

Annual Report for Period:07/2010 - 06/2011

Submitted on: 06/30/2011

Principal Investigator: Rover, Diane T.

Award ID: 0807051

Organization: Iowa State University

Submitted By:

Rover, Diane - Principal Investigator

Title:

E2020 Scholars: Advancing the NAE Vision

Project Participants

Senior Personnel

Name: Rover, Diane

Worked for more than 160 Hours: Yes

Contribution to Project:

Coordinated project planning and meetings. Co-leader of the Curriculum/Assessment Group. Participated in scholar review and selection. Participated in ENGR 110X and 210X.

Name: Shelley, Mack

Worked for more than 160 Hours: Yes

Contribution to Project:

Participated in project planning and meetings. Informed, guided and conducted project assessment and evaluation activities.

Name: Mickelson, Steven

Worked for more than 160 Hours: Yes

Contribution to Project:

Participated in project planning and meetings. Co-leader of the Community Group. Facilitated and guided E2020 learning community and course development. Contributed to project evaluation.

Name: Bruning, Monica

Worked for more than 160 Hours: Yes

Contribution to Project:

Participated in project planning and meetings. Co-leader of the Scholarship Group. Co-coordinator for the cohort program. Facilitated the first-year cohort experience. Managed the scholarship application, review, and selection process.

Name: Castleberry, Paul

Worked for more than 160 Hours: No

Contribution to Project:

Team member and co-leader of the Community Group with co-PI Mickelson. This responsibility aligns with his position in the College of Engineering as Learning Communities Coordinator.

Name: Johnson, Joel

Worked for more than 160 Hours: Yes

Contribution to Project:

Team member and co-leader of the Scholarship Group with co-PI Bruning. This responsibility aligns with his position in the College of Engineering as director of the Engineering Scholarship Program. Member of the E2020 scholarship selection committee.

Name: Brumm, Tom

Worked for more than 160 Hours: Yes

Contribution to Project:

Team member and co-leader of the Curriculum/Assessment Group with PI Rover. This responsibility aligns with his appointment in the College as director of assessment. Participated in project planning and meetings.

Post-doc

Graduate Student

Name: Martinez, Nico

Worked for more than 160 Hours: No

Contribution to Project:

Graduate student working with diversity programs. Member of the E2020 scholarship selection committee.

Name: Joines, Amy

Worked for more than 160 Hours: No

Contribution to Project:

2009-10: Student director of the Engineering Leadership Program. Member of the E2020 scholarship selection committee.

Name: Laingen, Mark

Worked for more than 160 Hours: Yes

Contribution to Project:

Participated in project planning and meetings. Co-coordinator of E2020 cohort program. Coordinator for the transfer cohort. Instructor for E2020 seminar courses. Sources of support for graduate assistantship include the college and an NSF STEP grant.

Undergraduate Student

Name: Williams, Ana

Worked for more than 160 Hours: Yes

Contribution to Project:

Student coordinator for cohort program and peer mentor for E2020 first-year cohort. This position is paid by the project.

Name: McLaurin, Elease

Worked for more than 160 Hours: No

Contribution to Project:

Summer 2010: E2020 peer mentor. Assisted with summer orientation for new students.

Name: Sevcik, Joshua

Worked for more than 160 Hours: Yes

Contribution to Project:

E2020 peer mentor for transfer student cohort. Supported by this project and an NSF STEP project.

Name: Mulloy, Patrick

Worked for more than 160 Hours: Yes

Contribution to Project:

E2020 peer mentor for transfer student cohort. Supported by this project.

Name: Klutzke, Brenda

Worked for more than 160 Hours: Yes

Contribution to Project:

E2020 scholar, peer mentor to new cohorts, and seminar teaching assistant.

Name: McGuire, Ethan

Worked for more than 160 Hours: Yes

Contribution to Project:

E2020 scholar, peer mentor to new cohorts, and seminar teaching assistant.

Technician, Programmer

Name: Hill, Gloria

Worked for more than 160 Hours: No

Contribution to Project:

Through June 30, 2010: Assisted the PI with meetings, budgeting, and other project management activities.

Name: Stowe, Jane

Worked for more than 160 Hours: No

Contribution to Project:

Secretary for the Engineering Scholarship Program. Assists the director of the program.

Name: Spurlock, Cindy

Worked for more than 160 Hours: No

Contribution to Project:

Enrollment Services Office Coordinator. Assists team members with prospective student information.

Name: Prouty, Tina

Worked for more than 160 Hours: No

Contribution to Project:

Scholarship Program Coordinator. Assists the director with data management and analysis.

Name: Centeno-Diaz, Laura

Worked for more than 160 Hours: No

Contribution to Project:

Diversity Programs Coordinator. Member of the E2020 scholarship selection committee.

Name: Darrow, Mary

Worked for more than 160 Hours: No

Contribution to Project:

Member of the E2020 scholarship selection committee. Contributed to the transfer cohort experience. This involvement aligns with her activities on an NSF STEP project.

Name: Anderson, Virginia

Worked for more than 160 Hours: No

Contribution to Project:

Starting fall 2010: Program assistant providing assistance with meetings, budgeting, and other project management activities.

Other Participant

Name: Jacobson, Doug

Worked for more than 160 Hours: No

Contribution to Project:

E2020 pillar group leader for Innovation. Contributed lectures/activities for the E2020 seminar courses. University Professor in Electrical and Computer Engineering.

Name: Kaleita, Amy

Worked for more than 160 Hours: No

Contribution to Project:

E2020 pillar group leader for Global Awareness. Contributed lectures/activities for the E2020 seminar courses. Associate Professor in Agricultural and Biosystems Engineering.

Name: Rehmann, Chris

Worked for more than 160 Hours: No

Contribution to Project:

E2020 pillar group leader for Systems Thinking. Contributed lectures/activities for the E2020 seminar courses. Professor in Civil, Construction, and Environmental Engineering.

Name: Rollins, Derrick

Worked for more than 160 Hours: No

Contribution to Project:

Through fall 2009: participated with scholarship selection.

Name: Hartmann, Beth

Worked for more than 160 Hours: No

Contribution to Project:

E2020 pillar group leader for Leadership. Contributed lectures/activities for the E2020 seminar courses. Lecturer in Civil, Construction and Environmental Engineering.

Research Experience for Undergraduates

Organizational Partners

Sandy Jennings-Hammond

The project uses the services of the outside individual as a communications specialist for selected project needs.

3M

The 3M Corporation has financially supported the Engineering Leadership Program, which is the program after which the E2020 Scholars Program is being modeled. 3M wrote a letter of support for the grant and remains interested in the project.

Rockwell Collins

Rockwell Collins has financially supported the Engineering Leadership Program, which is the program after which the E2020 Scholars Program is being modeled. Rockwell Collins wrote a letter of support for the grant and remains interested in the project.

Other Collaborators or Contacts

Learning Communities Task Team (a college-wide committee comprised of advising staff and faculty from each department): Stakeholders in pillar module development.

Activities and Findings

Research and Education Activities: (See PDF version submitted by PI at the end of the report)

Findings: (See PDF version submitted by PI at the end of the report)

Training and Development:

The E2020 scholars, both first-year and transfer students, have participated in program activities to advance their academic and professional development. The students have completed course modules to develop their knowledge, skills and abilities in the four pillar areas.

Undergraduate peer mentors have been introduced to the NAE's vision for the engineer of 2020 and have facilitated scholar understanding and development.

The seminar course instructor, faculty leaders, and project team members have begun to explore, collect, and develop materials to support curriculum and assessment of the four pillar areas of the program.

Information has been shared across groups in the project, leading to expanding the awareness and knowledge base of team members and collaborators.

Outreach Activities:

Refer to Activities attachment (e.g., communications to various audiences, poster at the ISU Student Success Summit).

Journal Publications

Books or Other One-time Publications

Web/Internet Site

URL(s):

<http://www.engineering.iastate.edu/e2020>

Description:

The E2020 website provides an overview of the project intended to inform prospective students as well as interested persons inside and outside the university. It also provides information about the E2020 scholarship and program and supports the application process.

Other Specific Products

Contributions

Contributions within Discipline:

Resources and materials are being identified, collected, and developed

to teach students about engineering leadership, innovation and entrepreneurship, systems thinking, and global awareness. Instructional materials for two seminar courses were developed. An intranet repository has been created for internal project use by faculty and staff in engineering. This will continue to be expanded on as the project continues. Resources will also be made available to other engineering educators.

Contributions to Other Disciplines:

The curriculum and assessment resources will use and contribute to the larger body of knowledge in the four pillar areas. There are various leadership programs and initiatives on campus and in the education community. There is an entrepreneurship program in the College of Business and various activities across colleges. Global awareness and systems thinking are also important areas across disciplines.

Contributions to Human Resource Development:

The goal of this project is human resource development. Scholarships supported a cohort of undergraduate student scholars, including transfer students and underrepresented students. Peer mentors were trained, and along with the scholars, gained new knowledge, skills and abilities in the four pillar areas of the E2020 program. Faculty and staff also acquired new information about student development.

Contributions to Resources for Research and Education:

Information resources are under development to support teaching, learning and assessment in the four pillar areas of the project. E2020 team members will collaborate with similar efforts at other institutions, such as Purdue University's E2020 initiative.

Contributions Beyond Science and Engineering:

Conference Proceedings

Special Requirements

Special reporting requirements: None

Change in Objectives or Scope: None

Animal, Human Subjects, Biohazards: None

Categories for which nothing is reported:

Any Journal

Any Book

Any Product

Contributions: To Any Beyond Science and Engineering

Any Conference

Annual Report for Year 3

E2020 Scholars

NSF S-STEM Program

Award #0807051



Activities

Project Goals and Objectives

The E2020 Scholars Program offers scholarships for cohorts of undergraduate engineering students within the college's established learning community infrastructure, giving specific attention to the aspirations and attributes of the National Academy of Engineering's (NAE) vision for the engineer of 2020. The project has outlined a set of student development and learning opportunities consistent with the NAE vision. Four E2020 outcomes were identified: leadership, global awareness and understanding, systems thinking, and innovation and entrepreneurship. These outcomes are being integrated into curricular and co-curricular activities. E2020 scholars participate in a learning community, and the four pillar areas of leadership, global awareness, systems thinking, and innovation are introduced in a one-semester first-year seminar and reinforced in a two-semester second-year seminar. These seminars supplement the regular program of study for engineering students. The scholarship program is expected to promote student engagement and development centered on these E2020 outcomes.

The E2020 Scholars Program is pursuing the goals of the S-STEM program through four objectives:

- Provide opportunities of the Engineering Leadership Program to greater numbers of students and create learning outcomes consistent with the E2020 vision.
- Engage students in new learning opportunities through cohorts and communities focusing on E2020 concepts.
- Use E2020 scholarships in coordination with new programs being developed in a related NSF STEP grant (www.engineering.iastate.edu/seec/).
- Use the E2020 focus in coordination with the NSF STEP grant to prepare more graduates to fulfill the NAE and college vision.

The E2020 Scholars Program was designed to leverage two highly successful programs in the College of Engineering: the Engineering Scholarship Program and the Engineering Leadership Program. The program benefits from the application of successful, research-based practices, alignment with national recommendations, institutional and team strengths, and expert evaluation.

The program proposed to select 25 scholars during year one for students entering Fall 2009, split approximately evenly between incoming freshmen students and transfer students; 23 scholars during year two for students entering Fall 2010; and 22 scholars during year 3 for students entering Fall 2011.

Project Management and Communications

The project team held meetings monthly to plan, review strategies and progress, and share information. These team members include faculty members Diane Rover, Steve Mickelson, Mack Shelley, Monica Bruning, and Tom Brumm; staff members Joel Johnson and Paul Castleberry; and graduate student Mark Laingen. The team also includes an evaluator from ISU's Research Institute for Studies in Education (RISE), which transitioned during the year from Jason Pontius to Andy Ryder.

There were several changes related to project administration in year 3. We submitted a withdrawal of co-PI for Krishna Athreya due to her departure from ISU. Co-PI Bruning moved from a college staff member to a lecturer in the Department of Educational Leadership and Policy Studies. Project communications support moved from a college office to team member assistants. Rover's appointment as associate dean ended on June 30, 2010, when she returned to the regular faculty. With that, project administrative support moved from the college to the Department of Electrical and Computer Engineering.

Four subgroups continued to manage project activities: Scholarships Group, Community Group, Curriculum/Assessment Group, and Evaluation Group. Project PI's serve as leaders of these groups. The groups were less structured during year 3 as activities blended across groups. Various collaborators and stakeholders are involved directly or peripherally in the groups. Active stakeholders in the project include engineering faculty and staff from the Learning Communities Task Team, diversity programs in the college, and the ABET Committee. Several members were directly involved in project activities. The four pillar groups (one group per pillar area, each comprised of faculty, staff and students) formed during year 2 were not formally involved in project activities in year 3. These groups will likely be reformulated into a single, smaller internal advisory group.

Each pillar area is led by a faculty member outside of the PI team:

- Leadership: Beth Hartmann, Lecturer, Civil, Construction and Environmental Engineering
- Innovation/entrepreneurship: Doug Jacobson, University Professor, Electrical and Computer Engineering
- Systems thinking: Chris Rehmann, Professor, Civil, Construction and Environmental Engineering
- Global awareness: Amy Kaleita, Associate Professor, Agricultural and Biosystems Engineering

The faculty leaders group actively worked with project team members throughout the year. They met for planning and review purposes every semester and held a planning retreat during the summer.

Data entry at the NSF S-STEM Scholarship Reporting Site was completed through spring 2011. This additional reporting requirement is met by using project funds to support data collection and formatting by RISE and ISU's Office of Institutional Research.

A Sharepoint intranet site continues to be used as a tool to maintain and share project information, such as meeting minutes, documents, readings, curriculum materials, pillar documents and resources, scholarship applications, etc.

The E2020 Program website, <http://www.engineering.iastate.edu/e2020>, has been updated with new scholar and program information. The website provides an overview of the project for prospective students, including information about the E2020 scholarship. The scholarship application is online through the website.

Each new class of E2020 Scholars has been announced through a press release and appears in, for example, the College of Engineering's *E-News* and *Alumni E-News* newsletters, which reach audiences of over 500 and 20,000 respectively. Another release is written for E2020 Scholars to use in their local newspapers to announce their acceptance into the program and receipt of an E2020 scholarship.

The E2020 Scholars Program is being managed in coordination with an NSF STEP-funded project, SEEC: <http://www.eng.iastate.edu/seec/>. The SEEC project has enhanced the programs and services available to students receiving E2020 scholarships, especially transfer students. All but a few E2020 team members are also SEEC team members. SEEC newsletters, distributed twice annually, include a link to the E2020 project website. SEEC project funds designated for curriculum development have been used to support the faculty leaders and instructor (graduate student Laingen) to develop and teach the E2020 seminar courses.

Scholarships

Program and college student services staff shared information about the program and scholarships at various college recruitment events throughout the year. ISU Admissions created Facebook advertising as well as streaming email communications as part of their integrated communications system. Electronic advertising reached several thousand prospective students.

The Scholarships Group reviewed and updated the selection process. The same award criteria, which satisfy NSF S-STEM requirements, were used in year 3 to select the new fall 2011 cohort. Scholarships were awarded to new engineering freshman and transfer students based on academic potential and financial need. Among other requirements, students must have grade-point averages and/or scores on college entrance examinations that exceed minimum levels. An online application form collects personal information, academic information, extracurricular activities, and essays.

A selection committee conducted a review process and made final decisions on students selected as E2020 Scholars for the fall 2011 entry year. The committee included faculty, student services staff, and students. The committee converged on a finalist list and an alternate list. Offers were made from the finalist list. Several alternates were offered, after students withdrew application for admission by the nationally recognized May 1 deadline.

Demographic data are available on all applicants and new scholars. These are summarized **in the Findings of this report.**

The project PI and team members met with the college's associate dean for administration during fall 2010 to finalize the shared financial obligations for the 2009, 2010, and 2011 scholar cohorts. The E2020 scholarship award grid was updated.

Cohort and Community Development

A cohort coordination group managed the activities of multiple cohorts during year 3: the cohorts entering fall 2009 (both first year and transfer students), and the cohorts entering fall 2010 (both first year and transfer students). This group was led by project team members: Monica Bruning for the first year cohorts, and Mark Laingen for the transfer cohorts. The group also includes peer mentors for each cohort.

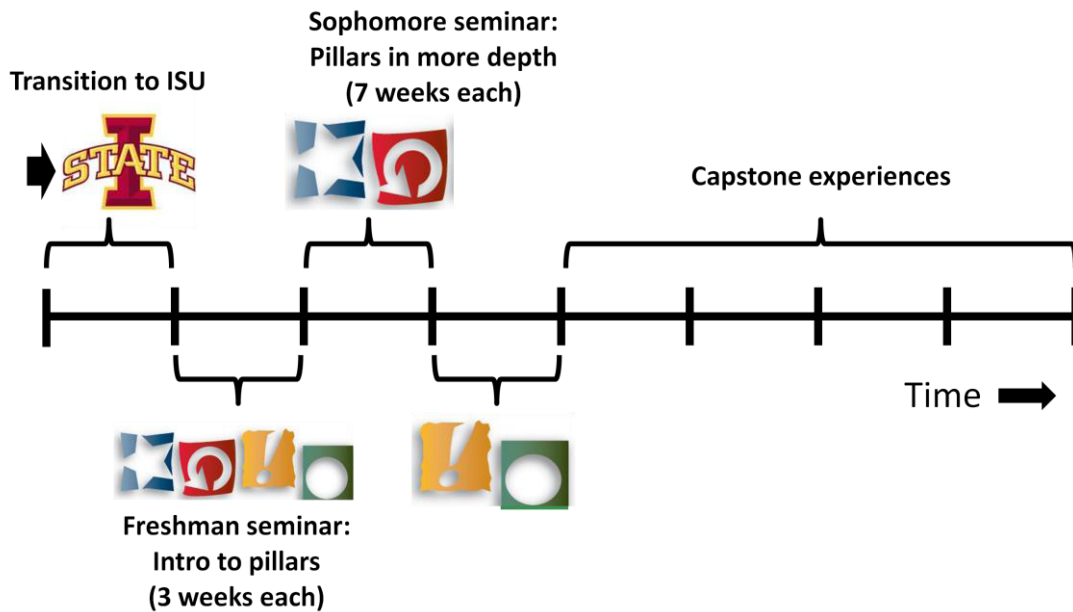
New scholars begin their affiliation with the E2020 Program during summer orientation. They attend an introductory one-on-one meeting to acquaint them and their families with the program and expectations. Scholars register on the E2020 social networking site to initiate relationships with other scholars, peer mentors, faculty, and staff before fall semester begins. The E2020 Program provides scholars an opportunity to develop a community of practice with other scholars, upper-class peer mentors, and engineering faculty who share a common interest in developing competence related to the four pillars. The program builds on ISU's strong Learning Community initiative by requiring that the scholars participate during their first semester/year in a degree program specific learning community (e.g., Mechanical Engineering Learning Community) or a thematic learning community (e.g., Women in Science and Engineering Learning Community). During the scholars' first and second years, the E2020 Learning Community meets regularly and complements a student's primary learning community. Scholars learn about the four pillar areas in a one-credit seminar course during their second semester and in another one-credit seminar course during fall and spring semesters of the second year. More information on the courses is available **in the Curriculum and Findings sections of this report.**

Community Group leaders updated the college-wide Learning Communities Task Team about the project and scholar participation in learning communities at the LCTT meetings during fall and spring semesters. Potential opportunities for learning communities to use E2020 results will be a topic of the LCTT summer 2011 retreat.

Curriculum and Assessment

During summer 2010, there was a faculty leader retreat with project team members in preparation for pillar and course development for 2010-11. The learning outcomes for the pillars were developed, and the seminar courses for the first and second years, ENGR 110X and ENGR 210X, respectively, were designed. ENGR 110X was delivered to the 2010 cohort during spring 2011. ENGR 210X was delivered to the 2009 cohort during fall 2010 and spring 2011 semesters. The courses were team-taught by Mark Laingen and the faculty leaders. The courses are summarized **in the Findings of this report.**

The sketch below illustrates the experiences by a cohort and the coverage of the pillars in E2020 courses as part of the program.



Faculty leaders actively pursued not only curriculum development but also networking, scholarship and dissemination related to the pillars. The faculty leader for leadership, Beth Hartmann, represented ISU at the PSU-MIT Engineering Leadership Meeting in October 2010 (<http://www.eldm.psu.edu/events/PSU-MIT-LeadershipMeeting.html>). Project team members also co-authored a paper on engineering leadership presented at the IEEE/ASEE Frontiers in Education Conference in October 2010. The faculty leader for systems thinking, Chris Rehmann, presented a paper at the ASEE Annual Conference in June 2011 in the Civil Engineering Division program, titled Introducing Systems Thinking to the Engineer of 2020.

Project team members submitted a proposal to the NSF program on Transforming Undergraduate Education in STEM (TUES) in May 2011, titled E2020 Teaching, Learning, and Assessment: Improving Engineering Curricula through Cross-Functional Module Development and Learning Outcome Assessment Practices. The proposal was motivated by the limited funds available for curriculum development in the S-STEM grant and by the early success with experimental course development for the E2020 cohorts. The objectives of the proposal include: 1) enhancing the conceptual learning of leadership, systems thinking, innovation and entrepreneurship, and global awareness through the implementation of E2020 learning modules, 2) improving students' attitudes toward science and engineering, 3) inspiring and training community college and university educators to incorporate the E2020 modules into engineering and science courses, and 4) improving the quality of STEM education for community college and undergraduate students through E2020 learning outcomes.

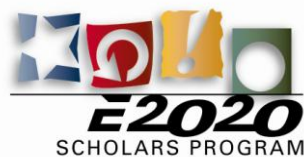
Evaluation

The Evaluation Group is led by co-PI Mack Shelley in coordination with evaluators from RISE. The Evaluation Group facilitates all evaluation activities involving students as the primary contact with the Office for Responsible Research and the ISU Institutional Review Board. Evaluation plays a synergistic role with student-related initiatives for engineering recruitment and retention in the E2020 and SEEC projects. During 2010-11, the SEEC evaluation team accumulated a large, longitudinal database of information from ISU's Office of the Registrar and Engineering Career Services for students admitted into the College of Engineering since the fall of 2002. The data analysis may have implications for E2020 activities; see **the Findings of this report**.

Evaluation during year 3 continued to establish criteria and implement data collection for more detailed subsequent data-driven evaluation efforts. Data to assess longer-term student outcomes are in the process of being collected and analyzed. As in preceding years of the project, a process evaluation was based on participation by the evaluators in E2020 meetings and in related meetings, including ISU's NSF-funded SEEC (STEM Student Enrollment and Engagement through Connections) project. Interactions during year 3 with the PI and co-PIs for E2020 indicate that project planning and implementation and group coordination continue to proceed well.

A survey was administered to the 2009 cohort prior to fall 2010 to obtain feedback on their experiences during the first year of the E2020 program. Results of the survey are summarized **in the Findings of this report**. The survey has been updated to administer to both 2009 and 2010 cohorts before fall 2011.

Annual Report for Year 3
 E2020 Scholars
 NSF S-STEM Program
 Award #0807051



Findings, Products, and Contributions

The activities of the project led to several results and outputs during year three. These are highlighted below.

E2020 Scholars Program Visual Identity

During year one, a logo for the E2020 Scholars Program was created by a graphic designer in the college. Each of the E2020 outcome areas is depicted by a graphical icon.



- Star: leadership
- Arrow: System thinking
- Exclamation: Innovation
- Circle: Global awareness

The logo continues to be used in program communications, giving the program and scholars a distinctive visual identity.

E2020 Scholars

The first scholarships were awarded for cohorts beginning fall 2009, i.e., 2009-10. A total of three rounds of scholarships have been awarded. The table below lists the number of scholarships anticipated in the grant proposal and the actual number of scholarships awarded. The lower number of transfer scholarships awarded vs. proposed in 2009 and 2011 was due to smaller applicant pools.

Cohort	Number of Scholarships - Proposed			Number of Scholarships - Awarded		
	First Year	Transfer	Total	First Year	Transfer	Total
2009-10	12	13	25	15	8	23
2010-11	11	12	23	12	14	26
2011-12	11	11	22	16	9	25
Total	34	36	70	43	31	74

The table below summarizes the number of applicants and scholars for the fall 2009, fall 2010, and fall 2011 cohorts.

	Total	First Year Students			Transfer Students		
		All	Women	Minority	All	Women	Minority
2009-10							
Applicants	208	189	52	28	19	1	1
Scholars	23	15	5	5	8	0	0
2010-11							
Applicants	195	173	35	15	22	5	0
Scholars	26	12	7	4	14	5	0
2011-12							
Applicants	269	243	51	38	26	5	6
Scholars	25	16	7	3*	9	2	0*
Total							
Scholars	74	43	19	12	31	7	0
* as reported in applications (3 students did not report)							

A majority of ISU transfer students come from Iowa community colleges. Minority student enrollment in STEM at community colleges in Iowa is a challenge due to the demographics of the state. However, the transfer data overall, and in particular the data for under-represented groups, point to a critical issue that two-year and four-year institutions in the state should address.

The first cohort of E2020 scholars, which entered during fall 2009, is listed in the table below.

Last Name	First Name	Home State	Major	Learning Community / Transfer Institution	Status
Bomett	Moses	IA	ENGR	LEAD LC (multicultural)	Changed major Deceased 10/8/10
Carr	Alexander	CO	Aer E	Major LC	
DeLoatch	Sterling	IL	Cpr E	LEAD LC (multicultural)	
Fleege	Alicia	WI	ENGR	Honors LC	
Jimenez	Lizette	IL	Ch E	Major LC	
Klutzke	Brenda	MN	M E	Honors LC	
Kruger	Samuel	IA	C E	Major LC	
Lyon	Todd	IA	Cpr E	Major LC	
Magstadt	Benjamin	NE	E E	Major LC	
Morgan	Donathan	MO	E E	LEAD LC (multicultural)	
Morrow	Kristen	IA	BSE	Major LC + ELP	
Page	Ryan	IA	I E	Major LC	
Rager	Karly	SD	CE	Major LC	
Rondon	Andrew	KS	C E	Major LC	
Wenger	Justin	IA	Con E	Major LC	
Escher	Anthony	IA	ME	Kirkwood CC	
Flaherty	Patrick	IA	ME	LC / Iowa Central CC	
Jolley	Christopher	IA	CE	LC / Hawkeye CC/Salt Lake CC	
King	John	IA	Ch E	Kirkwood CC, Iowa Western CC	
McGuire	Ethan	IA	Ch E	Southwestern CC	
Schulte	Eric	IA	C E	LC / Hawkeye CC	

Smith	Jeffrey	NE	Aer E	Univ. of Nebraska	Left school
Titus	Mathew	IA	M E	LC / DMACC	

Two of the twenty-three scholars are no longer in the program; and one scholar died in a car accident last fall.

The second cohort of E2020 scholars, which entered during fall 2010, is listed in the table below.

Last Name	First Name	Home State	Major	Learning Community / Transfer Institution	Status	
Anderson	Christina	NE	MatE	Major LC		
Demmon	Carrie	IA	ChE	WISE LC		
Fox	Tyler	IL	ENGR	Undeclared LC		
Gilsdorf	Ryan	MO	CprE	Major LC		
Jones	Tyler	MN	ME	Major LC		
Nelson	Lauren	MN	ChE	WISE LC		
Olivares	Alexandra	IA	AerE	Major LC		
O'Loughlin	Caitlin	IA	CE/Env	WISE LC		
Rosenthal	Michael	IA	CE/Env	Major LC		
Sanocki	Mark	WI	CE/Env	Major LC		
Sauerbrei	Samantha	IA	ChE	Honors LC		
Stovall	Jasmine	NE	CE/Env	Major LC		
Anderson	Taylor	IA	SE	Iowa Central CC		
Beougher	Andrew	IA	EE	Des Moines Area CC		
Briesmoore	Rebecca	IA	CE	Univ. of Iowa		
Dobbie	Paul	IA	ME	DMACC		
Freebolin	Jake	IA	ME	Kirkwood CC (spring entry)		
Geerdes	Edwin	IA	ME	Iowa Lakes CC		
Judkins	Andrew	IA	ENGR	LC / Marshalltown CC		
Lundeen	Kurt	IA	ME	Scott CC		
Mally	Elizabeth	IA	CE	Kirkwood CC		
McCuddin	Hannah	IA	AerE	LC / Western Iowa Tech CC		
Mishler	Margaret	IA	IE	Kirkwood CC		
Pavel	Brittney	IA	ChE	LC / Iowa Central CC		
Sprecher	Jeremy	IA	BSE	Oregon St. Univ./DMACC		
Swenson	Benjamin	IA	ConE	LC / Kirkwood		

None of the twenty-six scholars has left the program.

The table below shows the results of the application and selection process conducted this year for the third cohort of E2020 scholars, who will start fall 2011.

Last Name	First Name	Home State	Major	Learning Community / Transfer Institution
Bouslog	Tyler	IA	AE	LC
Brendel	Conrad	PA	ENGR	LC
Gordon	Adrian	Virgin Islands	BSE	LC
Hallisey	Erin	IL	ENGR	LC
Johnson	Courtney	MO	ChE	LC
Keierleber	Lisa	IA	AERE	LC
Krezowski	Catherine	MN	ENGR	LC
Langel	Tyler	IA	ENGR	LC
Lieser	Rachel	MN	ENGR	LC
Lopez	Christian	IA	AERE	LC
Mendick	Mark	NE	ME	LC
Modjeski	Andrew	MN	AERE	LC
Ohms	Theresia	MO	ME	LC
Peck	Alexander	IA	CprE	LC
Weimer	Erika	MN	ChE	LC
Whitmore	Christopher	MN	MatE	LC
Bauer	Jonathan	WA	ME	Transfer school
Boddie	James	IA	SE	Transfer school
Cullen	Nicole	IA	ENGR	Transfer school
Kopacz	Joseph	IA	ME	Transfer school
Maloney	Mark	IA	AERE	Transfer school
Pettit	Alex	IA	ChE	Transfer school
Scheiding	Sara	IA	IE	Transfer school
Stauffacher	Alex	Iowa	EE	Transfer school
Volsen	Joshua	Iowa	EE	Transfer school

Each scholar must participate in a first year learning community (LC). The LC is shown in the tables above in the specified column. The fall 2011 cohort LC information was not available for this report. “Major LC” refers to the learning community offered by the academic department. All academic departments in the College of Engineering offer learning communities. There are currently fewer learning community options for transfer students. However, through the NSF STEP SEEC project, new transfer learning communities are becoming available. SEEC initiatives have increased the percentage of transfer students participating in a learning community.

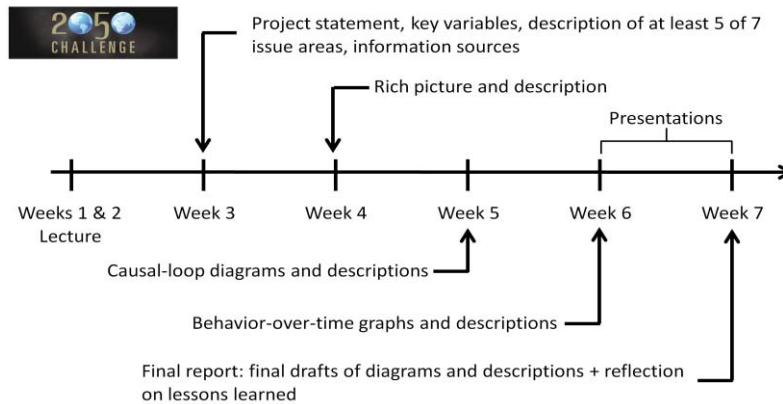
E2020 Seminar Courses

ENGR 110X is the one-credit seminar course taken by scholars during the second semester of their first year in the program. ENGR 210X is the one-credit seminar course taken during fall and spring semesters of the second year. 110X introduces students to each of the four pillars over twelve weeks. A three-week learning format is used for each pillar. The first week introduces the students to knowledge content related to the pillar. The second week focuses on the students developing basic skills related to the knowledge they learned in week one through an active learning activity. During the third week, students are asked to demonstrate their ability to apply their new knowledge and skills to a real-world

problem related to that pillar and to present their findings to the rest of the class. The class uses team-based learning methods to maximize the student learning experience. The knowledge, skills, and abilities (KSA) format used in this class is used for each of the four pillar sessions. Peer mentor sessions are interspersed with the class sessions to promote student-peer mentor interaction.

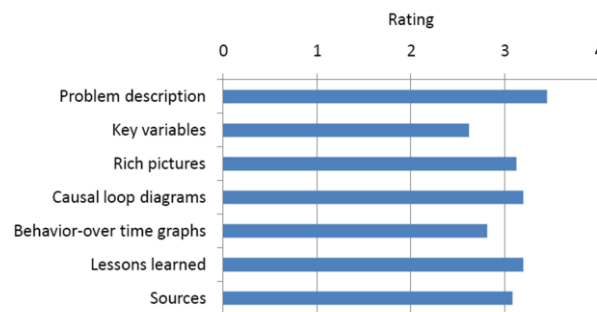
ENGR 210X provides more in-depth investigation into the pillars. The fall semester seminar was split into two seven-week periods, one for the leadership pillar and another for systems thinking. The spring semester seminar was split between the innovation and global awareness pillars. Each seven-week period is designed to address a pillar through the KSA model introduced in ENGR 110X. The first two weeks are dedicated to introduction of new knowledge; the next three weeks focus on skills development and team building (e.g., in the case of the systems thinking pillar, developing an understanding of rich pictures, causal loop diagrams, and behavior-over-time graphs); and in the last two weeks, the team applies the pillar in the context of a specific problem. For example, the seven-week module for the systems thinking pillar in ENGR 210X is illustrated in the diagram below.

Engr 210X: Assignment



Faculty pillar leaders have written specific pillar student learning outcome statements and developed initial pillar-specific learning modules and assessment methods for addressing the student learning outcomes. For example, faculty assessed student understanding of systems thinking concepts.

Ratings of student work from 3 instructors



More information about systems thinking learning and assessment in 110X and 210X is provided in the ASEE Conference paper listed in the **Publications section**.

Publications and Presentations

Results of the survey administered to the 2009 cohort prior to fall 2010 to obtain feedback on their experiences are given in the following report:

J. Pontius, R. Cooper, and C. Rumann, "E2020 Student Scholar Survey," Research Institute for Studies in Education, Iowa State University, November 2010.

The survey report has been disseminated and reviewed internally. Sample results are given in the **Evaluation Findings section**.

The E2020 Program was presented as a poster at Iowa State's Student Success Summit in March 2011 (<http://www.ucs.iastate.edu/mnet/studentssuccess/>).

A. Williams, M. Bruning, D. Rover, M. Laingen, S. Mickelson, T. Brumm, and M. Shelley, "E2020 Scholars Program," poster, Iowa State University Student Success Summit, March 24, 2011.

A poster image is shown below; and a PDF file of the poster is available at the project website.

IOWA STATE UNIVERSITY **E2020** **NATIONAL SCIENCE FOUNDATION**
Scholarships in STEM (S-STEM) Program

Engineer of 2020 - E2020 Scholars Program

College of Engineering • www.eng.iastate.edu/e2020

Overview
The E2020 Scholars Program provides scholarships to first-year and transfer students who have demonstrated academic potential, an interest in solving the challenges engineers of 2020 will face, and financial need. Scholarship award amounts total \$2,500 per year, renewable up to four years, for a potential \$10,000.

E2020 Scholars Program Expected Outcomes:

- Provide academic and professional development opportunities to greater numbers of students and create learning outcomes consistent with the National Academy of Engineering's (NAE) E2020 vision.
- Improve educational opportunities for students, faculty, and student support staff.
- Increase retention of students to degree achievement.
- Improve student support programs at institutions of higher education.
- Increase numbers of well-educated and skilled employees in technical areas of national need.

"Scholarships are vital to bringing students into STEM fields of study and broadening participation in engineering. The E2020 scholarship recognizes not only the academic accomplishments of the Scholars, but also the vision these Scholars have for creating a better world. Each Scholar brings unique experiences and talents, and collectively, they represent the promise of engineering to society."
Dr. Diane Rover, E2020 Principal Investigator and Professor, Electrical and Computer Engineering.

Program Development
First Semester: Focus on transitioning to Iowa State
Second Semester: E2020 Scholars Program Seminar - Overview of E2020 Pillars (ENGR 110X)
Third Semester: E2020 Scholars Program Seminar - Leadership & Systems Thinking (ENGR 210X)
Fourth Semester: E2020 Scholars Program Seminar - Innovation/Entrepreneurship & Global Awareness/Understanding (ENGR 210X)
Remaining Semesters: Capstone Experiences

Program Pillars
Programming has been developed around the NAE's vision of the Engineer of 2020. Four areas of focus have been identified within this vision and transformed into the four pillars of the program.

Student Demographics

2009-2010 Cohort	Gender	Ethnic Minorities	Scholars Received
110X/Year	4 Women, 12 Men	5	12 First Year**
210X/Year	7 Men	None	1 Transfer**
Total			13 Total

*One student was a minor in STEM, but not College of Engineering. One student is deceased.
**Students left school.

2010-2011 Cohort	Gender	Ethnic Minorities	Scholars Received
210X/Year	7 Women, 13 Men	4	13 First Year
110X/Year	1 Woman, 3 Men	None	1 Transfer
Total			14 Total

E2020 Scholars represent nine different states.

Student Success
An overwhelming majority of E2020 Scholars agree the Program

- was a positive experience.
- supported their growth as a person.
- enhanced their educational experience.
- fit well with their courses.
- helped them feel better prepared to succeed in college.

Students expressed that the pillars had

- expanded their perspective on the field of engineering
- gave them a greater appreciation for the complexity of engineering
- allowed them to see common threads across their classes

Students agreed the peer mentors, program coordinators, and faculty were helpful and appreciated the sense of community created by the program.

Based on the E2020 Scholar survey administered by Iowa State's Research Institute for Studies in Education (RISE).

Leadership
Includes teamwork, communication and service

Systems Thinking
Includes interdisciplinary engineering design

Innovation and Entrepreneurship
Includes creativity and planning

Global Awareness and Understanding
Includes cultural adaptability

E2020 Team
Principal Investigator: Diane Rover
Co-Principal Investigators: Michael Bruning, Michael Laingen, Michael Shelley
Faculty Advisors: Paul Mickelson, T. Brumm, C. Rumann, J. Pontius, R. Cooper
Staff Advisors: Dr. Diane Rover, E2020 Principal Investigator and Professor, Electrical and Computer Engineering.

NSF Grant No. 0807051
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An overview of the E2020 Program has also been accepted as a work-in-progress paper to the Frontiers in Education Conference next fall:

M. Bruning, D. Rover, and A. Williams, "Work in Progress – Developing Engineers for 2020 – An Innovative Curricular and Co-Curricular Approach", to appear *ASEE/IEEE Frontiers in Education Conf.*, October 2011.

Systems thinking and leadership curriculum development activities were published and presented at conferences during year 3:

C. Rehmann, D. Rover, M. Laingen, S. Mickelson, and T. Brumm, "Introducing Systems Thinking to the Engineer of 2020," *ASEE Annual Conference*, Vancouver, BC, Canada, June 2011.

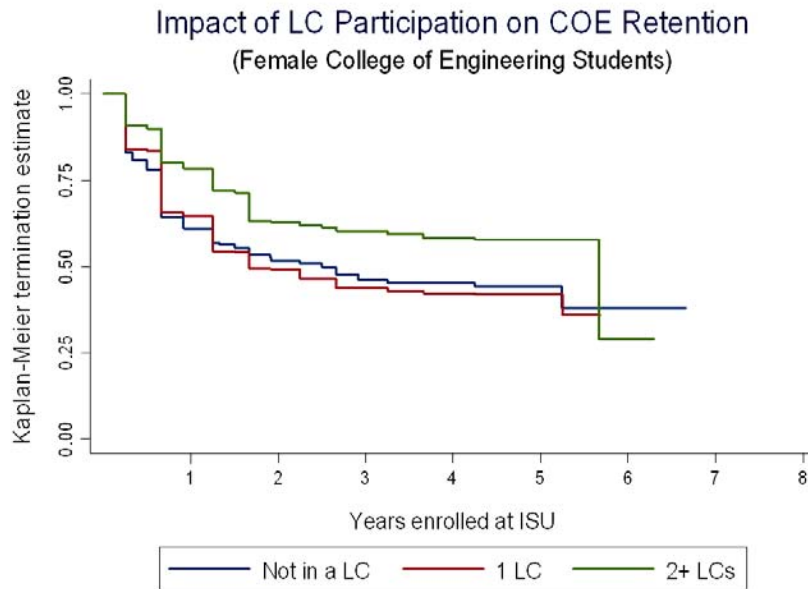
K. Athreya, N. Bhandari, M. Kalkhoff, D. Rover, A. Black, E. Miskioğlu, and S. Mickelson, "Engineering Leadership Program: A Thematic Learning Community", *Proc. 40th ASEE/IEEE Frontiers in Education Conf.*, session, October 2010.

SEEC Project Findings

The SEEC project, an NSF STEP grant that began in 2007, is a collaboration between ISU and Des Moines Area Community College (DMACC). The project's goal is to increase the number of engineering graduates at Iowa State by 100 per year, to approximately 900 graduates annually. Included within this goal are increases in the percentages of women and minority graduates in engineering at ISU and the number of pre-engineering students at DMACC. The project is on track to exceed 900 graduates. ISU Institutional Research predicts 891 and 992 engineering graduates in the graduating classes of 2011-12 and 2012-13, respectively. During the project, engineering has seen a significant improvement in first-year retention of Iowa community college students. The five-year average for learning community retention from 2000-2004 was 77.5% for students direct from high school and 55.3% for Iowa community college transfer students. From 2005-2009, the percentages are 75.5% and 73.6%, respectively. Transfer students are supported prior to entering Iowa State through the Engineering Admissions Partnership Program (E-APP), created in 2008 as a SEEC project initiative. Pre-engineering community college students who sign up for Iowa State's Admissions Partnership Program (APP) are invited to join the E-APP Learning Community. Efforts to measure and document the "SEEC Effect" are underway. For example, in relation to transfer student success, various background characteristics, academic data, and student experiences are being analyzed and compared with specific attention to SEEC treatments, such as DMACC's pre-engineering orientation course and Iowa State's E-APP program.

The SEEC project Evaluation Team has collected and analyzed DMACC and ISU institutional data, combined with longitudinal student records (engineering basic program data, course enrollment data, and student retention data) to estimate and interpret statistical models showing which variables predict student retention in engineering or in another college at Iowa State. Among the most salient findings is that female students in engineering derive significant benefit from participating in multiple learning communities. Most engineering students are in one learning community, and the value-added is

particularly notable for women majoring in engineering who participate in additional learning community opportunities. The magnitude of this effect was determined using Kaplan-Meier survival estimates of the survival function, which compares the probability of different sets of students being retained in successive academic terms. The data show that women participating in more than one learning community are significantly more likely to be retained than are women participating in one or no learning communities. This effect is depicted in the graph below.



This finding is interesting in light of the E2020 Program requirement that scholars participate in a traditional learning community as well as the E2020 learning community.

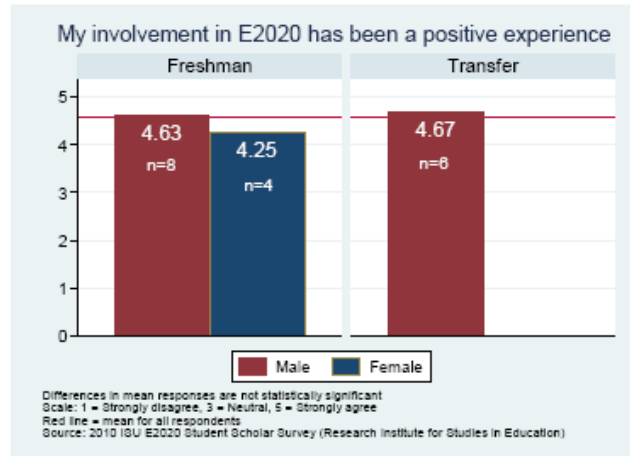
Evaluation Findings

Based on the E2020 Student Scholar Survey administered in 2010, student feedback after the first year of the program was quite positive, with 89% of student respondents agreeing (indicating either *Somewhat agree* or *Strongly agree*) that their involvement in the E2020 program: was a positive experience; supported their growth as a person; enhanced their educational experience; fit well with their courses; and helped them feel better prepared to succeed in college. A sample of the survey results excerpted from the report is shown below.

Q1: My involvement in E2020 has been a positive experience.

Response	Percent	n
Strongly agree	66.7%	12
Somewhat agree	22.2%	4
Neutral	11.1%	2
Somewhat disagree	0.0%	0
Strongly disagree	0.0%	0
Total		18

Prepared by RISE, Iowa State University



The survey also indicates that the four pillars have emerged as a particular area of strength for the program. Students in their comments expressed that the pillars had expanded their perspective on the field of engineering, given them a greater appreciation for the complexity of engineering, and allowed them to see common threads across their classes. Student evaluations of E2020 faculty staff were also very positive. When asked if the peer mentor, program coordinators, and faculty were helpful, not a single student disagreed. Average transfer student responses on survey items tended to be higher (more positive) than freshman responses, though the differences were not statistically significant. The fact that transfer student responses were generally as positive as freshman responses speaks well for the E2020 program's ability to integrate transfer students into the curriculum.

Four S-STEM program goals were articulated for E2020:

1. Improved educational opportunities for students:
To what extent do students demonstrate progress on E2020 learning outcomes?
2. Increased retention of students to degree achievement:
Do scholarship support, E2020 relevance to students, and learning community engagement increase retention?
3. Improved student support programs at institutions of higher education:
What is the benefit of complementary NSF STEP grant activities?
4. Increased numbers of well-educated and skilled employees in technical areas of national need:
What is the result of the E2020 focus and the concurrent goal of the NSF STEP grant to increase the number of engineering graduates?

Several of the findings suggest progress made toward achieving these four goals.