - Bring teachers from HSs, CCs, and 4 year institutions to RII-3 centers for summer experiences.
  - Work with RETs from nano, bio, sensor programs around the state to ID teacher and student participants.
  - Work with LSAMP coordinators to ID RET participants.
  - Work with AMSTI representatives to ID RET participants willing to work with AEOI to determine skill sets of concern.
  - Pair RETs where possible with their own students (REUs or REHs) for material understanding and responsibility.
  - Develop joint publications with RII-3 centers and AEOI.

• **Metrics/Deliverables:**
  - Ask to provide a short evaluation as a team of RETs (identify where possible “pipeline/feeder” teacher opportunities)
  - Call 6 months later and ask to provide thoughts on class impact after returns.
  - Qualitative evaluation.
  - Ask researchers if they found this helpful or burdensome.
Diversity Component

• Science on Saturdays
  – Motivational Tools for Nano/Bio/Sensors
  – Current Program Chemistry Focus
  – Needs addition of Nano/Bio/Sensors student concepts
  – Coordinator: Dr. Shaik Jeelani, TU
    • Assisted by: Dr. Pam Leggett Robinson
    • To work with Centers and LSAMP Campus Coordinators
    • Responsibility of TU, assisted by UA AEOI team and RII Centers
  – Currently Operated at TU
  – RII-3 Grad Students from centers to work on a nano/bio/sensors related presentation for elementary or middle school presentation.
  – Grad students to help with presentation.

• SoS Program:
  • 10 Activities per year
  • SoS to Rotate Campuses
  • Co-Hosted w/ RII Centers
  • Encourage in Rural Areas
  • $1,050 /activity = $10,500
    • Travel to site: $300
    • Materials = $750

Dr. Pam Leggett Robinson: Contact: ?
Diversity Component

• Science on Saturdays Goals:
  – Excite teachers and students about nano/bio/sensors
  – Provide broader science to capture more STEM interest
  – Serve as a tool for AMSTI teachers.
  – Serve to reach minority students and teachers.

• Milestones/Objectives:
  – Generate basic exciting and easy to understand concepts.
  – Work with national NSF and other groups for ideas.
  – Work with AMSTI to publicize upcoming events.
  – Work with LSAMP CCs to identify students and teachers.

• Metrics/Deliverables:
  – Measure attendance.
  – Take quick science surveys of attendees.
  – Teacher/parent content survey.
  – Obtain info on attendee demographics as possible.
  – Capture institutional and geographic diversity info.
  – Number grad students assisting & materials developed
Diversity Component

• Graduate Student Workshop
  – Recruitment Tool to identify future Nano/Bio/Sensors Grad Students
  – Coordinator: Dr. Shaik Jeelani, TU
    • Assisted by: Ms. Sharee Smalls
    • To work with Centers and LSAMP Campus Coordinators
    • Responsibility of TU, assisted by UA AEOI and RII Centers
  – Encouraging TU to Host Year 1
  – To showcase for nano/bio/sensors programs and ideas.
  – If difficult to identify students to attend, suggestion consider using funds for publicity efforts, e.g., developing a TV commercial or program.
  – Could combine with other events/meetings.

• Grad Student Workshop:
  • 1 Event per year
  • Rotate Campuses
  • Co-Hosted w/ RII Centers
  • Encourage with HBCUs and Community Colleges
  • $10,000 per event
Diversity Component

• Graduate Student Workshop

Goals:
  – Reach out to grad students and provide awareness of opportunities in nano/bio/sensors.
  – Provide motivational talks encouraging pursuit of nano/bio/sensors degrees and careers.

• Milestones/Objectives:
  – Provide once per year, rotating RII-3 campuses, 1 day workshop, informational material booths.
  – Provide lab facility tours and talks by RII-3 researchers.

• Metrics/Deliverables:
  – Attendance
  – Encourage post-event questions and track student interest (encourage on-line question submittal)
  – Possibly track students from attendance sheet to see who enrolls and pursues STEM. (May be a difficult task for a one day impact event.)
Diversity Component

- **EPSCoR Open House**
  - Critical component of outreach to inform state representatives and companies about research performed and programs
  - Coordinator: Dr. Shaik Jeelani, TU
    - Assisted by: Ms. Sharee Smalls
    - To work with Centers and LSAMP Campus Coordinators
    - Responsibility of TU, assisted by UA AEOI and RII Centers
  - Encouraging TU to Host Year 1
  - Centers and others involved in nano/bio/ sensors to use as showcase.
  - Could combine with other events/meetings including Grad Student Workshop

- **EPSCoR Open House:**
  - 1 Event per year
  - Rotate Campuses
  - Co-Hosted w/ RII Centers
  - $10,000 per event
Diversity Component

- **EPSCoR Open House Goals:**
  - To inform key sectors of research efforts (government, industry, community, etc.).

- **Milestones/Objectives:**
  - Hold 1 day event annually showcasing RII-3 campuses with lab and facility tours.
  - Provide overview of exciting research and societal impact.
  - Highlight student presentations.
  - Include diverse populations such as 2-4 Yr institutions, HBCU, and community college participants.

- **Metrics/Deliverables:**
  - Attendance
  - Determine methods to generate familiarity with follow-up letters, etc.
  - Track diversity of participants, institutions, and geographic locations.
Math Science Circles

Math Science Circles
- Coordinated by: Dr. Vasily Prokorov (PI) USA
  - Assisted by Dr. Cornilus Pillen (Co-PI)
  - To work with Centers and AEOI as below.
- Currently 9 schools in Mobile Area working with MATH CIRCLES (NASA sponsored)
- NOW to Expand Circles and Develop Addition Experimental “Science” Concept:
  - Researchers give talks at MSC.
  - Center grad student team to develop basic math “toy” word problems related to their research. Ex: nanotube “puzzle” or “lattice” structured problems.
  - Center grad students participate in at least one Math Circle per semester to present materials & work w/ MC team & K-12 students.
  - Training grad students, K-12 teachers, and others to sponsor MSCs in other areas of the state.
  - Materials developed for inclusion in other AMSTI programs statewide and Math Circles Programs Nationwide.

Math Science Circles:
- $60K/year
  - 0.65 mo 2 PIs
  - 2 Math Grad Students ; Trained how to do MCs
  - Summer Training for Others with Travel Support ($9.5K/yr)
## Math Science Circles

### Math Circles:

- **Spring 2009**
- Hold Mobile Mathematics Olympiad
- Winners participate in Colorado State Olympiad
- Engage Faculty in outreach at local high schools.
  1. Visited LaFlore HS Jan ’09; Discussed STEM opportunities with over 200 African-American students.
  2. Pillen and Prokhorov to visit other local public schools for pilot Math Circles
- Train ASMS faculty Sarah Gelsinger (USA Alumna) in Math Circle activities.
- Developing web pages on acquiring and maintaining a Math Circle library for local schools and other parties.
- Develop sample problem sheets. Problems are culled from copyrighted materials, and have to develop efficient method of attribution and fair use.
- Making contact with Alabama Council of College Teachers of Mathematics to present at their annual meeting.
- 27 Events Fall 2008

### Math Science Circles:

- **Spring 2009**
- Recruit graduate students AY 09-10
- Invite external speakers for Spring 2009
  - Invite EPSCoR scientist to Mobile Math Circle for presentation
- Plan local teacher workshop in conjunction with MCPSS and USA- SARIC Summer 2009
- Hold 1 day local teacher workshop in Mobile on Math Circle activities Fall 2009
- Continue Mobile Math Circle with graduate student training
- Complete public school contact to set up school outreach for Spring 2010
- Other items:
  - “USA PIs do not see a use for GRSP students at this time”. Need centers/students input, ideas, and participation to ensure fit with RII-3.
- 7pm Monday/Wednesday evening problem sets and talks
Math Circle Quarterly Report Continued...

Invitations sent to 310 mathematics teachers and their students in Mobile & Baldwin counties.

62 students attended Fall 2008 sponsored events. 17% African American & 38% Female.

<table>
<thead>
<tr>
<th>Fall 2008 (Mobile Math Circle)</th>
<th>Fall 2008 (ASMS Math Circle)</th>
<th>Outside speakers.</th>
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<tbody>
<tr>
<td>Problem Topic Areas:</td>
<td>Problem Topic Areas:</td>
<td><strong>Dr. Peter Dragnev</strong>, Indiana-Purdue Univ, Talk: “School</td>
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<tr>
<td>Word, Time &amp; Clock problems</td>
<td>Challenging Algebra Problems</td>
<td>Districts on Mars, Fuel Depots</td>
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<tr>
<td>Rocket City Math League problems</td>
<td>Challenging Geometry Problems</td>
<td>on Jupiter, Inimical Dictators on</td>
</tr>
<tr>
<td>AMC problems</td>
<td>Advanced Geometry Problems</td>
<td>Neptune?! How to Arrange</td>
</tr>
<tr>
<td>Some combinatorics problems</td>
<td>Selected Olympiad Problems</td>
<td>Points on Sphere “.</td>
</tr>
<tr>
<td>Moscow MC problems</td>
<td>Pigeonhole Principle</td>
<td><strong>Dr. Josh Barnard</strong>, USA gave a</td>
</tr>
<tr>
<td>Points on Sphere</td>
<td>Knots</td>
<td>talk “Sudoku déjà vu”.</td>
</tr>
<tr>
<td>Invariants and semiinvariants</td>
<td>Points on Sphere</td>
<td><strong>Dr. David Benko</strong>, USA, gave a</td>
</tr>
<tr>
<td>Olympiad &amp; ciphering problems</td>
<td>Sudoku</td>
<td>talk “A random walk on Wall</td>
</tr>
</tbody>
</table>
| Sudoku                         | Invariants                    | Street”.
| Euler's Legacy. The Eternal Vision of | Euler's Legacy                | |
| Leonard Euler.                 | Math Model of Stock Prices    | |
| Math Movie Night.              |                                | |
| Math Model of Stock Prices     |                                | |
| Linguistics problems           |                                | |
Math Science Circles

• **Math Science Circle Goals:**
  
  **Goal 1:** Instill early appreciation of mathematics as a basic skill set for STEM programs, including nano/bio/sensors.

• **Metrics/Deliverables:**
  
  – Number students impacted annually.
  – Track new and prior Mobile Math Circle participant STEM achievement records.
  – Number of Nano/Bio/Sensors related math problems developed and taught as part of Math Circles and other Math Club programs.
  – Number partnerships developed between club staff, Math Circles staff, RII-3 grad students, and AMSTI teachers.
  – Percentage increase in math course GPA after Math Circles.
  – Survey ranking to determine which problem sets worked best with student and teacher participants.
  – Number of Nano/Bio/Sensors successful problem sets distributed to National level Math Circles and Clubs.
Math Science Circle Goals:

Goal 2: Stimulate early math appreciation within minority student populations.

Metrics/Deliverables:

- Incorporation of 3 high schools in Southwestern Alabama to include primarily African American, Hispanic, and Native American Majority Population institutions.
- Percentage increase in math course GPA after Math Circles.
- Survey ranking of nano, bio, and sensor problem sets.
- STEM higher education enrollment and graduation rates of comparative subset minority students.
- Number of minority and underrepresented group students participating in all math circles and related math clubs in state.
Math Science Circles

• **Math Science Circle Goals:**

  **Goal 3:** Train graduate students and teachers statewide on how to use problem solving techniques for instilling math appreciation.

• **Metrics/Deliverables:**
  - Number of graduate students and teachers trained statewide annually as part of USA Outreach Program.
  - Number of Math “Science” Circle programs established: continuing and new programs.
  - Funding and other resources identified to provide additional support of statewide math circles and similar programs.
Math Science Circles

• **Math Science Circle Goals:**
  
  **Goal 4:** Determine impact of Math Circles and similar programs on STEM degrees and careers.

• **Metrics/Deliverables:**
  
  – Number of other math club programs identified in the state and working relationships between AEOI and programs developed.
  
  – Student STEM enrollment numbers from these groups in higher education, STEM focus area, and matriculation rates.
  
  – Number of best practices techniques developed through partnerships to share with other programs statewide and nationally.
Math Science Circles

• **Math Science Circle Goals:**
  
  **Goal 5:** Incorporate Math Circles and RII-3 concepts as a useful AMSTI approved resource for teachers.

• **Metrics/Deliverables:**
  
  – Number of AMSTI teachers using Math Circle and RII-3 problem set concepts annually.
  – Affiliation acceptance of materials developed by AMSTI.
AAMU EMAP

- AAMU EMAP
- Seed funds for introducing math skill building into freshmen engineering
- Building from prior programs
- Coordinator: Dr. Zhigang Xiao, AAMU
  - With Dr. Kaveh Heidary, Prof. Stoney Massey, Dr. Satilmis Budak
  - Involving: A math mentor and 2 REUs
  - Focus on EE101
- Can be extended further by:
  - Comparison to USA & UA engineering math skills improvement programs. (AEOI)
  - Identify similar engineering “math-skill” improvement programs and track student progress, selecting best practices for impact. (AEOI - $)

- AAMU EMAP
  - $25K per year
    - $22K Stipends
    - $2K Materials
    - $1K Travel
    (UA $1K Assistance)
AAMU EMAP

• AAMU EMAP Quarterly Activities:
• Conducted three meetings to discuss initiatives based on prior student performance.
  – How to enhance math background for success in subsequent engineering classes.
  – Planned activities include:
    • Conduct a math assessment test at start & end of EE101, SP 09.
    • Add math-related class activities to encourage the math improvement.
    • Introduce ALEKS math software into the class. (Meeting held with ALEKS to learn software.)
    • Bringing in student math mentor.
    • Award if student meets target grade.
    • Adding field trip to local company or NASA and Army Labs.
    • Finding two summer REU students – to help develop experiments, problems, and serve as mentors in fall (e.g., providing talks on research, developing project, etc.)

- Spring 2009 Pilot Class
- Summer 09 Training REUs
- Fall 2009 Larger Class
AAMU EMAP

- **EMAP Programs:**
- **Goals:**
  - Serve as a BRIDGE from AMSTI institutions and other schools to STEM areas.
- **Objectives/Milestones:**
  - Work with AMSTI program developers to identify what “math” and science bridging is needed for engineering and other core programs related to nano and bio degrees/careers.
  - Identify/develop methods to stimulate interest and motivate students toward continuing with STEM degrees.
- **Evaluation/Metrics:**
  - Monitor pre and post skills tests.
  - Track degree performance.
  - Compare performance to non E-MAP students. (e.g., to date, 50% E-MAP students retained from the non-calculus pool v. 30% non E-MAP)
AAMU EMAP

• AAMU EMAP Goals:
  Goal 1: To identify the basic math skill sets needed to excel in engineering and sensor sciences (electrical engineering).

• Metrics/Deliverables:
  – Math test performance evaluation to determine key areas for improvement and areas needing improvement.
  – Compare with GPA increase in math and sensor related core courses of attendees v. non-attendees in electrical engineering department and students in college of engineering as a tracking measure for skill set performance.
AAMU EMAP

- **AAMU EMAP Goals:**
  
  **Goal 2:** Use basic language of sensor sciences as a platform to explain problems for succeeding in calculus.

- **Metrics/Deliverables:**
  - Number of sensor (and/or nano/bio) problems and programs incorporated.
  - Number of sensor problems identified and developed by math-engineering team for use at calculus level (for use in publishing book).
  - Qualitative math and science attitude survey rankings of students after using problems.
  - Number of STEM degrees awarded as a comparison to those not in program from department or college.
AAMU EMAP

• **AAMU EMAP Goals:**
  
  **Goal 3:** Excite faculty and students about science in sensors, bio and nano areas.

• **Metrics/Deliverables:**
  
  – Qualitative math-science survey.
  – Number of freshmen student participants in EMAP returning to help with future EE101 projects and develop materials for problems or sensor laboratories.
Coordination, Research, Clearinghouse

- Coordination:
  - Monitoring RII-3 Supported Outreach and Diversity Programs
    - Ensuring RII-3 Relevance and Connectivity
    - Assisting with Development
    - Goals, Objectives, Metrics and Data
  - Outreach Activities Currently Underway in RII-3:
    - Leveraging Resources
    - Identifying and Seeking Additional $$ to Expand and Build Partnerships
    - Encouraging Linking RII-3 People with Outreach Programs to Serve as Resources
    - Advertising
  - Partnering, New Programs, and Curriculum
    - Pairing Assistance (AMSTI, CCs, HBCUs, etc.)
      - Website Application
    - Disabled Persons Activities
    - Additional Funding Sources
    - Available to Work w/ Centers/GRSP on Education and Outreach (proposal writing, activities, etc.)

Coordination, Research, Clearinghouse:
- $70K per year / Year 1:
  - Mgmt/Coord: $14.7K
  - Research: $2.5K
  - EMAP Asst.: $1K
  - Grad Student: $6.4K
  - Travel $868 (Modif)
  - OH/Indir/SubKs $45K
Coordination, Research, Clearinghouse

• **Research:**
  – Determined Baseline Participant Data
  – Baseline Program Data
  – Starting Tracking Phase
    • Demographics, Institution, Geographic, etc.
  – Baseline Nano, Bio, Sensor Program Data
    • Identifying Partnering Opportunities, Leveraging Resources, Reducing Duplication, etc.
  – MSP START Research Proposal (Funded at $300,000)
  – Key Student Skill Sets for Nano, Bio, Sensors
  – Diversity, Outreach, and Education Best Management Practices
    • Identifying Assistance Being Provided and Improvements Needed

• **MSP START:**
  • Additional Funding to:
    • Research EPSCoR State Program Effectiveness as Model for Supporting Development of Educational Efforts
    • Establish Partnership Between RII3 Centers, K-20, and Private Sector
    • Planning Grant to Develop Large Scale Proposal
Coordination, Research, Clearinghouse

- **Clearinghouse:**
  - Primary Means of Disseminating Research Data
  - Searchable Web-based Delivery
  - Links to Reports, Papers, Data
    - Baseline Data
    - Follow-up Tracking Data
    - Best Management Practices
    - Demographics, etc.
  - Links to Related Programs
  - Information to Promote/Advertise Programs
    - Stimulating Diversity and Recruitment
Coordination, Research, Clearinghouse

- **Deliverables:**
  - Clearinghouse
  - Baseline Data
  - Tracking
    - Activity Deliverables
  - Funding and Program Development
  - Set of Best Management Practices
AEOI for the RII-3

• To Ensure RII3 Complies with NSF Broader Impact Requirements Efficiently!

• See New Website: http://aeoi.eng.ua.edu

• Questions?

Contact: Dr. Karen Boykin, 205-348-4008