



An NSF Engineering Research Center's Approach to STEM Education

Adah Leshem

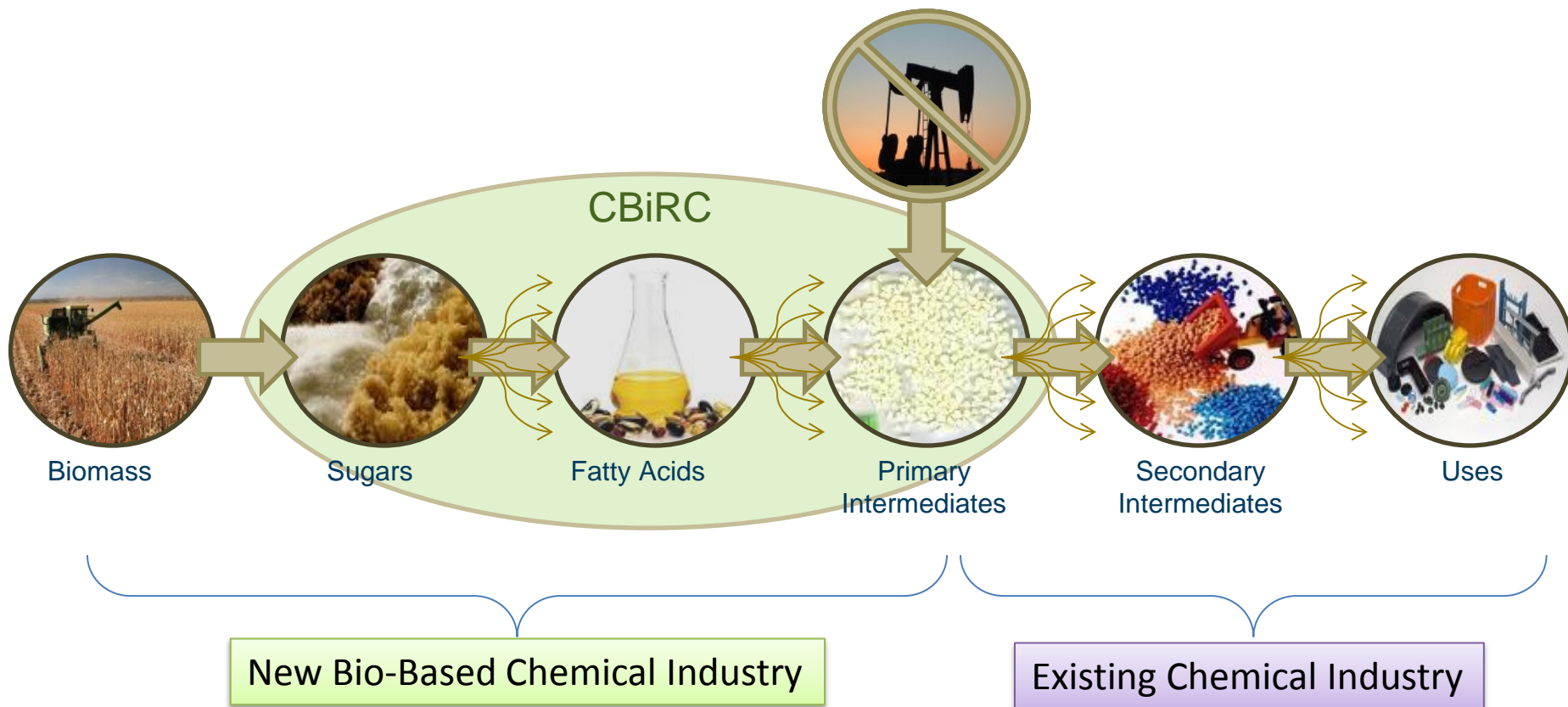
Pre-College Education Director

NSF Engineering Research Center for Biorenewable Chemicals

Iowa State University



NSF Engineering Research Center for Biorenewable Chemicals



Multidisciplinary





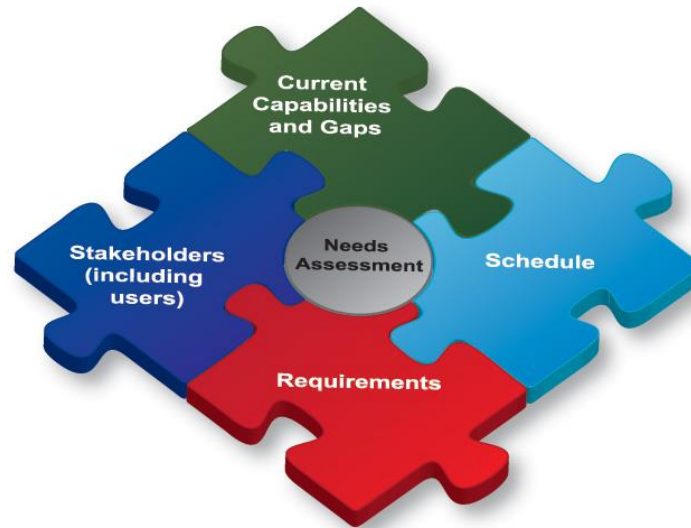
ERC's and STEM

- ERC's are REQUIRED to have a STEM education component.

*THE KEY INGREDIENTS OF **INNOVATION**
ARE A TALENTED, DIVERSE WORKFORCE CAPABLE OF
STIMULATING CREATIVE IDEAS; A GOOD IDEA,
MOST OFTEN THE FRUIT OF **BASIC RESEARCH**;
AND A **PROCESS TO** TURN THAT IDEA INTO A
PRODUCT OR PROCESS OF SOCIETAL BENEFIT THAT
CAN REACH **THE MARKETPLACE.***

SymbiTM
IOWA's GK-12 PROGRAM

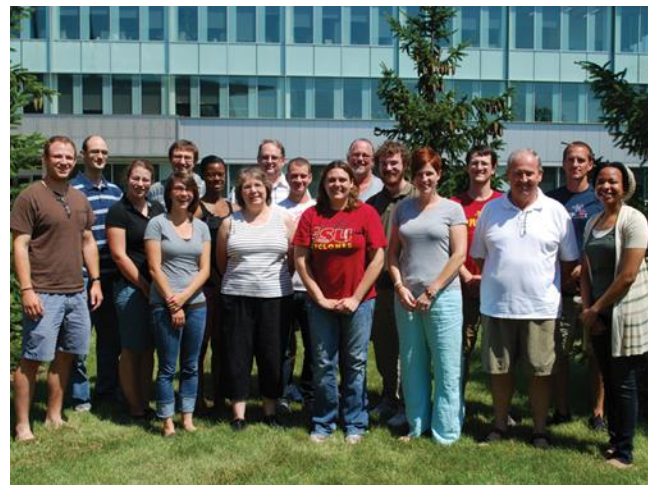
Needs Assessment



- **Lack of communication between STEM teachers in same building;**
- **Lack of alignment between grade levels and between middle school and high school curriculum;**
- **Lack of accessible and affordable STEM content professional development opportunities;**
- **Lack of opportunities for high school students to explore STEM outside the classroom.**

Pre-College Education – Long Range Vision

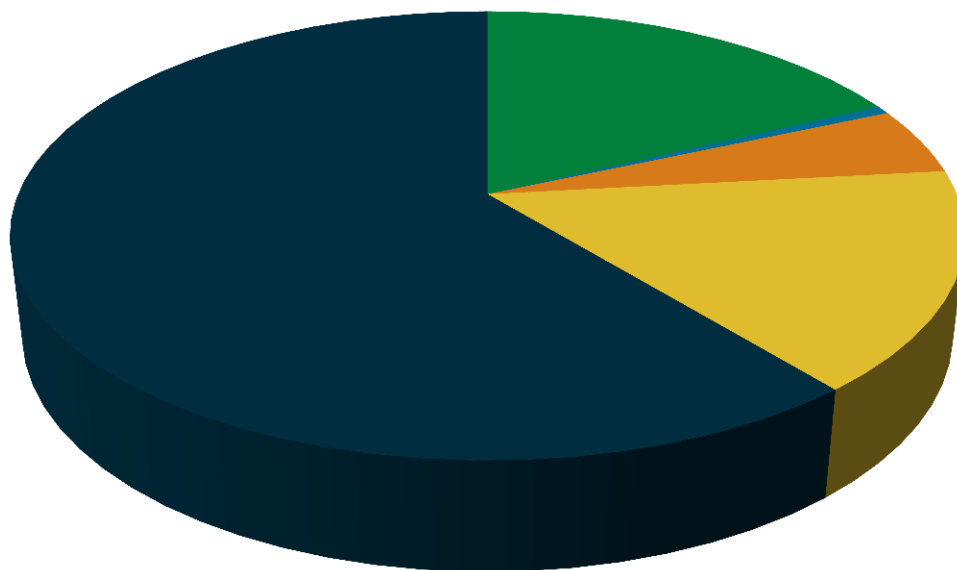
- Long term partnerships between CBiRC and local school districts to provide STEM teacher professional development and student engagement;
- Science teachers who think and perform as 21st century engineers/scientists in their classrooms;
- Professional learning communities for STEM teachers across disciplines, grades and schools;



Produce a diverse set of high school graduates who are ready to meet the demands and challenges of the 21st century and are competitive in science, technology, engineering, and math fields

Des Moines Public School District

10 Middle schools 5 High schools
40% minority enrollment – 13 % increase over past 10 years



■ African American

■ American Indian

■ Asian

■ Latino

■ White

Source: Des Moines Public School District

Partnership with Des Moines 2009-13



- ***Research Experience for Teachers (RET)*** - high school STEM teachers' professional development;
- ***Biorenewables Summer Academy*** - middle school science teachers' professional development;
- ***Plants in Society & Biorenewables*** workshops - elementary school teachers' professional development;
- ***Young Engineers and Scientists (YES)*** - research internships for high school students;
- ***Symbi GK12*** – resident experts in K12 classrooms;



CBiRC Faculty & Student Contributions to the Pre-College Education Program

- **Research seminars and presentations of CBiRC and biorenewables**
- **Discussions with teachers about how to weave engineering concepts into K-12 curricula;**
- **Tours of lab facilities for visiting middle and high school students;**
- **Demonstrating research projects;**
- **Serve as mentors and supervisors for teacher and high school student interns;**
- **Visit schools to engage students in hands-on activities;**
- **Internet conferencing (Adobe connect and Skype) with school classrooms;**
- **Serve as residents experts in middle and high school classrooms.**

CBiRC Impact in Des Moines



- **Pilot Professional Learning Community – alignment of science curriculum between middle and high school;**
- **High school STEM Academy;**
- **Increase in student applications for research internships (YES);**
- **75% YES alumni enrolled in STEM college programs;**
- **Increase in number of middle school *Science Fair* projects;**
- **Annual Science & Engineering Day events in DSM middle schools;**
- **Support with *Next Generation Science Standards***

How to Collaborate with Higher Ed

- **ERC Pre-College Director or Education Outreach Director**
- **Office of Education Outreach**
- **Office of STEM Education – university and college**
- **Office of the Provost – Associate for Research**
- **University Extension**

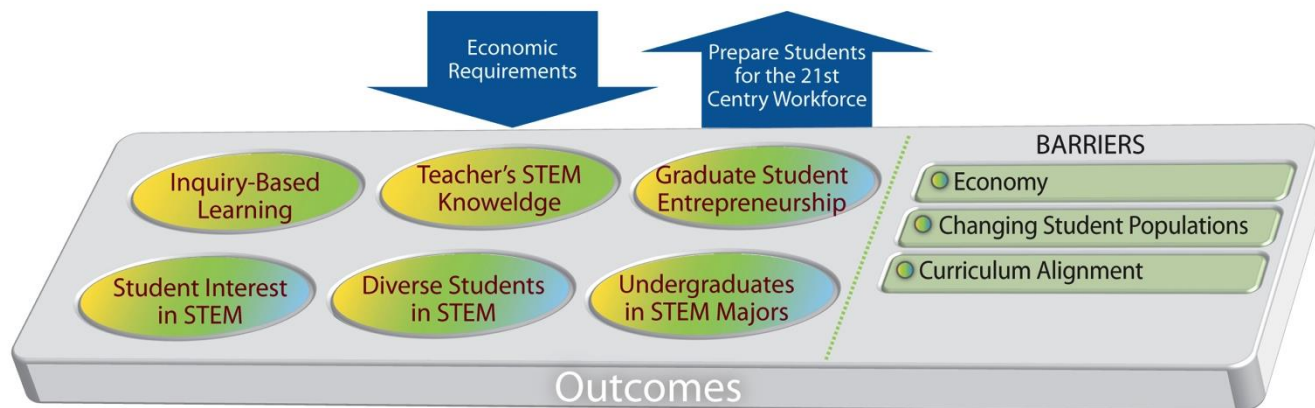




Thank you



Outcomes



- **GK12 Fellows learned to communicate complicated research concepts to non-technical audiences and gained teaching experience;**
- **YES participants gained a deeper understanding of scientific research and greater knowledge about STEM fields and academic options;**
- **Middle school students became more engaged in science activities and were able to connect abstract principles to their own experiences;**
- **K-12 teachers dramatically changed their pedagogical techniques, expanded their emphasis on active learning through experimentation and inquiry-based activities and in general expanded their STEM knowledge.**