2011

Annual Report – Year Four

SEEC: Student Enrollment and Engagement through Connections

Report Period: 1 July 2010 – 30 June 2011

Report Prepared by:

*Diane Rover

Monica Bruning

Mary Darrow

Sandy Jennings Hammond

Kari Hensen

Dave Kissinger

Frankie Santos Laanan

Marcia Laugerman

Harry McMaken

Steve Mickelson

Andrew Ryder

Mack C. Shelley, II

*Contact for more information about the SEEC Program

This material is based on work supported by the National Science Foundation under Grant 0653236

DMACC
DES MOINES AREA COMMUNITY COLLEGE

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

SEEC Principal Investigators (PIs)

Diane Rover, ISU
Professor, Electrical and Computer Engineering

Harry McMaken, DMACC
Professor, Engineering and Math

SEEC Co-Principal Investigators (Co-PIs)

Monica Bruning, ISU
Senior Research Associate and Lecturer, Educational Leadership and Policy Studies

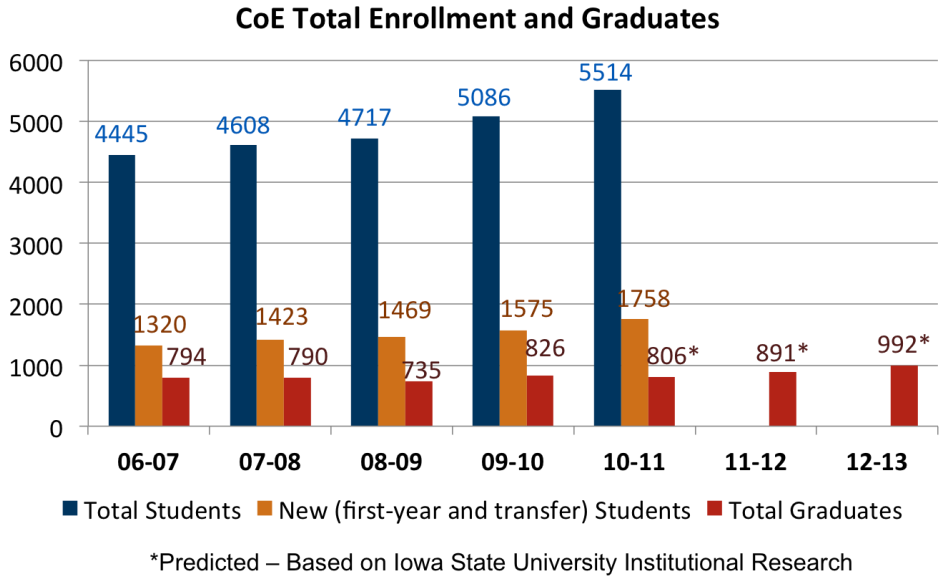
Frankie Santos Laanan, ISU
Associate Professor, Educational Leadership and Policy Studies
Co-director, Office of Community College Research and Policy

Steve Mickelson, ISU
Professor, Agricultural and Biosystems Engineering
Director, Center for Excellence in Learning and Teaching

Mack Shelley, ISU
University Professor, Political Science and Statistics

1. Project Overview and Progress

The STEM Student Enrollment and Engagement through Connections (SEEC) project, pronounced "seek," is a collaboration between Iowa State University (ISU) and Des Moines Area Community College (DMACC). The goal of the SEEC project 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 Iowa State and the number of pre-engineering students at DMACC. ISU Institutional Research predicts 891 and 992 engineering graduates in the graduating classes of 2011-12 and 2012-13, respectively, as shown in the graph below.

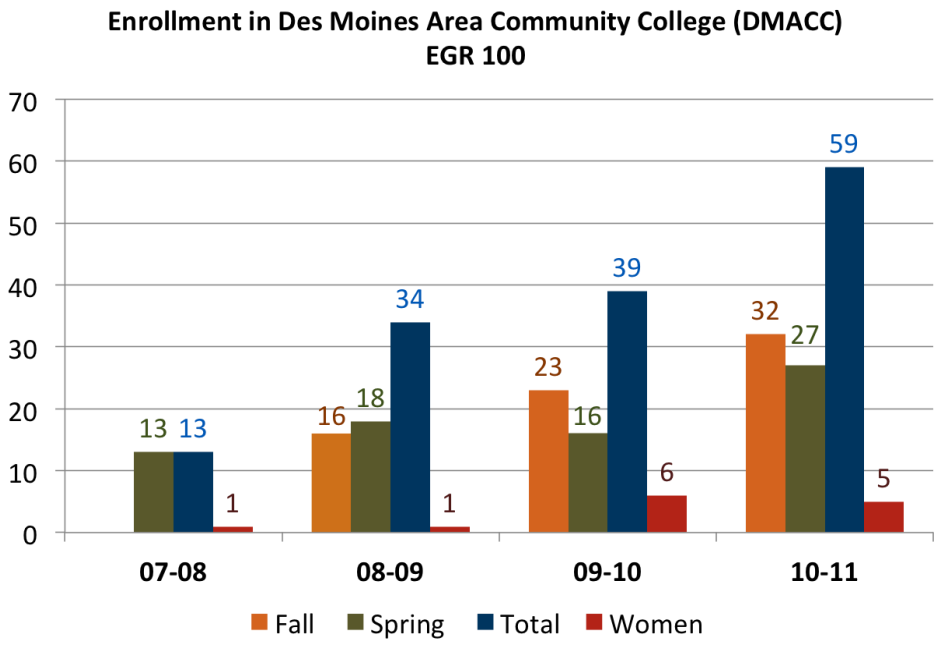


Data since 2006-07, projected out to 2012-13, for the College of Engineering (CoE) illustrate the upward trend in total undergraduate engineering enrollment and new student enrollment (including transfer students). The percentage increase in enrollment from fall 2009 to fall 2010 was 8.4%; this compares with a fall 2010 increase of 5.4% nationally as reported by ASEE for undergraduate engineering enrollment (*ASEE Connections*, May 2011). Results expected from the SEEC project are gradually being realized with the continued efforts of project partners and collaborators.

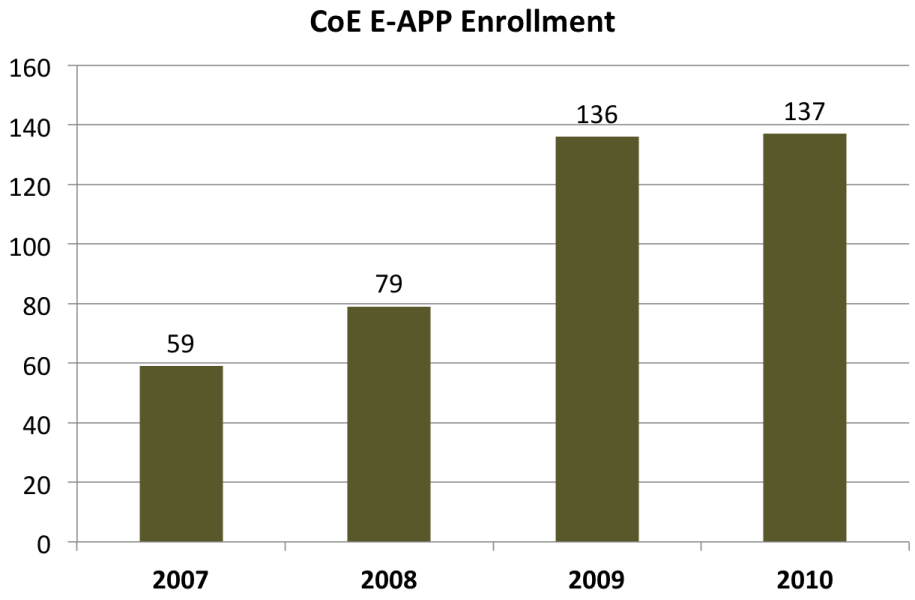
Pre-engineering student enrollment at DMACC is also increasing as shown in the table below.

Pre-engineering Students	2008-09	2009-10	2010-11*
Total	42	153	198
Women	8	15	25
Minorities	10	18	33
* Does not include summer enrollment			

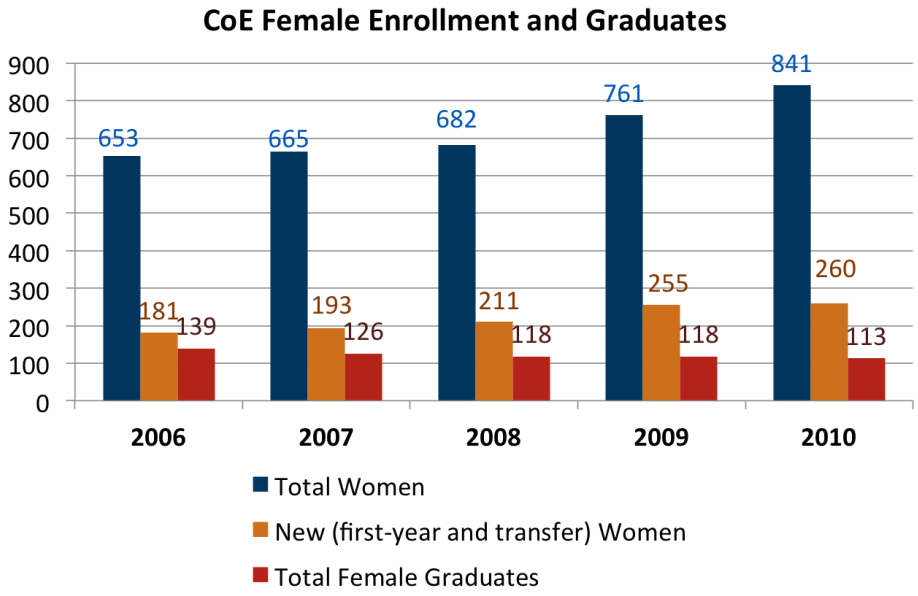
This trend is also seen in DMACC's engineering orientation course, EGR 100, as shown in the graph below. EGR 100 is now offered at several DMACC campuses. Although there is increasing interest in engineering by women students at DMACC, it has been harder to attract women to the course.

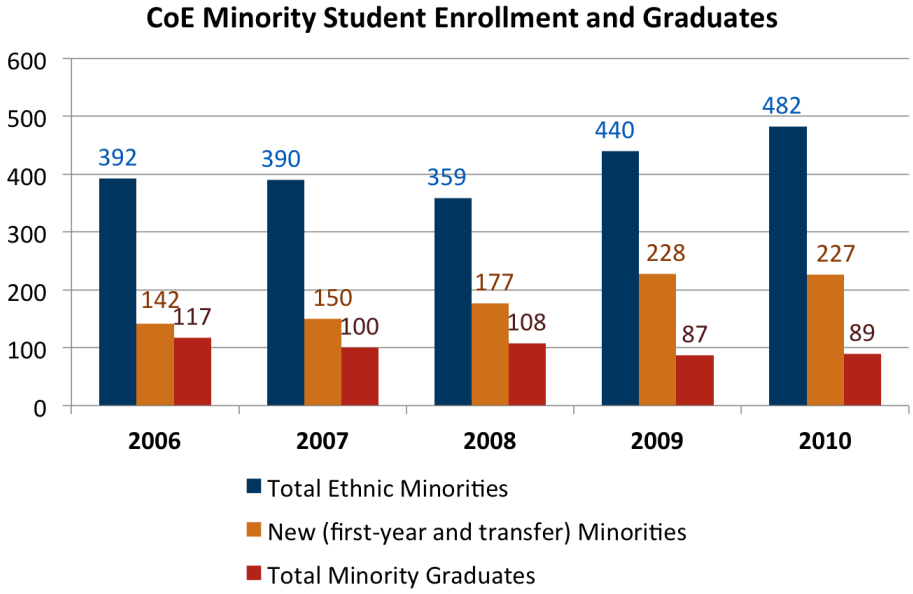


The increased interest in engineering by DMACC and other Iowa community college students is also reflected in enrollment in the Engineering Admissions Partnership Program (E-APP), created in 2008 as a SEEC project initiative. E-APP enrollment is shown in the graph below.



On the goal of increasing the *percentages* of women and minority graduates in engineering at Iowa State, the percentage data have remained mostly flat. Absolute enrollment numbers have increased, as shown in the graphs below. These increases have not been proportionally greater than the overall increases. There have been exceptions, such as a notable percentage increase in new women students in fall 2009.





The total enrollment and number of graduates are influenced by retention as well as new student enrollment. The CoE has seen a significant improvement in first-year retention of Iowa community college students. The five-year average for first-year 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 were 75.5% and 73.6%, respectively.

Efforts to measure and document the effect of SEEC project activities on these results (i.e., the "SEEC effect") are underway. SEEC effect evaluation includes quantitative and qualitative methodological approaches. 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.

Progress toward project goals has been achieved through six main objectives of the SEEC project as defined below.

O1. **Learning Village**. To build a learning village that enhances student engagement and creates ISU connections for community college pre-engineering transfer students.
O2. **Connected Curriculum**. To enhance first- and second-year learning experiences, with an emphasis on student success and engagement and classroom climate.
O3. **Student-centered Advising**. To develop and enhance academic advising and mentoring programs for precollege, community college, and university students.
O4. **Coordinated Networking**. To establish a recruiting and outreach network across Iowa to tap into diverse communities of students, and to improve the awareness and understanding of engineering among those who influence student choices.
O5. **Evaluation**. To evaluate project effectiveness and improve project activities.
O6. **Dissemination**. To share best practices on campus in other areas of STEM, with other community colleges in Iowa, with other institutions, and at national meetings.

The objectives of the SEEC project are being addressed through a set of recruitment, retention, and engagement activities associated with developing the community, curriculum, advising, and networking components of the project. Both recruitment and retention goals are supported by project components related to objectives O1-O3 (community, curriculum, and advising). Recruitment goals are primarily supported by the networking component of objective O4. SEEC project activities and outcomes associated with each of these objectives have been coordinated using a logic model approach.

2. Participants

Table 1 lists SEEC project participants for 2010-2011, along with their project role, time involvement, and objective team involvement.

Table 1

*SEEC Project Participants, Year Four (2010-2011)**

Participant	Institution	Project Role	>160 Hours	Objective Teams				
				L	C	A	N	E
Diane Rover	ISU	Principal Investigator	Yes		LE			
Harry McMaken~	DMACC	Principal Investigator	Yes	CO	CO			
Monica Bruning~	ISU	Co-Principal Investigator	Yes				LE	
Frankie Santos Laanan~	ISU	Co-Principal Investigator	Yes			LE		
Steve Mickelson~	ISU	Co-Principal Investigator	Yes	LE	CO			
Mack Shelley~	ISU	Co-Principal Investigator	Yes				CO	LE
Mary Darrow~	ISU	Senior Personnel	Yes	CO	CO	LE	CO	
Sandy Jennings-Hammond~	ISU	Senior Personnel	Yes	CO	CO	CO	CO	
Mani Mina~	ISU	Senior Personnel	No	CO	CO			
Derrick Rollins	ISU	Senior Personnel	No				CO	
Andrew Ryder~	ISU	Senior Personnel	No	CO			CO	CO
Karen Zunkel~	ISU	Senior Personnel	No		CO		CO	
Dimitra Jackson~	ISU	Postdoctoral Associate	Yes			CO		
Derek Groenendyk~	ISU	Graduate Assistant	No		CO			
Zayira Jordan~	ISU	Graduate Assistant	Yes				CO	
Mark Laingen~	ISU	Graduate Assistant	Yes	CO	CO	CO		
Marcia Laugerman~	ISU	Graduate Assistant	Yes	CO				CO
Carlos Lopez~	ISU	Graduate Assistant	Yes			CO		
Greta Schmalle~	ISU	Graduate Assistant	No		CO			
April Walker~	ISU	Graduate Assistant	Yes				CO	
Virginia Anderson	ISU	Collaborator	Yes					
Tom Brumm	ISU	Collaborator	No		CO			
Holly Bignall	ISU	Collaborator	No				CO	
Paul Castleberry	ISU	Collaborator	No	CO	CO			
Lora-Leigh Crystal	ISU	Collaborator	No	CO			CO	
Nancy Franz	ISU	Collaborator	No				CO	
Beth Hartmann~	ISU	Collaborator	No		CO			
Carol Heaverlo	ISU	Collaborator	No				CO	
Doug Jacobson~	ISU	Collaborator	No		CO			
Joel Johnson	ISU	Collaborator	No			CO	CO	
Amy Kaleita~	ISU	Collaborator	No		CO			
Donna Le	ISU	Collaborator	No			CO		
Jason Pontius~	ISU	Collaborator	No	CO				CO
Chris Rehmann~	ISU	Collaborator	No		CO			
Jay Staker	ISU	Collaborator	No				CO	
Ahmed Ageyman	DMACC	Collaborator	No			CO		
Randy Gabriel	DMACC	Collaborator	No				CO	
Kari Hensen	DMACC	Collaborator	Yes	CO	CO	CO		

Randall Jedele	DMACC	Collaborator	No	CO			
Dave Kissinger	DMACC	Collaborator	Yes				CO
Michael Lentsch	DMACC	Collaborator	No				CO
Randy Mead	DMACC	Collaborator	No				CO
Les Pearery	DMACC	Collaborator	No		CO		
Sokish Sands	DMACC	Collaborator	No				CO
Randy Smith	DMACC	Collaborator	No	CO	CO		
Jim Stick	DMACC	Collaborator	No	CO	CO	CO	
Aubrey Brouillette~	ISU	K-12 Role Model	No				CO
Tracy Hansen~	ISU	K-12 Role Model	No				CO
Breanna McKown~	ISU	K-12 Role Model	No				CO
Andrea Dvorak~	ISU	Peer Mentor	No	CO			
Lauren Gabel~	ISU	Peer Mentor	No	CO			
Kelsey Groff~	ISU	Peer Mentor	No	CO			
Maria Hannasch	ISU	Peer Mentor	No	CO			
Amanda Homan~	ISU	Peer Mentor	No	CO			
Kimberly Kehoe~	ISU	Peer Mentor	No	CO			
Mary Krull~	ISU	Peer Mentor	No	CO			
Malaika Muvundamina~	ISU	Peer Mentor	No	CO			
Annie Olson~	ISU	Peer Mentor	No	CO			
Amanda Oswald~	ISU	Peer Mentor	No	CO			
Rachel Pearson~	ISU	Peer Mentor	No	CO			
Hannah Rundell~	ISU	Peer Mentor	No	CO			
Kathryn Russell~	ISU	Peer Mentor	No	CO			
Kathryn Schlichting~	ISU	Peer Mentor	No	CO			
Rachel Schmidt~	ISU	Peer Mentor	No	CO			
Halli Winter~	ISU	Peer Mentor	No	CO			
Cimone Wright~	ISU	Peer Mentor	No	CO			

*Maximum of 25 participants are allowed to be entered into NSF Fastlane System
~Received grant funds
Note: L=Learning Village, C=Curriculum, A=Advising, N=Networking, E=Evaluation; LE=Leader, CO=Contributor/Collaborator

2.1 Partnering Organizations

DMACC is the only external organization partnering and participating in the SEEC grant with ISU.

2.2 Internal and External Advisory Groups

ISU Institutional Advisory Board (Internal to ISU)
Chair: Elizabeth Hoffman, *Executive Vice President and Provost*
Sandy Gahn, *Senior Research Analyst*, *Institutional Research*
Doug Gruenewald, *Co-Director, Learning Communities*
Connie Hargrave, *Associate Professor, Curriculum and Instruction and Center for Technology in Learning and Teaching*
Thomas Hill, *Vice President of Student Affairs*
Mary Holz-Clause, *Associate Vice President, Extension and Outreach*
Gary Mirka, *Associate Dean and Professor, Industrial and Manufacturing Systems Engineering*

DMACC Institutional Advisory Board (Internal to DMACC)
Chair: Kim Linduska, *Executive Vice President for Academic Affairs, Ankeny Provost*
Ahmed Ageyman, *Academic Advisor*
Randy Mead, *Executive Dean for Program Development*
Randy Smith, *Professor and District Chair of Mathematics*
Carol (Renee) White, *Professor, Civil Engineering Technology*
Laurie Wolf, *Executive Dean for Student Services*

External Advisory Board
Chair: Jim Melsa, *Professor & Dean Emeritus, ISU College of Engineering*
Kimberly Douglas-Mankin, *Director, Women in Engineering & Science Program, Kansas State University*
Robert Driggs, *Dean of Mathematics & Science, Kirkwood Community College*
Leigh Hagenson Thompson, *Technology Manager & Project Leader, The Dow Chemical Company*

2.3 Other Collaborators

The SEEC project collaborates with several ISU offices and programs outside of the College of Engineering. SEEC partners include:

- E-SET (ISU Extension)
- Program for Women in Science and Engineering (PWSE)
- Office of Admissions
- Office of Community College Research and Policy (OCCRP)
- Office of Financial Aid
- Office of the Registrar
- Research Institute for Studies in Education (RISE)
- ISU Learning Communities
- ISU GIS Facility
- Iowa Department of Education
- Project Lead the Way, Iowa
- Iowa 4-H Clubs

3. Activities and Findings

Year four activities and findings, organized by objective, are summarized in this section. These reports were prepared by team leaders and describe various aspects of the project.

3.1 Learning Village

The Learning Village focused on three efforts in year four of the SEEC project. The sections below (A, B, and C) summarize these efforts and the related activities and findings.

A. Expand/enhance the Learning Village concept.

- Activities
    - The E-APP webpage and an online brochure were developed.
      http://www.eng.iastate.edu/transfer/app
      http://www.eng.iastate.edu/transfer/app/EAPPBrochure.pdf
    - The E-APP Learning Community was formed in August 2010.
    - The Engineering Transfer Student Questionnaire (E-TSQ) was administered through OCCRP.
    - Team members presented the following paper at the ASEE Annual Conference and Exposition in Vancouver, B.C. Canada, June 26-29, 2011: "Characteristics of Community College Transfer Students that Successfully Matriculate and Graduate in Engineering"

- Findings
    - DMACC EGR 100 perceptions of engagement and transfer readiness were reported.
    - Engineering transfer student data per semester were collected, including community college, student demographics, basic program grades, community college grade point average, gender, and ethnicity.
    - Data for direct-from-high-school students and new transfer students were compared, and basic program and placement data for community college transfer students were assessed to determine predictors of student success.
    - Attendance and demographics of community college students attending the ISU Engineering Career Fair, APP Days, Transfer Student Days, SEEC-Learning Village transfer student events/activities were recorded.
    - ISU engineering retention data were recorded and analyzed over time using comparison groups: Admissions Partnership Program vs. non-Admissions Partnership Program, Learning Community vs. non-Learning Community, etc.
    - E-APP participation was sustained from 09-10 to 10-11.

B. Enhance/expand the LC model at DMACC and ISU.

- Activities
    - DMACC created new Learning Community links: Calculus I and Physics I; Calculus II and Physics II; Engineering Graphics and English I.
    - A pre-engineering communication network was established at DMACC.
    - EGR 100 was expanded to be offered at the DMACC campus in Boone, Iowa.
    - Admissions, retention, basic program course success, learning community participation and placement data were presented to DMACC faculty, staff and administration.

- Findings
    - DMACC Learning Community participation was tracked.
    - DMACC's enrollment in EGR 100 grew from 39 in 09-10 to 59 in 10-11.
    - Learning Community participation increased within the College of Engineering at ISU to 85.8% or 1395 first-year, full-time students.
    - Learning Community participation for new transfer students dropped from 37.7% in fall 2009 to 31.8% in fall 2010.
    - The one-year retention rate among learning community participants for fall 2010 was 80% for all Iowa community college transfer students starting in engineering, exceeding the rate of 76% for direct from high school students starting in engineering.

C. Develop informational materials with the Advising Team.

- Activities
    - Advising and learning community recommendations and tools were drafted based upon student success data (validation and dissemination in progress).
    - SEEC Data Briefs were prepared that highlight Learning Village and Advising initiatives.
        - SEEC Data Brief: Engineering Admissions Partnership Program (E-APP), November 2010
        - SEEC Data Brief: Engineering Orientation (EGR 100), November 2010
        - SEEC Data Brief: Measuring the "SEEC Effect:" Engineering Transfer Student Retention & Success, March 2011
- Findings
    - Various findings are documented in the informational materials.

3.2 Connected Curriculum

The thrust for the curriculum objective during year four was to enhance first- and second- year (lower-division) learning experiences with an emphasis on student development, engagement, and success. Activities related to curriculum during 2010-11 include:

- Course offerings that provide pre-engineering and engineering students with key learning experiences and professional development (e.g., ENGR 110X and 210X E2020 courses, bioengineering minor courses, and DMACC's EGR 100 course).
- Department interest in the transfer student transition and curricular aspects (e.g., transfer learning communities, sophomore courses, and 2+2 programs).
- Contributions to a university-wide student success summit.
- Continued SEEC project emphasis on data analysis of students' academic performance and success related to the Engineering Basic Program and lower-division academic experience.

The SEEC curriculum component coordinates with Iowa State's NSF S-STEM-funded E2020 Scholars Program. This program offers scholarships for cohorts of undergraduate engineering students, giving specific attention to the aspirations and attributes of the National Academy of Engineering's (NAE) vision for the engineer of 2020. The project outlined a set of student development and learning opportunities consistent with this vision to be integrated into curricular and co-curricular activities: leadership development, global awareness and understanding, systems-thinking, and innovation. The scholarship program promotes student engagement and development centered on these E2020 outcomes. The program provides scholars an opportunity to develop a community of practice with other scholars, upper-division peer mentors, and engineering faculty who share a common interest in developing

competence related to these four pillars. The program builds on Iowa State's strong learning community initiative by having the scholars participate 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). After the first year of the program, student feedback 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.

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.

During the second semester of the program, scholars participate in a seminar course (ENGR 110X) that introduces them to each of the four pillars. A three-week learning format is used for introducing each pillar. The first week introduces the students to knowledge content related to the pillar (e.g., tools introduced in the systems thinking pillar included rich pictures, causal loop diagrams, and behavior-over-time graphs). 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.

In their second year of the E2020 program, fall and spring semester seminar courses (ENGR 210X) provide more in-depth investigation into the pillars. Each semester-long course is split into two halves and is designed to address pillars through the KSA model introduced in the freshman seminar class (ENGR 110X). Each pillar is organized into KSA segments during the seven-week instruction. 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. 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.

The E2020 curriculum initiative was presented as a poster at Iowa State's Student Success Summit in March 2011 (http://www.ucs.iastate.edu/mnet/studentsuccess/). The summit provided an opportunity to share information about the SEEC and E2020 projects with others on campus. SEEC team members participated in planning for the summit and several SEEC-sponsored and SEEC-related activities were presented at the summit. For example, there were sessions on two systems that are being implemented university-wide:

- MAP-Works: During fall 2009, SEEC team members and college staff, in coordination with university retention initiatives, the Provost Office, and Student Affairs, piloted the use of MAP-Works (http://www.map-works.com/) in engineering through learning communities and first-year programming. MAP-Works is used by academic advisors to complement other established early-intervention activities in the college.
- ALEKS: During 2010, SEEC team members, in coordination with the Math Department and other university offices, acquired a new math placement exam called ALEKS (http://www.aleks.com/). ALEKS was used during summer orientation with the fall 2010 incoming students.

Findings from the curriculum development activities described above were reported in the following publications:

- J. Pontius, R. Cooper, C. Rumann, "E2020 Student Scholar Survey," Research Institute for Studies in Education, 2010.
- 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.
- 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.

3.3 Student-Centered Advising

The primary objective for the Student-Centered Advising Team is to develop and enhance academic advising and mentoring programs for pre-college, community college, and university students. Activities for 2010-11 have focused on four areas: A) a data system to track student success, B) professional development for DMACC and ISU advisors, C) transfer advising materials, and D) a transfer mentoring and intervention program. These are elaborated on below.

A. Develop a data system that informs program development to foster student success in engineering.
   - Activities
     - Team members implemented a new Engineering Transfer Student Questionnaire (E-TSQ) administered to all community college transfer students entering the College of Engineering in 2009-10 or 2010-11. The E-TSQ includes survey questions in the following areas: Community College Experiences, Iowa State Experiences, Engineering Programming.

   - Findings
     - The SEEC Advising Team developed and disseminated two SEEC Data Briefs to inform transfer student programming.
       - SEEC Engineering Transfer Student Profile, July 2010, http://www.eng.iastate.edu/seec/reports/SEEC_Transfer_Profile.pdf
       - Measuring the SEEC Effect – Engineering Transfer Student Retention & Success, March 2011, http://www.eng.iastate.edu/seec/events/SEEC_Effect_3.22.11.pdf

B. Provide professional development to community college pre-engineering and ISU advisors and faculty.

- Activities
    - Ongoing data on transfer student academic performance are disseminated and discussed to help inform advisors when they meet with transfer students for curriculum planning.
    - Engineering advising resource packets were distributed to all DMACC campuses through one-on-one and small group visits with advisers.

- Findings
    - Student services and academic advising for transfer students has improved in the engineering college and departments through training for ISU advisors to enhance their understanding of factors that affect the academic and social integration of community college students.

C. Develop/implement transfer advising materials and communications for/with community college stakeholders.
- Activities
    - The College of Engineering transfer website was updated. http://www.eng.iastate.edu/transfer/
    - The Advising Team worked with the Learning Village Team on the E-APP website and brochure.
    - The Pathway to STEM website and Transfer Student Guide (TSG) are in the final development stage. These are products of the Office for Community College Research and Policy, a SEEC project partner. The website provides detailed information for prospective community college students to learn about the STEM pathway. Information about specific majors in STEM as well as academic preparation and transfer/articulation information are provided. Resources for students, faculty and advisors at the community college are components of the Pathway website. The TSG includes eight chapters on topics such as: role of community colleges, crossing the transfer bridge into STEM, understanding transfer, building the transfer bridge, understanding the articulation puzzle, financing your education, and after you cross the transfer bridge. In addition to the website, educational videos highlight the experiences of community college students and transfer students in STEM majors as well as two-year faculty. The goal of the videos is to educate a diverse audience, especially community college students, about the strategies to successfully transfer from a two-year to a four-year STEM degree. www.pathway2stemdegree.org
    - The Advising Team is working with the Learning Village team on informational materials to inform programming and transfer advising messaging based on student success data.

D. Develop/implement a mentoring and transfer intervention program.
- Activities
    - An E-APP Transfer Peer Mentor Program was implemented as a part of the E-APP Learning Community.

Various events for transfer students were offered by the College of Engineering in partnership with the SEEC project; several are listed at the project website. Findings from advising-related activities were disseminated during year 4 by team members Laanan, Darrow and others; papers and presentations are listed in the Dissemination section.

3.4 Coordinated Networking

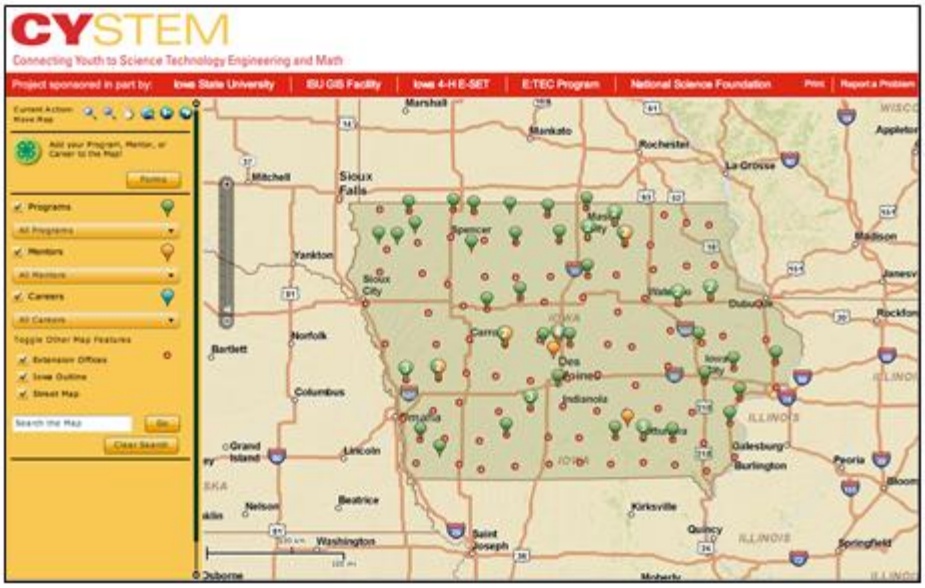
The Coordinated Networking activities during year 4 of the project continued to develop and implement recruiting initiatives with key partners, including ISU Extension, ISU Admissions, and the ISU Program for Women in Science and Engineering (PWSE). Relationships were also maintained with several state and national organizations that promote STEM workforce development and diversity.

The SEEC project partnered with ISU Extension and ISU Admissions to continue developing and offering the Engineering Talent in Every County (E-TEC) program. E-TEC provides $500 scholarships to incoming first-year and community college students. This 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. Applications for E-TEC scholarships increased as shown in the table below. There are 99 counties in the state of Iowa, and the goal is to increase awareness about engineering across all counties. Each year there has been about 25% more counties in submitted applications.

	Fall 2009	Fall 2010	Fall 2011
Total Number of Applicants	**57**	**51**	**116**
Gender			
Women	7	9	22
Men	50	42	94
Ethnicity			
African American	1	3	1
American Indian or Alaskan Native	0	1	0
Asian	2	2	4
Hispanic/Latino	1	1	1
Multi-racial	1	0	3
White	46	43	93
Not available	6	0	14
Number of IA Counties Represented	**29**	**38**	**50**
Number of Transfer Schools Represented			
Two-Year	1	NA	9
Four-Year	3	NA	4

The E-TEC program involves close collaboration with ISU Extension to implement programs to improve awareness, understanding, and interest in engineering in every county in Iowa. With ISU Extension, the SEEC project has piloted a web and GIS database repository of Iowa STEM programs, mentors, and professionals, as shown in the screen image below. It was demonstrated at the 2010 Iowa State Fair. Approximately 20,000 persons visited the ISU Extension booth at the state fair.

http://ags.gis.iastate.edu/cystem



Efforts are underway to populate the database with information about STEM programs, mentors, and professionals. To further facilitate E-TEC goals, a mini-grant program was created for 4-H leaders, adult volunteers, and STEM teachers to increase awareness and understanding about engineering with special emphasis on under-served populations. A total of $8000 in mini-grant funds was awarded.

Information resources, collectively referred to as Personal Engineering Recruiting Kits (PERKits), have been assembled and are used by Extension staff, admissions representatives, ISU/DMACC alumni, teachers/professors, and family/parents. This year, notices about electronic PERKits were sent to over 250 youth field specialists, math and science teachers, academic advisors, and outreach and recruitment volunteers. The SEEC project and its partners distributed 100 print PERKits to 4-H field staff, 50 print PERKits during school visits by peer mentors in PWSE, and over 30 PERKits at parent/teacher workshops.

The SEEC project has partnered with PWSE on various activities to recruit women into engineering and to promote an understanding of engineering through the NAE's Changing the Conversation. As a part of SEEC initiatives, PWSE employed undergraduate students with the goal of connecting ISU undergraduate STEM females with two distinct audiences: 1) prospective and new transfer women in STEM fields and 2) youth across the state. Undergraduate STEM peer mentors hosted individualized visits with prospective transfer students and connected with enrolled STEM transfer women through the WISE learning communities. In addition to having one-on-one meetings as a part of the learning community, transfer women in STEM were able to participate in small group events (such as attending networking events with professional women in STEM and job shadowing female STEM professionals in the workplace). SEEC funds were used to enhance and expand visits by undergraduate student role models. Student role models visited classrooms across the state of Iowa – reaching over 5000 students. SEEC funds allowed PWSE to reach additional classrooms and were used to provide multiple visits with an afterschool program targeting African-American middle school girls. In all the visits, PWSE incorporated the messaging from the Changing the Conversation work that has been integrated into the networking initiatives of SEEC.

3.5 Des Moines Area Community College (DMACC)

DMACC and ISU continue to work collaboratively across the objectives of the SEEC project. DMACC also has the goal of increasing student participation and interest in engineering with emphasis on racial and ethnic minority and female students. This goal is achieved through efforts to increase enrollment in its Pre-Engineering Academic Program and to improve the rate at which DMACC students transfer to four-year college programs.

During year 4, DMACC sponsored two events to encourage student engagement in engineering study and interest in engineering careers. Plans are for both events to become recurring opportunities at DMACC. The first event, Explore Engineering Day, was held in Fall 2010 and targeted DMACC students with an ACT score of 23 or higher, who enrolled in an academic program that requires skills similar to those needed in engineering disciplines (i.e., architectural technology, computer aided design, manufacturing technology), and have taken courses often completed by students in engineering (i.e., calculus, classical physics, biology). The event featured table talks with minority, women, and professional engineering mentors, informational tables and booths, and the opportunity to speak with representatives of professional engineering societies representing minorities in engineering disciplines. Underrepresented students were recruited through DMACC deans and the Provost, faculty members in selected programs and courses, and other students. Women were encouraged to attend and invited to bring a female friend with whom they were paired for the day's events. In total, 67 students attended Explore Engineering Day, including 12 women.

The second event, Discover Engineering Day, was held in Spring 2011 and targeted high school students and their parents interested in beginning postsecondary education at DMACC. The event featured an introduction to careers in engineering, educational and vocational presentations, interactive sessions by ISU engineering faculty, staff, students, and professional engineers, and a speaker discussing how to navigate various educational pathways for engineering majors. Participating high school students were also able to meet with a DMACC Career Advantage Advisor about educational and vocational plans. Underrepresented students were recruited through current students and parents, high school counselors, high school math and science teachers and talented and gifted leaders. Female students who registered were encouraged to bring a female friend to the event. In total, 127 students and 88 parents attended Discover Engineering Day, including 28 women.

During year 4, the engineering curriculum was expanded to include the DMACC campus in Boone, Iowa. A full set of courses were offered for the first time during the 2010-2011 academic year. New sections of all engineering courses were added at the Ankeny campus so that all courses were available each semester. Expansion is next planned for the Urban (Des Moines) and West (West Des Moines) campuses.

Also, a new physics laboratory was added to the Hunziker Career Academic Center in Ames, Iowa. This new facility will allow DMACC to better serve students currently enrolled at ISU. DMACC can now provide small section alternatives to many of the large lecture gateway courses taught at ISU in a location convenient for the ISU students. This will have a direct impact on retention of these students in engineering.

DMACC's efforts in the past four years have resulted in an increased participation in EGR 100, the pre-engineering orientation course, growing from 13 students in 2007-08 to 39 students in 2009-10 to 59 students most recently in 2010-11. Additionally, enrollment in Pre-Engineering Programs has also

expanded, from 42 students in 2008-09 (including eight women) to 198 students in 2010-11 (including 25 women and 33 minority students).

3.6 Evaluation

The work of the Evaluation Team intersects with all facets of SEEC, helping facilitate all research and evaluation activities involving students as the primary contact with the Office for Responsible Research and the ISU Institutional Review Board; and melding institutional data from DMACC and ISU with additional data collected through surveys, focus groups, and other processes. Evaluation plays a synergistic role with student-related initiatives for engineering recruitment and retention, including SEEC, E-TEC, and E2020.

The Evaluation Team worked to prepare and analyze DMACC and ISU institutional data, combined with longitudinal student records (engineering basic program data, course enrollment data, and student retention data) to help estimate and interpret statistical models showing which variables predict transfer student retention in engineering or in another college at Iowa State University. 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. It is worth noting that 86% of all undergraduates in the College of Engineering at ISU participate in at least one learning community and that Iowa State has received national recognition for the quality of its learning community programs.

The Evaluation Team worked in a facilitative and collaborative manner with the Coordinated Networking Team and members of ISU Extension to strategize a detailed evaluation of the statewide impact of the Engineering Talent in Every County (E-TEC) program. The evaluation plan includes tracking usage data for the E-TEC website to learn how university and county-based staff utilize program materials. Additionally, the Evaluation Team worked with the Coordinated Networking Team and with ISU's Office of Institutional Research to add a supplemental institutional question to the ISU Cooperative Institutional Research Program survey for Fall 2011 regarding students' points of contact with Extension and other areas of ISU. The question wording is:

> Did participating in any of the following influence your decision to attend Iowa State? (Check all that apply; if none apply, leave unmarked.)
>
> - ☐ E-TEC (Engineering Talent in Every County) scholarship or engineering career information from website, teachers, counselors, 4-H leaders, others
> - ☐ 4-H Science Programs
> - ☐ First Lego League
> - ☐ State Science and Technology Fair of Iowa
> - ☐ Program for Women in Science and Engineering programs (i.e. Taking the Road Less Traveled Career Conference for Girls, Student Role Model Classroom Visits, Girl Scouts, etc)

During spring 2011 joint ISU/DMACC meetings (team and advisory board meetings involving board members, principal investigators, and other team members), key evaluation findings from the past year were presented. Faculty and staff at DMACC have noticed an increasing number of women enrolling in pre-engineering. Data suggest that community college transfer students see a big retention advantage when completing engineering basic program courses at DMACC within three semesters. However, if

they take more than three semesters to finish, the advantage dissipates, perhaps because math, physics, or other science skills have atrophied. Other significant results included the importance of undergraduate student peer mentors to the effectiveness of ISU's program. This finding has encouraged team members at DMACC to consider how they might involve student peers in their pre-engineering programs. Information was also presented detailing the episodic nature of educational experiences of DMACC and transfer students who have multiple competing interests outside of schooling.

Discussions with and feedback from the advisory boards continued to assist the project with evaluation and planning, especially in relation to sustainability. SEEC Internal Advisory Board meetings were held on December 3, 2010, and May 23, 2011. The December 3 meeting was a joint meeting of the ISU and DMACC boards. Meeting documents are shared internally on an intranet site, and agenda and minutes are posted to the project website.

- http://www.eng.iastate.edu/seec/events/minutes-iboard-Dec10.pdf
- http://www.eng.iastate.edu/seec/events/agenda-iboard-May11.pdf

A SEEC External Advisory Board meeting is scheduled for July 2011 due to travel conflicts for team and board members in May and June.

3.7 Dissemination

Dissemination has expanded as the project matures. A web presence is indicated by tracking results on the main website and other affiliated pages. Further, information on SEEC activities and findings has been shared in numerous publications as well as national and local presentations in the past year.

The SEEC project website (http://www.eng.iastate.edu/seec/) continues to serve as the portal on the project's progress for team members, advisory board members, and other interested parties. It also provides resources related to the project. The site saw over 500 unique visitors in year four of the project, with 47% of these users being returning visitors. Visitors spend an average of just over two and a half minutes per visit on the site and view, on average, two to three pages. The Resources and Team Members pages captured the number two and three spots respectively after the SEEC home page for most visited. The Big 12 STEP Network page (http://www.eng.iastate.edu/seec/big12step.shtml) has been viewed 33 times, and visitors spent an average of nearly two minutes on the main page for this section.

The SEEC project e-newsletter *Connections* serves as a source of project information and activities (http://www.eng.iastate.edu/seec/newsletter.shtml). *Connections* was published twice in year four, in July 2010 and April 2011. The newsletter was sent to 17 advisory board members and 107 other stakeholders. A spike in SEEC website activity occurred when the newsletter was sent. This increase in readership, combined with evidence from the newsletter tracking system, showed that the newsletter helped drive traffic to the SEEC website.

Various publications, presentations, and meetings through which SEEC project activities and findings were disseminated in year four are listed below. Included in this listing are four data briefs published as an ISSN series in 2010-11.

Publications

In ISSN series:

- Laanan, F. S., Rover, D., Bruning, M., Mickelson, S., Shelley, M., Laugerman, M., Darrow, M., & Pontius, J. Measuring the "SEEC Effect:" Engineering transfer student retention and success. *SEEC Data Brief No. 4*. Ames, Iowa: Iowa State University. March 2011.
- Laanan, F. S., Rover, D., Bruning, M., Mickelson, S., Shelley, M., & Darrow, M. Engineering Orientation (EGR 100). *SEEC Data Brief No. 3*. Ames, Iowa: Iowa State University. November 2010.
- Laanan, F. S., Rover, D., Bruning, M., Mickelson, S., Shelley, M., & Darrow, M. Engineering Admissions Partnership Program (E-APP). *SEEC Data Brief No. 2*. Ames, Iowa: Iowa State University. November 2010.
- Laanan, F. S., Rover, D., Bruning, M., Mickelson, S., Shelley, M., & Darrow, M. SEEC engineering transfer student profile. *SEEC Data Brief No. 1*. Ames, Iowa: Iowa State University. July 2010.

In *Journal of Women and Minorities in Science and Engineering*:

- Hoffman, E., Starobin, S. S., Laanan, F. S., & Rivera, M. (2010). Role of community colleges in STEM education: Thoughts on implications for policy, practice, and future research. *Journal of Women and Minorities in Science and Engineering,* 16(1), 85-96.
- Starobin, S. S., & Laanan, F. S. (Eds.). (2010). The role of community colleges in preparing future scientists and technicians. *Journal of Women and Minorities in Science and Engineering,* 16(1).
- Starobin, S. S., Laanan, F. S., & Burger, C. J. (2010). Role of community colleges: Broadening Participation among women and minorities in STEM. *Journal of Women and Minorities in Science and Engineering,* 16(1), 1-5.
- Starobin, S. S., & Laanan, F. S. (2010). From community college to Ph.D.: Educational pathways in science, technology, engineering, and mathematics. *Journal of Women and Minorities in Science and Engineering*, 16(1), 67-84.

In conference proceedings:

- Laanan, F. S., Jackson, D., & Rover, D. Engineering transfer students: Characteristics, experiences, and student outcomes. *ASEE Annual Conference*. Vancouver, British Columbia. June 2011.
- Mickelson, S., and M. Laugerman, Characteristics of Community College Transfer Students that Successfully Matriculate and Graduate in Engineering, *ASEE Annual Conference*. Vancouver, British Columbia. June 2011.
- Rehmann, C., Rover, D., Laingen, M., Mickelson, S., & Brumm, T. Introducing Systems Thinking to the Engineer of 2020. *ASEE Annual Conference*. Vancouver, British Columbia. June 2011.
- Rethwisch, D., Laanan, F. S., Haynes, M., & Starobin, S. S. A longitudinal evaluation of Project Lead the Way in the state of Iowa. Poster. *ASEE Annual Conference*. Vancouver, British Columbia. June 2011.
- Laanan, F. S., Jackson, D., Starobin, S. S., & Eggleston, L. Experiences of female transfer students in STEM majors at a Midwestern university. *National Institute for the Study of Transfer Students*. Asheville, North Carolina. September 2010.
- Laanan, F. S., Eggleston, L., Jackson, D., Le, D., Lopez, C., Nash, C., Starobin, S., Walker, A., & Walquist, K. Pathway to a science, technology, engineering, and mathematics (STEM) degree: From community college to four-year university. *National Institute for the Study of Transfer Students*. Asheville, North Carolina. September 2010.
- Jackson, D., & Laanan, F. S. Transfer students in STEM majors: Socialization factors that influence academic and social adjustment. *National Institute for the Study of Transfer Students*. Asheville, North Carolina. September 2010.

Presentations (in addition to conference presentations corresponding to proceedings papers)
At NSF meetings:

- Rover, D., Bruning, M., Lanaan, F. S., Mickelson, S., Shelley, M., McMaken, M., et al., SEEC: Student Enrollment and Engagement through Connections. Poster. *NSF STEP Grantees Meeting,* March 2011.
- Rover, D., Laanan, F. S., Mickelson, S., Shelley, M. & Hensen, K. Assessing your STEP Project: Disentangling the Effects of Interwoven Project Strategies. Workshop session. *NSF STEP Grantees Meeting,* March 2011
- Shelley, M. Implementing and analyzing the results from your evaluation plan. Workshop session. *NSF STEP Grantees Meeting,* March 2011.
- Shelley, M. Evaluation 101: How to construct and strategize for your evaluation plans. Workshop session. *NSF STEP Grantees Meeting,* March 2011.

At national meetings:

- Laanan, F. S., & Laugerman, M. *National Academy of Engineering and American Society for Engineering Education 2-Year/4-Year Engineering Transfer Students Policy Meeting*. Richmond, Virginia. June 2011.
- Merten, E. & Darrow, M. Creating Seamless Mobility: A Perspective on How Partnership Programs Can Shape the Future of Transfer. *American Association of College Registrars and Admissions Officers Transfer Conference*. New Orleans, Louisiana. February 2011.

At local meetings and events:

- Rover, D., Shelley, M., Darrow, M., & Laugerman, M. Strategies to increase transfer students in engineering. *Conference on Diversity in Science, Technology, Engineering, and Math*. Iowa Department of Education. Ankeny, Iowa. April 2011.
- Williams, A., Bruning, M., Rover, D., Laingen, M., Mickelson, S., Brumm, T., & Shelley, M. E2020 Scholars Program. *Iowa State University Student Success Summit*. Ames, Iowa. March 2011.
- Laanan, F.S. Iowa Community College – Iowa State University Academic Leaders' Roundtable. Ames, Iowa. February 2011.

3.8 Project Management

The leadership team continued to meet on a bi-weekly basis to discuss project activities and goals and to use logic model plans for project implementation and evaluation. The core leadership team at ISU remained unchanged, consisting of Diane Rover (PI), Monica Bruning (co-PI), Frankie Santos Laanan (co-PI), Steve Mickelson (co-PI), and Mack Shelley (co-PI). Rover's appointment as associate dean ended on June 30, 2010, when she returned to the regular faculty. The college also underwent a reorganization during summer 2010 resulting in the following changes: Bruning moved from a college staff member to a lecturer in the Department of Educational Leadership and Policy Studies; Mary Darrow (senior personnel) moved from a SEEC grant-funded position to a college student services position; new RISE evaluators were assigned to the project (Jason Pontius, followed by Andy Ryder); Mary Goodwin (senior personnel) left the university; communications support moved from college to OCCRP staff; the assistant dean for diversity (collaborator) moved to a faculty director; and project administrative support moved from the college to the Department of Electrical and Computer Engineering.

4. Data Collection and Analysis

During year 4, in response to third-year review feedback to more formally address the so-called SEEC effect, a SEEC research team accumulated a large, longitudinal database of information from Iowa State University's Office of the Registrar and Engineering Career Services for students admitted into the College of Engineering since the fall of 2002. The database includes roughly 13,000 students and tracks their progress on a semester-by-semester basis over a ten year period.

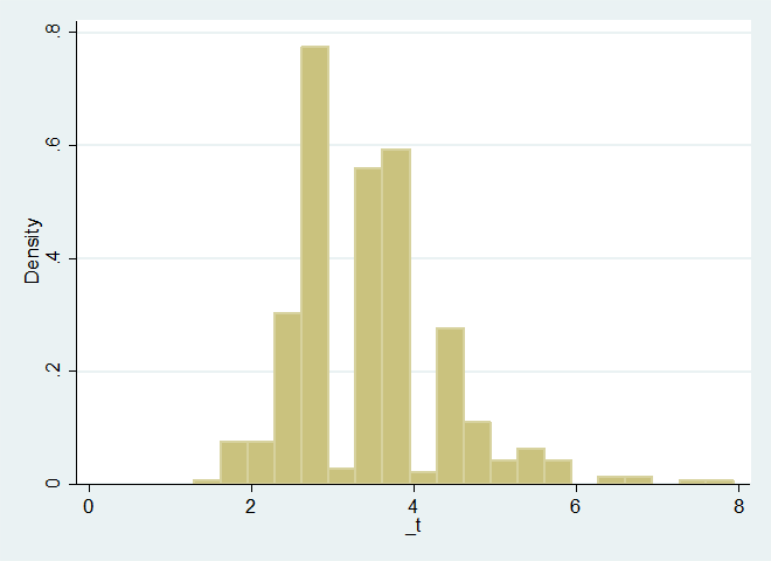
The data were analyzed for retention and graduation rates as well as employment statistics. Special attention was paid to the graduation and retention rates of Iowa community college transfers students, specifically those from DMACC. Available data points include enrollment information, participation in a learning community at Iowa State, participation in the Engineering Admissions Partnership Program (E-APP), information about Basic Program courses (both courses transferred from community college as well as those courses taken at ISU by Iowa community college students), and graduation data for Iowa community college students who successfully completed a degree in engineering.

The database tracks student progress and outcomes, including retention within the College of Engineering or transfer to another college at Iowa State University, ISU graduation rates, earned engineering and STEM degree rates, and time to degree measures. Predictive models of retention and graduation were created using logistic regression that included variables related to type of enrollment, learning community, E-APP, Basic Program courses, and other data points used as predictor or independent variables. The logistic regression models provide a discrete change in the probability of a student outcome occurring based on the values of various predictor variables. Students' persistence within a major in the College of Engineering, transfer to another Iowa State college, and graduation are modeled using the same predictor variables using survival analysis. Survival analysis is a way of plotting logistic likelihood of failure or survival (i.e., retention, graduation) over time (measured in semesters for SEEC).

Data mining and analysis are underway. The database has contributed to results and findings given in this report. In addition, team members are investigating various aspects of the data. For example, the table below shows retention rates for the 2004 cohort of Iowa community college students transferring into ISU's College of Engineering. Results are based on logistic regression using the following variables: gender, ISU basic program GPA, ISU basic program credits, transfer basic program GPA, and the number of transfer basic program credits. While all variables presented here are significant predictors, ISU basic program GPA is the most significant predictor of retention and graduation. For the other variables, average values were entered. Transfer GPA in basic program, number of transfer credits, and number of basic program credits at ISU may have been very homogeneous, therefore making the ISU basic program GPA the most significant predictor.

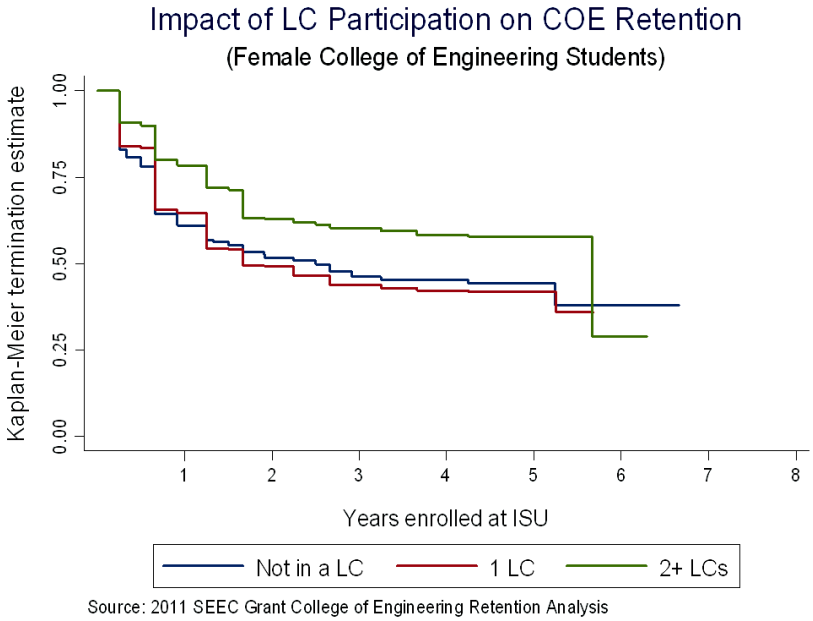
Iowa Community College Transfer Students (Fall 2004 COE Entry Cohort)				
ISU Basic Program GPA	COE Retention Rate	ISU Retention Rate	COE Graduation Rate	ISU Graduation Rate
0.0	5%	16%	4%	15%
1.0	15%	33%	13%	32%
1.5	23%	45%	21%	43%
2.0	35%	56%	32%	55%
2.5	48%	68%	46%	66%
3.0	62%	77%	61%	76%
3.5	74%	85%	74%	83%
4.0	83%	90%	84%	89%
Logit controlling for gender, ISU basic program GPA & credits, & transfer basic program GPA & credits				

As another example of data analysis, the graph below was produced using a survival analysis technique estimating time to graduation. It shows time to graduation measured in years for all Iowa community college transfers to ISU's College of Engineering between 2002 and 2008 who earned a degree in any major from ISU. This includes 436 graduates. The mean time to graduation was 3.4 years. The shortest time to graduation was 1.3 years and the longest time was 7.9 years.



A third example demonstrates the finding stated in section 3.6 that female students in engineering derive significant benefit from participating in multiple learning communities. Estimates from the longitudinal data show that female students in the College of Engineering who participate in two or

more learning communities are retained at a much a higher rate. This is depicted in the Kaplan-Meier Survival Curve below.



The overall goal of the data collection and analysis activities is to develop standard reports from the data to inform decision-making by administrators and directors at ISU, DMACC and other Iowa community colleges to promote student success in engineering at ISU.

5. Contributions

The following subsections highlight advances made through the project during year four.

5.1 Contributions to the Principle Discipline(s) of the Project

The goals to increase the number of engineering graduates at Iowa State and the number of pre-engineering students at DMACC are being met. Attracting and engaging more students in the discipline and helping students to succeed in engineering will strengthen the academic programs.

Project activities have created or enhanced programs, services, and resources for engineering students, faculty, and staff. A more robust transfer enterprise in engineering has been established at ISU. DMACC has significantly advanced its engineering-related programs and services as a result of the project.

At ISU, the SEEC project is working in concert with an NSF S-STEM project on curriculum and programming to achieve lower-division and upper-division student development outcomes aligned with national studies on engineering education.

The database and analysis developed during year 4 will contribute to new information about engineering student success and data-driven decision-making for engineering majors.

5.2 Contributions to Other Disciplines in Science or Engineering

The project has served as a model for each institution's transfer programs and services.

DMACC's activities support not only pre-engineering students, but also students with STEM interests. The partnerships on the ISU campus are not restricted to engineering. There is extensive collaboration with, for example, the Program for Women in Science and Engineering, and the Center for Excellence in Science, Math, and Engineering Education (CESMEE). The partnership with ISU Extension impacts their programs for talent expansion in STEM. Consequently, some of the activities of SEEC lead to interactions that address STEM more broadly.

The database and analysis developed during year 4 have involved and interested various individuals on campus. There are potential synergies with another project analyzing student performance in math courses. Through collaboration and sharing, the data analysis for SEEC may lead to new insights and practices for other STEM disciplines.

5.3 Contributions to the Development of Human Resources

Training and resources for staff and faculty at both institutions help them to more effectively support students. Also, the E-TEC scholarship program and information kit provide Extension youth professionals with resources and training.

Increasing and broadening the interest in engineering and improving the satisfaction and success of engineering students will ultimately grow the engineering workforce, and this goal of the STEP program is the motivation for all SEEC activities and accomplishments.

Two team members, Mary Darrow and Marcia Laugerman, are doctoral students in education who are pursuing dissertation research related to issues identified through SEEC project activities.

5.4 Contributions to the Physical, Institutional, or Information Resources that Form the Infrastructure for Research and Education

Institutional partnerships between ISU and DMACC have been created and/or strengthened through the project. The transfer infrastructure in ISU's College of Engineering has expanded, and best practices are emerging and influencing ISU and other institutions. For example, E-APP has improved the information and services available to students and faculty at community colleges across Iowa. New information resources continue to be used at both DMACC and ISU for recruiting and advising. Several initiatives facilitated/supported through SEEC (team member effort and/or funding) have been adopted by the university (e.g., MAP-Works). The GIS database repository on STEM programs in Iowa is a new information resource that will benefit the Extension community and serve as a state-wide resource for engineering career exploration. The longitudinal database on engineering student success is a new information resource for the college and university. An ISSN series of data briefs has been created and represents scholarly collaboration between ISU engineering and education faculty. At DMACC, pre-engineering offerings are expanding to several campuses. Also, a new physics laboratory at the Hunziker Career Academic Center will allow DMACC to better serve students currently enrolled at ISU.

5.5 Contributions to Other Aspects of Public Welfare Beyond Science and Engineering

E-TEC scholarships provide financial aid to students entering engineering.

SEEC activities are improving ISU's recruitment and retention efforts with community colleges. Community college student access to higher education is viewed by many as a public welfare issue.

The collective mission of both institutions and SEEC to change the perception of engineering and emphasize its impact on people and society is part of the national and global movement.