

2013

# Annual Report – Year Six

SEEC: Student Enrollment and  
Engagement through Connections

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<http://www.eng.iastate.edu/SEEC/>



## Project Goals

The Student Enrollment and Engagement through Connections (SEEC) project is a collaboration between Iowa State University and Des Moines Area Community College (DMACC). The project started in 2007. The goal was to increase the number of engineering graduates at Iowa State by 100 per year during the project, to approximately 900 graduates annually by 2012. Included within this goal are increases in the percentages of women and minority graduates in engineering at Iowa State and an increase in the number of pre-engineering students at DMACC. The number of engineering graduates for 2011-12 was 859. The 2012-13 graduation total is projected to be 997. We expect graduation gains to be maintained due to continuing increases in undergraduate enrollments in engineering: 4717 in fall 2008, 5086 in fall 2009, 5514 in fall 2010, 6025 in fall 2011, and 6604 in fall 2012.

The number of new transfer students in engineering from Iowa community colleges has steadily risen to over 150, up from about 100 at the start of the project. Engineering has also seen a notable improvement in first-year retention of DMACC and other Iowa community college students. Enrollment in DMACC's introductory engineering course totaled 105 students for 2012-13, seeing increases every year of the project (41, 52, 68, and 83, respectively, from 2008-09 through 2011-12).

Six project objectives, spanning the areas of learning communities, curriculum, advising, networking, and evaluation, have guided the project since its inception:

**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 have been addressed through a set of recruitment, retention, and engagement activities. Both recruitment and retention goals have been supported by project activities related to objectives O1-O3 (community, curriculum, and advising). Recruitment goals are primarily supported by objective O4. Activities were planned in

each of these areas using a logic model approach that identifies resources, outputs, outcomes, and impact.

Highlights resulting from this process include the creation of a transfer-friendly environment, a community of practice through partnerships, greater awareness about engineering and engineering careers, student-faculty interaction related to the engineer of 2020, and new datasets for research and evaluation. 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. A special initiative with DMACC created an engineering orientation course, EGR 100, now offered regularly at several DMACC campuses. SEEC Data Briefs and other publications present findings from the development and evaluation of an engineering transfer student success model.

Project activities and outcomes that are expected to be sustained include: DMACC's EGR 100, DMACC pre-engineering program, E-APP, transfer learning communities at Iowa State, targeted advising messaging with community college students and other stakeholders, NAE Changing the Conversation-based resources, engineering career awareness through ISU Extension, Engineer of 2020 curricular innovations, and new data management and reporting. Potential longer-term outcomes include: building a culture that embraces transfer student programming through professional and program development; leveraging learning community best practices to retain students at the second- and third-year levels, ultimately contributing to higher graduation rates; and using synergistic partnerships (e.g., with ISU Extension) to develop new resources and create interest in engineering study and careers. A collaboration with the Office of Community College Research and Policy is another aspect of the project that has produced related research to inform future practice at ISU, DMACC, and similar institutions.

## Major Activities I

### Learning Village

The E-APP Learning Community was formed in August 2010, and administration of it continues in the College of Engineering. Information about E-APP is maintained by the college:

- <http://www.eng.iastate.edu/transfer/app>
- <http://www.eng.iastate.edu/transfer/app/EAPPBrochure.pdf>

Findings from learning community-related activities were disseminated during year 6 by team members; refer to the Dissemination section.

### Connected Curriculum

Major activities related to curriculum during 2012-13 include:

- Continued support and expansion of the pre-engineering program at DMACC:  
<https://go.dmaccc.edu/programs/pdp/engineering/Pages/welcome.aspx>

- Ongoing development and integration of the E2020 curriculum at Iowa State; the E2020 Scholars Program is an NSF S-STEM funded project that has been coordinated alongside the SEEC project, [www.engineering.iastate.edu/e2020/](http://www.engineering.iastate.edu/e2020/).
- Continuing attention to SEEC-led data analysis of students' academic performance and success related to the Engineering Basic Program and lower-division academic experience.

The E2020 Scholars Program has provided scholarships for cohorts of undergraduate engineering students, including transfer students. The program focuses on four E2020 outcomes, or pillars, associated with the National Academy of Engineering's vision for the engineer of 2020: leadership, global awareness and understanding, systems thinking, and innovation and entrepreneurship. A one-credit seminar course, ENGR 110, is taken by E2020 scholars during the second semester of their first year in the program. It introduces students to each of the four pillars over twelve weeks. With three weeks per pillar, the first week introduces the students to knowledge related to the pillar; the second week focuses on developing basic skills through an active learning activity; and during the third week, students work in teams to demonstrate their ability to apply the new knowledge and skills to a real-world problem. Peer mentor sessions are interspersed with the class sessions.

Another one-credit seminar course, ENGR 210, is taken during fall and spring semesters of the second year, and provides more in-depth investigation into the pillars. The fall semester seminar is split into two seven-week periods, one for the leadership pillar and another for systems thinking. The spring semester seminar is split between the innovation and global awareness pillars. A faculty leader for each pillar has developed pillar-specific learning modules and assessment methods.

After completing the ENGR 110 and 210 seminar series, and beginning in the third year of the program, scholars continue to develop a deeper understanding of the pillars through individualized, capstone-like experiences using project-based learning. A project-based learning (PjBL) approach was selected to facilitate independent learning and a deeper understanding of the material. Through their E2020 PjBL experience, scholars are expected to develop self-directed learning skills.

During the past year, the 2011 cohort participated in the second-year seminar. The 2009 and 2010 cohorts were involved with independent study projects with faculty mentors.

The project has also been identifying ways to introduce the pillar topics to all engineering students, not only to E2020 scholars. Curricular/co-curricular options include the first-year experience and learning communities, using modules from the seminar courses; or via senior design, similar to the E2020 project-based learning experience. Starting with learning community program coordinators, instructors and peer mentors in the college, the project is sharing instructional materials for each of the pillars. The faculty leader for the leadership pillar delivered a two-part workshop during spring 2012. The faculty leader for the systems thinking pillar delivered a seminar at Iowa State's Learning Communities Mid-Year Institute and a workshop for the College of Engineering's Learning Community Task Team during spring 2013.

Findings from curriculum-related activities were disseminated during year 6 by team members; refer to the Dissemination section.

### **Student-Centered Advising**

The project has developed and distributed various transfer advising materials and communications for/with community college stakeholders. The following websites continue to be maintained and used:

- College of Engineering transfer website: <http://www.eng.iastate.edu/transfer/>
  - Includes a new page with resources for Iowa community college students: <http://www.engineering.iastate.edu/transfer/resources-for-iowa-community-college-students/>
- The Pathway to STEM website, including the Transfer Student Guide, developed under a separate NSF project: [www.pathway2stemdegree.org](http://www.pathway2stemdegree.org)
- DMACC's Preengineering Advising Guide, [https://go.dmacc.edu/programs/pdp/engineering/Pages/preengineering-ames\\_boone.aspx](https://go.dmacc.edu/programs/pdp/engineering/Pages/preengineering-ames_boone.aspx)

A new resource was developed by the college's transfer coordinator as part of a masters degree project, the Iowa Community College Transfer Advising Manual:

<http://www.engineering.iastate.edu/transfer/files/2013/06/CC-Engineering-Transfer-Advising-Manual-SPR13.pdf>.

The Pathway to STEM website is a product 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.

DMACC advising resources are being used widely with current DMACC students including dual enrolled high school students considering engineering.

Findings from advising-related activities were disseminated during year 6 by team members; refer to the Outcomes section.

### **Coordinated Networking**

The SEEC project partnered with ISU Extension to administer the Engineering Talent in Every County (E-TEC) program, which has conducted various activities to improve awareness, understanding, and interest in engineering. The program has provided \$500 scholarships to incoming first-year and community college students. There are 99 counties in the state of Iowa, and a goal of E-TEC was to increase awareness about engineering across all counties. Prospective students from over 50 counties submitted applications to E-TEC for fall 2012, a 75% increase compared to 2009. Sixty scholarships were awarded, including 17 to women, 7 to underrepresented minority students, and 7 to transfer students.

The SEEC project has provided and supported resources to promote an understanding of engineering through the NAE's Changing the Conversation (CTC). The NAE CTC report was used early in the SEEC project to inform work done by a Des Moines advertising firm (ZLR Ignition) for College of Engineering undergraduate recruiting materials. The "Be Creative" campaign materials were introduced in electronic and print media in 2009. Since then, various elements have been used in electronic, web and social media messaging by the college.

The SEEC project has proposed a case study for the NAE's online CTC community, [www.engineeringmessages.org](http://www.engineeringmessages.org), based on our STEP-funded work:

- <http://www.engineeringmessages.org/TakeAction/TheCTCBlog/26051.aspx>

The following online examples of products were referenced:

- Brochure developed for Iowa State University College of Engineering: <http://www.eng.iastate.edu/seec/COERecruitmentBrochure.pdf>
- ISU COE Twitter page, an example of online content and social media using design/messaging elements of the original brochure: [https://twitter.com/ISU\\_CoE](https://twitter.com/ISU_CoE)
- DMACC pre-engineering resource kit: <https://go.dmacc.edu/programs/pdp/engineering/Pages/engineering-kit.aspx>
- Iowa Women in STEM Poster Series, created by ISU's Program for Women in Science and Engineering in partnership with the SEEC project: <http://www.pwse.iastate.edu/PDF/PWSE%20Annual%20Report2011-2012.pdf>

## Major Activities II

### Dissemination Activities

The SEEC project website (<http://www.eng.iastate.edu/seec/>) was reviewed during year 6 and a re-design of the site as a final product for the project is in progress.

Various publications, presentations, meetings and other products through which SEEC project activities and findings were disseminated in year six are listed in the Significant Results section of this report. Team members actively represented the project and shared project results both locally and nationally.

### Evaluation Activities

Evaluation is led by co-PI Mack Shelley and Andy Ryder, a research and evaluation scientist with ISU's Research Institute for Studies in Education (RISE). The evaluators facilitate most evaluation activities involving students as the primary contact with the Office for Responsible Research and the ISU Institutional Review Board. They have assisted with institutional data collection from DMACC and ISU and other data collection through surveys, focus groups, and other methods.

Data entry for the NSF STEP Annual Survey was completed in 2013 for 2011-12. This reporting requirement is met by using project funds to support data collection and formatting by RISE and ISU's Office of Institutional Research.

During the past year, evaluation activities included planning for remaining evaluation reports and completion of the project. RISE will support these activities: SEEC project summative evaluation with team and board members, SEEC final report to NSF, 2014 NSF STEP annual survey, E2020 scholar surveys, and E2020 alumni surveys.

### **Project Management**

The leadership team continued to oversee project activities, outcomes, and sustainability. The core leadership team remained unchanged, consisting of Diane Rover (PI), Monica Bruning (co-PI, at DMACC during year 6), Frankie Santos Laanan (co-PI, on professional development leave during year 6), Steve Mickelson (co-PI), Mack Shelley (co-PI), and Kari Hensen (DMACC associate dean and project leader). Various faculty, staff, and administrators were involved in specific activities throughout the year.

### **Proposal Development**

Several SEEC team members participated in new NSF STEP proposal development activities during year 6 in various roles (e.g., PI, evaluator, advisory board member), including STEP Type I and Type II proposals.

Several SEEC team members, including DMACC members, contributed to a proposal to a USA Funds grant program, Key Transitions in Postsecondary Education. The proposal, led by Craig Ogilvie, physics professor and assistant dean of the Graduate College, was titled "Supporting Students of Color Transition from Community College to University: Multicultural Admissions Partnership Program (M-APP). Motivation for M-APP is tied to the success of SEEC's E-APP program. Results from APP and E-APP provide an evidence-based approach for the proposed program. The goal of the new program is to increase transfer enrollment, academic performance, retention, and graduation rates at Iowa State of U.S. ethnic minority students who transfer from partner community colleges (Des Moines Area Community College, Iowa Valley Community College, and Hawkeye Community College). The proposal is under review.

## Significant Results

### Enrollment Outcomes

The goal was to increase the number of engineering graduates at Iowa State to approximately 900 graduates annually by 2012. Included within this goal are increases in the percentages of women and minority graduates in engineering at Iowa State and an increase in the number of pre-engineering students at DMACC.

The following data comprise key enrollment statistics that summarize achievements toward project goals.

	2007-08	2011-12	2012-13
<b>Total Undergraduate Enrollment in Engineering</b>	4608	6025	6604
<b>New (First Year, Transfer) Enrollment in Engineering</b>	1423	1905	2121
<b>Number of Engineering Graduates</b>	790	859	997

The 2012-13 graduation total is projected. We expect graduation gains to be maintained due to continuing increases in undergraduate enrollments in engineering.

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 below. These increases have not been proportionally or substantially greater than the overall increases. For women students, there have been small percentage increases since the start of the project. Women as a percentage of total enrollment increased from 14.4% in 2007 to 15.1% in 2012; as a percentage of new entering students, from 13.6% to 15%; and as a percentage of graduates, from 14.9% to 15.3%. Iowa State remains below the national average, and the challenge remains to recruit and retain women to comprise 20% of engineering graduates.

	2007-08	2011-12	2012-13
<b>Female Undergraduate Enrollment in Engineering</b>	665	911	999
<b>New (First Year, Transfer) Women in Engineering</b>	193	280	318
<b>Number of Female Engineering Graduates</b>	118	131	NA

	2007-08	2011-12	2012-13
<b>Minority Undergraduate Enrollment in Engineering</b>	390	563	685
<b>New (First Year, Transfer) Minorities in Engineering</b>	150	226	250
<b>Number of Minority Engineering Graduates</b>	108	59	NA

	2007-08	2011-12	2012-13
<b>ISU E-APP Participation</b>	59	145	127
<b>DMACC EGR 100 Annual Enrollment</b>	13	83	105
<b>DMACC EGR 100 Female Enrollment</b>	1	11	11



Enrollment in DMACC's introductory engineering course and participation in its pre-engineering program has increased every year of the project.

The total enrollment and number of graduates are influenced by retention as well as new student enrollment. We have reported notable improvement in first-year retention of Iowa community college students in engineering at Iowa State.

### **Outputs and Products**

The SEEC project website (<http://www.eng.iastate.edu/seec/>) provides project information and resources. The site had 423 unique visitors between 7/1/12 and 5/14/13, with 26% of these users being returning visitors. Visitors spent an average of about a minute and a half per visit on the site and viewed, on average, two pages. This compares to about 500 visitors, 42% returning visitors, and about two minutes per visit in year 5 of the project. The Reports & Resources, Team Members, and Events pages captured the most traffic after the SEEC home page.

Various publications and presentations through which SEEC project activities and findings were disseminated in year six are listed below.

#### Publications

M. Laugerman and M. Shelley, "A Structural Equation Model Correlating Success in Engineering with Academic Variables for Community College Transfer Students," *Proceedings of the 2013 ASEE Annual Conference*, Atlanta, June 2013. Presented as a poster for the ERM Division, June 25, 2013.

D. Rover, S. Mickelson, B. Hartmann, C. Rehmann, D. Jacobson, A. Kaleita, M. Shelley, A. Ryder, M. Laingen, and M. Bruning, "Engineer of 2020 Outcomes and the Student Experience," to appear, *ASEE/IEEE Frontiers in Education Conference*, Oklahoma City, October 2013.

M. R. Laugerman, S. K. Mickelson, M. C. Shelley, and D. T. Rover, "The Engineering Admissions Partnership Program: A Navigation Strategy for Community College Students Seeking a Pathway into Engineering," accepted, *International Journal of Engineering Education*, vol. 29, no. 6, November/December 2013.

#### Presentations

C. Rehmann and D. Rover, "Introduction to Systems Thinking," workshop, Learning Communities Mid-Year Institute, Iowa State University, February 1, 2013.

D. Rover, S. Mickelson, M. Bruning, M. Shelley, F. S. Laanan, K. Hensen (DMACC) et al., "SEEC: STEM Student Enrollment and Engagement through Connections," poster, National Science Foundation STEP Grantees Meeting, Washington, D.C., March 14, 2013.

M. Darrow, K. Hensen, D. Koua, and D. Rover, "Supporting Community College Transfers," breakout session II-2, NSF STEP Grantees Meeting, Washington, D.C., March 14, 2013, presented as a joint workshop with the University of Virginia and Thomas Nelson Community

College.

SEEC materials at STEP Central for this session: <http://stepcentral.net/groups/posts/736/>

M. Darrow and F.S. Laanan, "Engineering Transfer Students: Voices from the Sidelines of the Engineering Playing Field," presentation at the Council for the Study of Community Colleges (CSCC) Conference, San Francisco, CA, April 2013.

S. Starobin, Y. Chen, A. Kollasch, and F.S. Laanan, "Measuring Constructs of STEM Student Success Literacy: Community College Students' Self-efficacy, Social Capital, and Transfer Knowledge," presentation at the Council for the Study of Community Colleges (CSCC) Conference, San Francisco, CA, April 2013.

C. Lopez and F.S. Laanan, "Transfer Students in STEM Majors: Academic and Social Involvement Factors that Influence Student Success," roundtable presentation at the Council for the Study of Community College (CSCC) Conference, San Francisco, CA, April 2013.

C. Rehmann and D. Rover, "Systems Thinking," workshop, Spring 2013 Learning Community Task Team Retreat, College of Engineering, Iowa State University, May 14, 2013.

#### Websites

SEEC project resources (such as SEEC Data Briefs):

<http://www.eng.iastate.edu/seec/resources.shtml>

Engineering transfer student resources, including E-APP information:

<http://www.eng.iastate.edu/transfer/>

DMACC pre-engineering program information:

<https://go.dmacc.edu/programs/pdp/engineering/Pages/welcome.aspx>

E2020 program information: [www.engineering.iastate.edu/e2020/](http://www.engineering.iastate.edu/e2020/)

#### Guides

Iowa Community College Transfer Advising Manual, Iowa State College of Engineering:

<http://www.engineering.iastate.edu/transfer/files/2013/06/CC-Engineering-Transfer-Advising-Manual-SPR13.pdf>

DMACC Preengineering Advising Guide:

[https://go.dmacc.edu/programs/pdp/engineering/Pages/preengineering-ames\\_boone.aspx](https://go.dmacc.edu/programs/pdp/engineering/Pages/preengineering-ames_boone.aspx)

#### Online Communities

The SEEC project is represented in these online communities:

- STEP Central community (STEPcentral.net):  
<http://stepcentral.net/resources/results?q=SEEC>
- Changing the Conversation (CTC) community ([www.engineeringmessages.org/](http://www.engineeringmessages.org/)):  
<http://www.engineeringmessages.org/TakeAction/TheCTCBlog/26051.aspx>

## Dissertations

M. Darrow, *Engineering Transfer Students: Voices from the Sidelines of the Engineering Playing Field*, Iowa State University, Ames, Iowa, June 2012. Supervised by SEEC co-PI Frankie Laanan.

M. R. R. Laugerman, *Academic and Social Integration Variables Influencing the Success of Community College Transfer Students in Undergraduate Engineering Programs*, Iowa State University, Ames, Iowa. June 2012. Supervised by SEEC co-PI Steve Mickelson.

C. Lopez, *Transfer Students in STEM Majors at a Midwestern University: Academic and Social Involvement Factors that Influence Student Success*, Iowa State University, Ames, Iowa, 2012. Supervised by SEEC co-PI Frankie Laanan.

## **Key Outcomes and Other Achievements**

### **Outcomes Reported in Publications and Dissertations**

Project outcomes published or accepted for publication during year 6 are summarized below.

M. Laugerman and M. Shelley, "A Structural Equation Model Correlating Success in Engineering with Academic Variables for Community College Transfer Students," *Proceedings of the 2013 ASEE Annual Conference*, Atlanta, June 2013.

**Abstract:** Student Enrollment and Engagement through Connections is a collaboration between a large Midwestern university and in-state community colleges (CCs) to increase success of transfers into engineering. This study explores predictors of completing a BS in engineering for CC transfers through a structural equation model. The model was estimated using academic variables from both institutions. The dataset includes 472 in-state CC transfer students admitted to the College of Engineering between 2002 and 2005. The model fits the data well ( $\chi^2=74.254$ ,  $df=30$ ,  $p<0.0001$ ;  $RMSE=0.056$ ,  $Comparative\ Fit\ Index=0.984$ ,  $chi-square/df\ ratio=2.475$ ). First spring university GPA and credit hours, CC transfer credits toward core engineering courses, first fall credit hours after transfer, first fall university GPA, and university core course GPA are significantly related to graduation in engineering. This research may help increase the success of CC transfers to engineering, emphasizing the importance of core engineering courses.

D. Rover, S. Mickelson, B. Hartmann, C. Rehmann, D. Jacobson, A. Kaleita, M. Shelley, A. Ryder, M. Laingen, and M. Bruning, "Engineer of 2020 Outcomes and the Student Experience," to appear, *ASEE/IEEE Frontiers in Education Conference*, Oklahoma City, October 2013.

**Abstract:** An NSF Scholarships in STEM (S-STEM) program has provided scholarships for cohorts of undergraduate engineering students since 2009, giving specific attention

to the National Academy of Engineering's vision for the engineer of 2020 (E2020). Four E2020 outcomes are emphasized in Iowa State's program: leadership, global awareness and understanding, systems thinking, and innovation and entrepreneurship. These outcomes, or pillars, are being integrated into curricular and co-curricular activities. The four pillar areas 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. In this paper, we describe the curriculum and its planned integration beyond the scholarship program. We present student feedback about their experience in the program. We also introduce relevant core competencies associated with the outcomes as judged by faculty and industry representatives.

M. R. Laugerman, S. K. Mickelson, M. C. Shelley, and D. T. Rover, "The Engineering Admissions Partnership Program: A Navigation Strategy for Community College Students Seeking a Pathway into Engineering," accepted, *International Journal of Engineering Education*, vol. 29, no. 6, November/December 2013.

**Abstract:** This paper presents the evaluation of a program designed to improve transfer outcomes for community college students pursuing an engineering degree. The program, the Engineering Admissions Partnership Program (E-APP), was designed to improve the navigational success of community college transfer students through connections to the university. These connections include coordinated academic advising, peer mentoring, campus visits, and online social and professional networks. The objective of the study is to determine the efficacy of the E-APP and its interventions, which are measured by increased participation rates and increased university retention rates for E-APP participants. Outcome data for the students are analyzed statistically for significant differences between the quasi-experimental groups (E-APP or not E-APP), matched based on Math ACT scores. The results show significant improvement in first-year retention rates for E-APP participants. The results of this study are both transferrable and scalable. This research may help increase the success of community college transfers to engineering through developing and implementing similar navigational programs across the country.

M. Darrow, *Engineering Transfer Students: Voices from the Sidelines of the Engineering Playing Field*, dissertation, Iowa State University, Ames, Iowa, June 2012.

**Abstract:** The purpose of this phenomenological study was to understand and illuminate the experiences and stories of Midwestern community college transfer students who entered and left engineering at a large Midwestern research university. Eight students participated in this qualitative study. The researcher encouraged the participants to share their perceptions and experiences of the various transitions involved in this phenomenological sequence of events. The following themes emerged: (a) Community college is like an extension of high school; (b) Inadequate community college advising; (c) Academic rigor; (d) "I can't/don't want to do this anymore...;" (e) Lack of academic support; (f) Variable quality of student-faculty interactions; (g) Sense of belonging; and (h) Challenges of being an older student.

M. R. R. Laugerman, Academic and Social Integration Variables Influencing the Success of Community College Transfer Students in Undergraduate Engineering Programs, dissertation, Iowa State University, Ames, Iowa. June 2012.

Abstract: The purpose of this dissertation is to collect and analyze data to determine success strategies for community college transfers to engineering. It does so by analyzing transcript level data collected longitudinally over a 10-year period as community college transfer students' progress before and after transfer into an engineering program. Characteristics of successful students are identified in terms of the academic and social integration variables using descriptive and inferential statistics. In addition to providing data analysis, the results determine distinctive strategies to increase the success of community college transfers in engineering.

C. Lopez, Transfer Students in STEM Majors at a Midwestern University: Academic and Social Involvement Factors that Influence Student Success, dissertation, Iowa State University, Ames, Iowa, 2012.

Abstract: America's community colleges play a critical role in educating and training women and underrepresented students for the STEM workforce. The purpose of this study was to investigate the perceptions of community college transfer students in STEM majors at Iowa State University. The research design included both quantitative and qualitative components, which provided an in-depth look at the experiences of STEM non-engineering and engineering students. The results of this study suggest that there is an association among the background characteristics, community college experiences, university experiences, and the overall adjustment and cumulative GPA of transfer students from STEM non-engineering and engineering majors. In addition, transfer students reported the importance of early experiences in science and mathematics and the extent to which these experiences inspired them to pursue a career in STEM.

### **Sustainable Outcomes**

Project activities and outcomes that are expected to be sustained include: STEM education partnering between DMACC and Iowa State, DMACC's EGR 100, DMACC pre-engineering program, E-APP, transfer learning communities at Iowa State, targeted CC advising messaging, NAE CTC-based resources, engineering career awareness through ISU Extension, Engineer of 2020 curricular innovations, and new data management and reporting. As described earlier in this report, various resources have been developed and continue to be supported in these areas.

New proposal development, such as the USA Funds application for M-APP described earlier in this report, is also an indication that practices, results and new opportunities generated through the SEEC project are recognized and valued by others.

## Training and Professional Development

SEEC team members presented or contributed to workshops on their campuses and at national meetings. The workshops provided professional development for faculty and staff, helping them to more effectively support and train students. The online resources developed by or in collaboration with the SEEC project, cited earlier in this report, also add to the knowledge used by stakeholders in student development at Iowa State, DMACC, and in the larger STEP community. The E-TEC program provided ISU Extension youth professionals with resources and training.

SEEC team members have continued to participate in national meetings, learning from others in the STEP community and in their professional communities.

E-APP peer mentors have supported the transition of transfer students into engineering at Iowa State.

The E2020 scholars 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 developed materials to support curriculum and assessment of the four pillar areas of the program. Information is being shared with others, such as faculty and staff involved with learning communities in the college, leading to expanding the awareness and knowledge base of team members and collaborators.

## Dissemination to Communities of Interest

The SEEC project has proposed a case study for the NAE's online CTC community, [www.engineeringmessages.org](http://www.engineeringmessages.org).

During the past year, the E2020 systems thinking pillar was presented to university-wide and college-level audiences outside of the project team. Non-engineering faculty and staff commented on the potential value of using it with their students. The faculty leader has also been invited to present a systems thinking workshop for the IINSPIRE LSAMP minority undergraduate students involved with summer research and bridge programs at Iowa State in July 2013.

SEEC publications and presentations were delivered to a wide array of audiences. Through partnerships and collaborations, such as with ISU Extension, OCCRP, IINSPIRE LSAMP, Iowa EPSCOR, and others, SEEC practices and findings have been shared with professionals from a variety of disciplines and organizations.

## Plans for Final Year

Dissemination and evaluation activities will be the primary focus of the final year. Both Iowa State and DMACC continue to be very encouraged about sustainability as other programs and initiatives are recognizing the success of and using key SEEC practices. We plan to more widely share the work with other institutions, document what is being sustained and in what manner, and use our evaluation team to complete project-level evaluation (i.e., aside from specific metrics, what worked and what did not in the implementation of the project).

## Products

See Significant Results section.

## Impacts

### Impact on STEM Disciplines

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 has worked 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. Resources and materials have been identified, collected, and developed to teach students about leadership, innovation and entrepreneurship, systems thinking, and global awareness. Instructional materials for two undergraduate seminar courses were developed and are being shared with faculty and staff in engineering. Resources are also being made available to other engineering educators.

The data analysis on the SEEC effect conducted during the project has resulted in key findings and recommendations for engineering student success and data-driven decision-making for engineering majors.

### Impact on Other Disciplines

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 has been 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 involves their programs for talent expansion in



STEM. Consequently, some of the activities of SEEC have involved interactions that address STEM more broadly.

The SEEC effect database and analysis have involved and interested various individuals on campus.

The E2020 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.

### **Impact on Human Resources Development**

Undergraduate engineering student career awareness, learning, development and success are at the heart of this project. Thousands of prospective and current students have participated in project activities and/or used project resources.

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.

The following team members participated in the 2013 STEP Grantees Meeting: Diane Rover and Mary Darrow, Iowa State; Kari Hensen and Deb Koua, DMACC.

### **Impact on Institutional Resources that Form Infrastructure**

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.

At DMACC, pre-engineering offerings are expanding to several campuses. Also, a newly renovated physics laboratory at the Hunziker Career Academic Center has allowed DMACC to better serve students.

Based on E2020 materials and findings, project team members have contributed to university and college workshops in support of undergraduate education at Iowa State.

### **Impact on Information Resources that Form Infrastructure**

New information resources continue to be used at both DMACC and ISU for recruiting and advising; refer to online resources cited earlier in this report. The longitudinal database on engineering student success is an 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. The College of Engineering transfer website continues to be updated with new materials to support community college transfer students. New this year is the Iowa Community College Transfer Advising Manual, which includes tips for student success that were a direct result of data collection and analysis from the SEEC Project.



Information resources are under development to support teaching, learning and assessment in the E2020 pillar areas. The E2020 program, though developed independently, is similar to a number of initiatives motivated across the U.S. in response to the NAE's report. One of the earliest was the University of Wisconsin's introductory course on the engineering grand challenges. Since then, Purdue University and other universities have implemented engineer of 2020 programs. The Grand Challenge Scholars Program (GCSP), a collaboration of Duke University, Olin College of Engineering, and the University of Southern California, is an NAE-sponsored version of Iowa State's NSF-funded E2020 Scholars Program. Several universities have established programs affiliated with GCSP.

### Impact on Society beyond Science and Technology

E-TEC scholarships have provided financial aid to students across the state of Iowa entering engineering.

An understanding of the E2020 pillars gives engineering students and graduates a stronger set of skills to collaborate with others outside of STEM.

The CTC messaging, student-centered advising and E2020 curriculum have created an inclusive learning environment that is attractive to diverse students. The E2020 cohorts have a higher percentage of students underrepresented in engineering compared to the percentage in the College of Engineering as a whole, thus broadening participation in engineering and diversifying the future STEM workforce.

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.

### Participants

SEEC project participants for 2012-2013, along with their project role, are listed below.

Participant	Institution	Project Role	>160 Hours in 2012-13
Diane Rover	ISU	Principal Investigator	No
Harry McMaken	DMACC	Principal Investigator	No
Kari Hensen	DMACC	Co-Principal Investigator	No
Monica Bruning	DMACC	Co-Principal Investigator	No
Frankie Santos Laanan	ISU	Co-Principal Investigator	No
Steve Mickelson	ISU	Co-Principal Investigator	No
Mack Shelley	ISU	Co-Principal Investigator	No
Mary Darrow	ISU	IINSPIRE LSAMP Collaborator	No
Beth Hartmann	ISU	E2020 Faculty Leader	No
Doug Jacobson	ISU	E2020 Faculty Leader	No

Sandy Jennings-Hammond	ISU	Consultant	No
Joel Johnson	ISU	COE Collaborator	No
Amy Kaleita	ISU	E2020 Faculty Leader	No
Deb Koua	DMACC	Grants/Contracts Collaborator	No
Marcia Laugerman	ISU	Collaborator	No
Donna Le	ISU	Web Designer	No
Chris Rehmann	ISU	E2020 Faculty Leader	No
Andrew Ryder	ISU	RISE Evaluator	No

Other team members have been involved to varying extents throughout the project, providing input or other support during the past year.

- ISU: Virginia Anderson, Paul Castleberry, Carlos Lopez, Mani Mina, Derrick Rollins, Jay Staker, Karen Zunkel
- DMACC: Joe DeHart, Randy Gabriel, Randall Jedele, Dave Kissinger, Michael Lentsch, James Stick

### Partnering Organizations

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

### Internal and External Advisory Groups

#### ISU Institutional Advisory Board (Internal to ISU)

**Chair:** Jonathan Wickert, *Senior Vice President and Provost*  
Sandra Gahn, *Senior Research Analyst, Institutional Research*  
Doug Gruenewald, *Co-Director, Learning Communities*  
Connie Hargrave, *Associate Professor, School of Education and Center for Technology in Learning and Teaching*  
Thomas Hill, *Senior Vice President for Student Affairs*  
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, *Associate Professor, Industrial & Manufacturing Systems Engineering, Kansas State University*  
Leigh Hagenson Thompson, *Technology Manager & Project Leader, The Dow Chemical Company*

### Other Collaborators

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

- 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