

### Section 1. Accomplishments

#### What are the major goals of the project?

##### Project Abstract

Recognizing that engineering and computer science are making concerted efforts to increase the diversity of students in their academic programs and in the workforce, the multi-institutional research team proposes a two-pronged approach: (1) To provide scholarships to a diverse population of low-income academically talented students with financial need and (2) to adapt, implement, and test a student experience model designed to increase the success of students in those fields. The model includes a set of well-established evidence-based practices that form an ecosystem of academic and co-curricular supports for students and is designed to foster retention, transfer, and graduation in STEM. The primary disciplinary foci are Electrical, Computer, and Software Engineering (ECSE) with the inclusion of cyber-security at Iowa State University, Des Moines Area Community College, and Kirkwood Community College. To broaden the impact of the effort, the proposal team seeks funding to conduct two research studies. The qualitative phenomenological study is designed to investigate and understand the development and maintenance of professional/career identity. The quantitative comparison study is designed to investigate the influence of individual motivation and the characteristics of the academic and social environments of electrical, computer and software engineering, including cyber-security, on student success, retention, transfer, and degree attainment. The project plans to award a total of 582 scholarships to 272 students (100 unique scholars at Iowa State University; 90 unique scholars at Des Moines Area Community College; and 82 unique scholars at Kirkwood Community College).

##### Project Overview and Goals

The S-STEM project, ECSEL: Electrical, Computer, and Software Engineers as Leaders, is a multi-institutional collaborative effort among Iowa State University (ISU), Des Moines Area Community College (DMACC), and Kirkwood Community College (KCC) providing scholarships for students majoring (or preparing to transfer) in electrical engineering, computer engineering, and software engineering. The total number of scholarships expected to be awarded across all three institutions over five years is 582. The project is implementing and testing a student experience model that leverages existing program elements from ISU's Department of Electrical and Computer Engineering, College of Engineering, Program for Women in Science and Engineering, IINSPIRE LSAMP Program, DMACC, and KCC. The ECSEL student experience consists of common practices and supports that span institutions including: learning communities, leadership development, professional development, academic support such as tutoring, academic advising for the ISU Engineering Basic Program, academic preparation for the ECSE field (including cyber security), and state and national resources for inclusive ECSE career awareness, recruiting and teaching. Research studies are exploring how diverse students in ECSE develop and sustain their engineering identities, and what drives these students to thrive and persist in ECSE degree programs.

The objectives of the project are to:

- 1) Pursue S-STEM goals (SS1-SS3) to recruit and retain diverse students in electrical, computer and software engineering (ECSE) disciplines.
  - (SS1) To increase the recruitment, retention, transfer, student success, and graduation of low-income academically talented students with demonstrated financial need who pursue baccalaureate degrees in STEM and enter the STEM workforce or graduate study;
  - (SS2) To implement and sustain effective, supportive curricular and co-curricular activities, practices, and strategies for students in (SS1); and
  - (SS3) To study models and activities in (SS2) and contribute to understanding the factors that affect academic/career pathways of students in (SS1).
- 2) Implement a scholarship program and student experience that support various ECSE pathways, emphasizing leadership development and professional preparation.
- 3) Coordinate key activities (practices, supports, curriculum, prior results, models and studies) across institutions to enhance transfer student success.
- 4) Investigate research questions to study the effect of project activities and better understand and influence student success and department culture.
- 5) Establish a community of practice for ECSE faculty to support their mentoring of students, inclusive teaching, and understanding of student success based on research findings.
- 6) Improve diversity and inclusion in ECSE programs, leveraging and enhancing support for women and other students from underrepresented groups.
- 7) Strategically manage the organizational, financial, data, and communication aspects of the project within and across institutions.
- 8) Evaluate project effectiveness, outcomes and impacts.
- 9) As broader impacts, improve educational pathways and contribute to a diverse workforce prepared to address societal needs including the nation's information infrastructure and security.

A logic model approach is being used for project management and evaluation. The logic model summarizes project resources, activities, outputs, outcomes and impacts, including measurable student, program, and process outcomes. The logic model is uploaded with this report (**uploaded document #1**).

- Expected outcomes for the project include these targets for enrollment, retention and graduation:
- Increase the percentage of undergraduate women enrolled in ECSE degree programs to 16%, thus doubling the number of women enrolled from 120 to 240.
  - Attain 1-year and 2-year retention rates of 86% and 80%, respectively, for female students in ECSE majors and ECSEL scholars.
  - Attain a 6-year graduation rate of 55% for female students in ECSE majors and ECSEL scholars.

The outcomes are being pursued through the ECSEL student experience. The ECSEL student experience uses many existing high-quality, evidence-based program elements, drawing on results from past NSF projects, experts at ISU, and leading researchers. Two complementary research studies are underway to contribute to the knowledge base. One research study is exploring how diverse students in ECSE develop and sustain their engineering identities. The study is examining engineering identity development through the use of Social Cognitive Career Theory (SCCT). This research study is using a phenomenological approach to examine the lived experiences and engineering identity development of ECSEL students using SCCT. The other study is using Self-Determination Theory (SDT) of motivation to understand how the environment can support diverse students to seek out ECSE programs and to persist in completing ECSE degrees. Most environmental supports have not been related to SDT. The study is examining whether environmental supports positively affect students' perceptions of competence, autonomy, and

belongingness and directly and indirectly affect their satisfaction with ECSE majors and intentions to stay in an ECSE program.

The broader impacts outcomes of the project include: opportunities for low-income academically talented students with financial need; partnerships with community colleges, industry, diversity programs, and researchers to broaden participation of diverse students in ECS engineering majors; development of diverse workforce in ECS engineering fields; improved education pathway through the community college into ECS engineering degree programs; engagement with ECS engineering by prospective students, parents, teachers; and capacity-building in cyber security to support national security.

This is a collaborative report prepared by ISU, DMACC and KCC. The accomplishments sections of this report are organized by institution, with each institution's section having subsections aligned with the goals of the project.

## 1. IOWA STATE UNIVERSITY ACTIVITIES AND ACCOMPLISHMENTS

Ten students were awarded ECSEL scholarships starting spring 2017 to form the first ECSEL cohort. Twenty-nine scholars were added in academic year 2017-18. In fall 2018, an additional 24 scholars joined the ECSEL Program, for a total of 63 scholarship recipients. The first ECSEL scholar graduated in fall 2017 (EE major), and two more scholars graduated in spring 2018 (SE majors), resulting in 60 scholars in the program at the end of grant year 2 (fall 2018). There has been 100% retention in the program. **Table 1 (uploaded document #1)** summarizes the scholarship recipients. On entry into the ECSEL Program, a student is either a current student in an ECSE major or an incoming student new to ISU. An incoming student may be either coming from high school and in their first year, or transferring to ISU from a community college.

For the three scholars who graduated in 2017-18, the EE graduate is working at Tesla in Palo Alto and the SE graduates are working at Boeing in Seattle and Airbnb in San Francisco.

During year 2, we managed ECSEL programming by dividing scholars into two groups (note that ISU's school colors are cardinal and gold):

1) Gold Scholars: Scholars who joined the ECSEL program in a previous year (10)

2) Cardinal Scholars: Scholars who joined the ECSEL program in the current year (29)

In addition, the cardinal scholars could be viewed as two groups: newly enrolled (13) and previously enrolled and continuing (16). These groupings reflect the need to support students at different entry points into ECSE majors. Starting fall 2018, we have differentiated some programming exclusively for first-year students.

**Tables 2 and 3 (uploaded document #1)** summarize undergraduate enrollment in ECSE majors at ISU as of fall 2017 and fall 2018, respectively. ISU engineering programs have had record enrollments in recent years. Enrollments have started to level off, with recent fluctuations in CPE and EE. CPE remains the largest of the three majors, although SE is close behind with its continued growth. Among new freshmen (not shown in the tables), CPE has declined each of the past two years, EE rebounded somewhat this year compared to last year, and SE increased again. Notably the percentages of women and minority students have increased among total students and within each major, as shown in **Table 4 (uploaded document #1)**. In addition, the percentage changes in enrollment of women and minority students have exceeded the overall trends. This is also true for new freshmen (not shown in the tables).

These increases show progress in general as well as toward the project's enrollment outcome. The project proposed a goal to increase the percentage of undergraduate women enrolled in ECSE degree programs to 16%, or to double the number of women enrolled from 120 to 240 (based on data used in the proposal). The percentage of undergraduate women enrolled in ECSE degree programs is 11% as of fall 2018; it is 12.6% in software engineering, the fastest growing program; and it has increased by almost 25% in ECSE majors since the grant started. Thus the trend is promising in relation to the percentage increase goal. The number of women enrolled in ECSE majors as of fall 2018 is 236, nearly at the target of 240. This is due in part to large enrollment increases college-wide prior to and coincident with the start of the grant. Breaking the percentage "glass ceiling" has been challenging, and progress may be the best measure of success.

## **1.1 Scholarship Program Recruitment, Selection and Administration**

As summarized above, 63 ECSEL scholarships have been awarded. Recruitment began fall 2016 and has been ongoing with a rolling applications process aligned with College of Engineering and university timelines for consideration and notification. Scholarship information, requirements, instructions and online application forms for both incoming and current students are available from the ECSEL website under the "Interested Students" page: <https://ecsel.ece.iastate.edu/students/interested-students/>.

ECSEL team members work closely with department and college student services staff to coordinate recruiting opportunities and scholarship administration. Current and prospective students meeting eligibility requirements have been emailed information about the scholarship program and invited to apply. In addition, ECSEL team members, ECSE academic advisers, the WISE Program, and the Engineering LEAD (Diversity) Program have reached out to potential students and shared information. A marketing flyer was updated and used at various events for prospective student and family visits to campus. Academic advisers continued to identify potential students during summer orientation.

Applications are compiled in an intranet database and reviewed by an ECSEL scholarship committee. The committee made decisions based on eligibility and a broad set of factors.

## **1.2 Student Experience Planning and Implementation**

The ISU ECSEL student experience uses evidence-based practices to support scholars through graduation using a variety of academic and extracurricular activities focused on professional and leadership development. We are using the proposed student experience model as a roadmap, as depicted at the website (<https://ecsel.ece.iastate.edu/students/>).

For a full description of student experience programming during fall and spring semesters, refer to the ISU Student Experience Description in **uploaded document #2**.

During fall and spring semesters of year 2, ECSEL scholars met weekly with ECSEL ECE team members. For spring semester, all scholars met weekly in a one-credit seminar class. ECSEL faculty mentors presented tech talks during class meetings. The April tech talk was also attended by members of the DMACC ECSEL program as a networking activity between ISU and DMACC. In addition to seminar meetings and mentoring activities, other activities are integral to the ECSEL student experience, including professional networking and experiential and service learning.

Various photos and communication about activities and events are uploaded with this report (**uploaded document #2, uploaded document #3**).

Mentoring activities are described in the **section on Training and Professional Development**.

Plans for the ECSEL student experience for year 3 (2018-19) are outlined in the **section on Plans for the Next Reporting Period**.

### **1.3 Faculty Engagement**

ECSE faculty members are involved as project team members and mentors and also have scholars in their courses. Student-faculty interaction is both formal and informal. Faculty members are involved in various student experience activities, as described in the previous section, such as coordinating meetings, presenting tech talks, and serving as resources for other activities. The formal faculty mentors include Doug Jacobson, Phillip Jones, Diane Rover (co-coordinator) and Joe Zambreno (CPE students); Julie Dickerson, Mani Mina (co-coordinator), and Gary Tuttle (EE students); and Chinmay Hegde, Kristin Rozier, and Srikanta Tirthapura (SE students). Each mentor is assigned a small group of scholars.

Mentoring activities are described in the **section on Training and Professional Development**.

The ECSEL project is being conducted in tandem with the NSF RED-funded RIDE project in the department. Faculty are involved with RIDE activities and change processes. The projects are synergistic in various ways, and we use both projects to engage faculty to support student success.

### **1.4 Diversity and Inclusion Support**

ECSEL partners with diversity programs on campus including WISE, LEAD (multicultural students in engineering) and student organizations such as Digital Women and SWE. WISE Program staff are directly involved with project planning and activities, and WISE activities are part of the ECSEL student experience. The ECSEL team draws on the expertise of team members and researchers who have various experience with diversity and inclusion in programs such as ISU ADVANCE, WISE, and their research. In concert with the RED RIDE project, there are efforts to enhance awareness and understanding among faculty and staff in the department. Refer to the **section on Training and Professional Development** for more information.

### **1.5 Research Studies**

Two research studies are underway: 1) engineering identity development of ECSEL students, and 2) student motivation and the characteristics of ECSE academic and social environments. The research activities are synergistic with an NSF RED project in the department (<https://ride.ece.iastate.edu>), being conducted in tandem with the ECSEL project. A research and evaluation retreat for project team members was held at the end of fall semester 2017 to review and coordinate activities. Comments and feedback were collected and documented.

#### **1.5.1 Identity Research**

Researchers Sarah Rodriguez, Kelly Cunningham, and incoming graduate student Maria Espino attended regularly scheduled ECSEL team meetings to discuss grant activities and provide progress reports on the identity study. These meetings helped to facilitate recruitment of identity study participants through team member connections to the project and provide context for understanding the ECSEL experience for students.

The identity team met regularly to discuss data collection, analysis, and preparation of conference papers for initial data collection period. These meetings helped to make decisions regarding study design and analysis as well as clarify direction of the identity study in terms of dissemination and publications.

### **1.5.1.1 Data Collection and Analysis**

#### **Iowa State University**

Year 2 focused on rapport-building and continued data collection for ISU. This research study utilized a phenomenological approach to examine engineering identity development in the experiences of 18 undergraduate women involved in the ECSEL program and engaged in ECSE majors (no men have participated thus far, despite recruitment).

#### **Des Moines Area Community College**

Year 2 focused on research study recruitment and program rapport-building between the ISU researcher and the DMACC institutional partners. These relationships were used to facilitate recruitment in fall 2017 and continued engagement throughout the duration of the grant. This study examined the experiences of 4 community college students (2 men, 2 women) involved in the ECSEL program.

Each student at ISU and DMACC completed a single student questionnaire, an annual phenomenological interview, and bi-monthly student reflective journals (as outlined in the year 1 report). All data were compiled and analyzed using qualitative data analysis software.

### **1.5.1.2 Initial Findings and Dissemination**

Year 2 data collection resulted in the production of one conference presentation and paper (in preparation) to the American Educational Research Association. Presence at the AERA conference is essential for broad dissemination of this project's findings. Initial findings include:

***ECSEL Helps Make Connections & Enhance Identity Development:*** The ECSEL program provided the ECSE women with an opportunity to make connections both to faculty members and peers as well as provided a space for engineering identity development. The program helped students make connections through their involvement with the program, particularly through the engagement activities, systematic meetings, and the dedication of physical space to this group. These activities, meetings, and space enabled students to frequently see each other and feel as though the community of women in ECSE was connected both in and outside of the classroom. Students believed that the program has helped them to feel more like an engineer by enabling them to work on and build an interest in real-life engineering issues, be recognized by their faculty and female peers, and feel a sense of competence and belonging within their department and college.

***ECSE Women Struggle to Gain Identity Recognition from Male Peers:*** Despite their involvement with the ECSEL program, women continued to acknowledge that their relationships with male peers remained strained. Male peers often failed to recognize the abilities of the participants and attempted to marginalize them both inside and outside of the classroom. Although they connected with more women in their department, the participants in this study were forced to return to normal department conditions once they left the ECSEL activities, relationships, and spaces. This return marked a challenge in developing and refining an engineering identity. Students appreciated the opportunities given to expand their relationships with other women in ECSE, but were left wondering how the department might shift to be more inclusive as a whole, rather than just within this diversity effort.

### ***Intersecting Identities Influence How Women Interact & Develop Engineering Identities:***

ECSE women expressed the ways in which their varying identities influenced their engineering interactions and subsequent engineering identity development. Students related that identities such as gender, age, race/ethnicity, motherhood, creative nature, and transfer background influenced the way in which their peers, faculty, and others interacted with them regularly. Students felt as though their identities as women, post-traditionally aged students or students of color influenced the expectations and assumptions that others bestowed upon them. Other students, who were mothers often felt marginalized by their peers or found it difficult to fully integrate into the engineering study or project groups due to responsibilities at home. Students also described the importance of their creative identities and how that shaped the ways in which they approached the curriculum, interactions, and career intentions. Students who described a strong relationship with their transfer student identity (transferred from community college or another four-year institution) felt a sense of isolation and condescension from students who had completed the majority of their coursework at the university.

These findings were also shared with the ECSEL leadership team and utilized to formulate an activity for soliciting greater feedback from the program's participants. The identity research team collaborated on the creation of documents and scripting to help facilitate that conversation between participants, peer mentors, and leadership.

#### **1.5.2 Motivation Research**

The quantitative research team of Lisa Larson and Mack Shelley has administered a survey to the first two cohorts of ECSEL scholars resulting in 33 survey responses consisting of 13 CPE, 7 EE, and 13 SE students. Additional data derived from institutional surveys obtained from the registrar will be combined with our survey data to permit complex analyses of relationships broadly following Vincent Tinto's student integration model. Using the framework of self-determination theory, moderating effects on student outcomes will be estimated for sense of belonging/relatedness, volitional autonomy, perceived competence in engineering, and interest in engineering. The conceptual model is shown in Figure 1 (**uploaded document #1**).

#### **1.6 Evaluation**

The evaluation team consists of Mari Kemis, Mack Shelley, and Mani Mina. They are regular participants and presenters in project meetings, including the annual retreat where evaluation and research activities are discussed.

A key evaluation activity is providing information for NSF S-STEM data reporting. Data were successfully uploaded and submitted for 33 scholars at ISU in December 2017 and for 39 scholars in July 2018. Instructions and notes were revised to describe the database variables, data sources available through the ISU registrar's system and elsewhere, and timelines for future reference. Going forward, scholar data will be submitted at the end of each semester as required.

Results indicate that scholars were highly involved in program activities. Over half participated in academic support services and meetings or conferences in the 2017-18 academic year. More than one-third participated in community building activities or internships, and ten or more in field trips or research opportunities. Three scholars have graduated and are working in their fields of study.

Scholars were surveyed at the end of the spring 2018 semester for feedback on their participation in ECSEL, including what they saw as positive and also their suggestions for improvement. Students most commonly cited becoming a member of a community of scholars as the most

positive aspect of the ECSEL program. Several students mentioned that forming these relationships with other students provided much-needed support and encouragement. One student stated, "It create[d] a group of people that I know I can ask for help." Many students appreciated that the program allowed them to meet other women with similar majors and interests, which made them feel less isolated. Echoing this sentiment, one student commented, "...All I had to do was take a look around to know that it was possible for me to succeed."

Along with getting to know other students, students benefitted from making connections with faculty. Through these relationships and other components of the program, students received advice and tips for success, learned about important resources and opportunities, and developed important skills, such as critical thinking and problem solving. Several students also mentioned that the most positive aspect of the program was the scholarship itself, which reduced some of their financial burden. About 90% of the scholars would recommend this program to others.

The most commonly cited suggestion for improving the experience of ECSEL scholars was more interaction with other students. Despite most students mentioning that the development of community was the most positive aspect of the program, students wanted more opportunities to network and build relationships with their peers. One student stated, "I feel like I know the members of ECSEL but not on a very personal level." Several students provided suggestions for enabling these relationships, including lengthening meeting periods, having more group activities, and offering social activities outside of the classroom. Students had several other recommendations for improving the ECSEL experience.

An updated ECSEL Evaluation Plan is attached (**uploaded document #1**). Evaluation plans for year 3 are outlined in the **section on Plans for the Next Reporting Period**.

## **1.7 Project Management and Coordination**

The ECSEL project team is comprised of the PI and team members listed in the **Participants section** of this report. The ECSEL ECSE team is a subset consisting of team members who are ECSE faculty and staff members. The entire project team met every two weeks during the year, and the ECSE team met more frequently. Other subsets, e.g., research, evaluation, scholarship committee, met additionally as needed. A research and evaluation retreat was held in December to review and coordinate activities and allow more in-depth, cross-cutting discussion. DMACC and KCC ECSEL team members participated via web conferencing in the ECSEL session of the retreat. A Qualtrics form was available for meeting participants to provide feedback during/after each of the sessions. Leadership conference calls were held in fall and spring semesters, however, a face-to-face collaborative retreat in May (like in year 1) was not possible due to scheduling conflicts. ISU, DMACC and KCC scholarship coordinators shared information during recruitment and selection, and transfer students from DMACC and KCC received ISU ECSEL scholarships starting fall 2018. During year 2, ISU researchers corresponded with and/or visited the DMACC and KCC programs in relation to their studies on those campuses. In addition, team members at ISU, DMACC and KCC informally engaged in conversations about the project during other joint meetings (such as for the IINSPIRE LSAMP Alliance and the CIRTL AGEP Alliance).

The partnering between the ECSEL and WISE programs at ISU was expanded during year 2 to better serve the needs and interests of scholars. WISE staff member Allie Parrott joined the ECSEL team and facilitated planning the ECSEL student experience for year 3 (2018-19), leveraging key programming and expertise as well as incorporating feedback, evaluation and research. The expanded collaboration also resulted in creating a new position, ECSEL Student Experience Coordinator, to manage the ECSEL student experience across multiple cohorts of scholars and to oversee peer mentors. A WISE graduate assistant (Alicia Herron-Martinez) was



hired during summer 2018. Plans and supporting information are presented in the **section on Plans for the Next Reporting Period**. We are proud to report that the ISU WISE program was awarded the 2018 WEPAN Women in Engineering Initiative Award in serving as model for other institutions.

An online file-sharing repository continues to be used by the project team using CyBox, Iowa State's Box service. A project website is in place, <https://ecsel.ece.iastate.edu> . A project manager (Megan Heitmann) works with the project team through support provided by the Engineering Research Institute (<https://www.engineering.iastate.edu/research/eri/> ). A graduate research assistant (Megan Reiman) works with ECSE team members on project tasks as well as cyber security research. Three peer mentors, one each for CPE, EE and SE, provided support during 2017-18, including holding office hours in the dedicated work/study space for the ECSEL scholars in Coover Hall. Graduate research assistants were supervised by faculty members and supported project activities during year 2 as listed in the **Training and Participants sections** of this report.

The news articles, publications, presentations and websites listed in the Products section support communication and dissemination to various audiences. Refer to the **Dissemination section** of this report.

## **1.8 Broader Impacts**

Project activities supporting broader impacts during year 2 focused on providing opportunities for low-income academically talented students in ECSE; partnering with community colleges, diversity programs, and researchers to improve diversity and inclusion in ECSE; improving the education pathway through the community college into ECS engineering degree programs; and capacity-building in cyber security. For details, refer to the Broader Impacts Summary in the **section on Impact on the Development of the Principal Disciplines of the Project**.

## **2. DES MOINES AREA COMMUNITY COLLEGE ACTIVITIES AND ACCOMPLISHMENTS**

### **2.1 Scholarship Program Recruitment, Selection and Administration**

During year 2, DMACC refined its scholarship marketing materials including the development of a new logo, posters, fliers and targeted emails to eligible students. The website front page is uploaded with this report (**Products section**), and information is available at the DMACC ECSEL website: <https://www.dmacc.edu/ecsel> .

A total of 16 full scholarships have been awarded in years 1 and 2. Nine full scholarships and one explorer scholarship have been awarded for the fall 2018 semester. Engineering faculty and academic advisors are actively promoting this program to qualified applicants for the upcoming semester. ECSEL team members visit engineering orientation classes (EGR 100) at three campuses to promote scholarship activities and ensure students are enrolled in appropriate transfer coursework.

### **2.2 Student Experience Planning and Implementation**

Each scholar is matched with a faculty mentor who teaches engineering or computer science coursework. In year 2, DMACC scholars visited Iowa State University on April 25, 2018, to learn more about the fields of electrical, computer, and software engineering. Plans are underway to create additional opportunities for the DMACC scholars to engage with the ISU scholars.

## **2.3 Faculty Engagement**

Each mentor participated in an orientation training session to ensure they understood the program outcomes and goals and were familiar with recommended engineering courses and sequencing. Plans are underway to share faculty mentor resources from ISU and KCC. In addition, DMACC academic advisors will meet with the ISU engineering advisors to enhance our partnerships.

## **2.4 Diversity and Inclusion Support**

DMACC's Teaching and Learning Center (<https://www.dmacc.edu/tlc/>) is actively providing STEM faculty with resources and pedagogy support through a variety of initiatives including a summer institute, Adjunct Professional Growth Program, Teacher Work Sample Program, and numerous topical webinars and workshops. Plans are under way to expand resources and connections to help STEM faculty develop inclusive and effective teaching practices with a newly awarded NSF INCLUDES grant (<https://www.news.iastate.edu/news/2018/09/06/includes>). Both DMACC and KCC are collaborators with ISU and other institutions on the grant.

## **2.5 Evaluation and Research**

DMACC is prepared to complete the NSF S-STEM data reporting each semester now that scholarships have been awarded. The DMACC ECSEL team met with ISU evaluation and research team members to establish a qualitative research protocol for scholars. Plans are underway to connect scholars with the research team. In the coming year, DMACC will coordinate with ISU on a survey to examine opinions about activities, progress towards project objectives, and contextual factors.

## **2.6 Project Management and Coordination**

DMACC established an ECSEL leadership team with key representatives from engineering and computer science faculty, student services, institutional research, and the grant department to implement ECSEL grant objectives. The leadership team met regularly during Year 2 to fine tune marketing and scholarship procedures and support the ECSEL scholars. In addition, the faculty mentors met for training. A Microsoft Team site was developed to host resources and enhance communication among the leadership team.

## **2.7 Broader Impacts**

Refer to the DMACC Broader Impacts Summary in the **section on Impact on the Development of the Principal Disciplines of the Project**.

# **3. KIRKWOOD COMMUNITY COLLEGE ACTIVITIES AND ACCOMPLISHMENTS**

## **3.1 Scholarship Program Recruitment, Selection and Administration**

Five Kirkwood students, including three women and two underrepresented minority men, received ECSEL scholarships during year 2 (2017-18 academic year). Of these, three were on the four-year transfer track, and two were two-year vocational students. Students were selected in cooperation with the Kirkwood Foundation using their scholarship application process and the ECSEL selection rubric. An ECSEL-specific scholarship application form and process will be available from the soon-to-be launched ECSEL website.

Two scholarship recipients have graduated from Kirkwood and are working full-time in information technology fields. One student is now studying electrical engineering at the University of Iowa. Two students are studying electrical engineering at ISU as scholars in their ECSEL program. One ECSEL scholar is continuing in her second year at Kirkwood.

### **3.2 Student Experience Planning and Implementation**

ECSEL students participated in informal cohort activities through the campus STEM club, and one scholar served as a club officer. One student completed an honors project, four attended regional professional conferences, and two participated in STEM-related volunteer activities within the local community.

### **3.3 Faculty Engagement**

The Kirkwood PI collaborated with faculty from several academic departments, including Math/Science, Industrial Technology, and Business/Information Technology to recruit, mentor, and provide professional development experiences for ECSEL students. The PI promoted the ECSEL program at bi-annual Math/Science department retreats, co-advised the STEM club, and made a presentation at a Project Lead the Way Young Women in STEM event.

### **3.4 Diversity and Inclusion Support**

The Kirkwood ECSEL team worked with the Kirkwood IINSPIRE-LSAMP program (<http://www.kirkwood.edu/LSAMP>) to recruit scholars and to provide professional development experiences for students. Two LSAMP students transferred to ISU after receiving an ISU ECSEL scholarship. Kirkwood is also a partner on the newly awarded NSF INCLUDES grant with ISU, DMACC and other institutions (<https://www.news.iastate.edu/news/2018/09/06/includes>).

### **3.5 Evaluation and Research**

NSF S-STEM data reporting is completed each semester. Plans are underway to connect scholars with the ISU qualitative research team. In the coming year, Kirkwood will coordinate with ISU on a survey to examine opinions about activities, progress towards project objectives, and contextual factors.

### **3.6 Project Management and Coordination**

An ECSEL website is under development to be launched in fall 2018. Based on our experience with the 2017-18 ECSEL cohort, we have decided to no longer make a distinction between “scholars” and “explorers” in the program. Students on the transfer track and the vocational track are both enrolled in qualifying programs that meet workforce needs in ECSE-related fields through specific pathways. In preparation for growth in number of ECSEL students, we are developing an ECSEL-specific credit-based seminar to be offered beginning in fall 2019.

### **3.7 Broader Impacts**

Refer to the KCC Broader Impacts Summary in the **section on Impact on the Development of the Principal Disciplines of the Project**.

**3) What opportunities for training and professional development has the project provided?**

Various training and professional development activities were provided for and/or undertaken by team members, faculty, staff and students involved in project activities.

#### Undergraduate Student Professional Development

Professional development activities for ECSEL scholars are part of the student experience, as described in the respective **ISU, DMACC and KCC sections** of this report. Scholars have participated in numerous program activities to advance their academic and professional development.

The ISU WISE Program has partnered with campus organizations – Margaret Sloss Women’s Center, Student Activities Center, Catt Center for Women in Politics – to organize a Women’s Empowerment and Leadership Conference (WE Lead). It is an all-day event, incorporating keynote speakers, breakout discussions, student speakers, etc. It is held on campus to promote leadership and empowerment among undergraduate students.

#### Mentoring Activities and Training

ECSEL scholars are mentored by faculty and peers as part of the ECSEL program. All received training in their respective roles as part of the mentoring experience. ECSEL team members Mani Mina and Diane Rover serve as coordinators for the mentoring experience. The training and activities draw primarily from the list of mentoring resources (**uploaded document #1**).

In addition, Mina has developed a set of introductory slides to share his award-winning mentoring approach (**uploaded document #1**). New scholars attend an introductory session on mentoring that uses the slides and items a-c. The faculty mentors attend a meeting with the coordinators to discuss goals and practices. The mentoring experience is also informed and improved through input and findings from the ECSEL research teams. An overview of the ISU faculty-scholar mentoring program is uploaded with this report (**uploaded document #1**). The formal faculty mentors include Doug Jacobson, Phillip Jones, Diane Rover (co-coordinator) and Joe Zambreno (CPE students); Julie Dickerson, Mani Mina (co-coordinator), and Gary Tuttle (EE students); and Chinmay Hegde, Kristin Rozier, and Srikanta Tirthapura (SE students).

Dr. Hegde, one of the department’s 2018 NSF CAREER grant awardees, included partnering with the ECSEL project in his education and broader impacts plan (award #CCF-1750920, <https://news.engineering.iastate.edu/2018/04/10/two-ecpe-engineers-receive-prestigious-nsf-career-award/> ). He received input and mentoring from ECSEL team members Joe Zambreno and Diane Rover. The reviewers cited the strength of the plan, which proposed, among several strategies: “The PI is deeply committed to increasing the involvement of under-represented populations in computational science and engineering ... [and] will be involved in the ECSEL project. The PI’s office is co-located to the ECSEL scholar laboratory at Iowa State ... . The PI will serve as a mentor for some of these ECSEL scholars and offer them research opportunities in his group.”

Five scholars served as peer mentors during year 2. There were three peer mentors each semester, one each for CPE, EE and SE. These peer mentors received training through Dr. Mina. Plans for updating the peer mentoring program in year 3 based on expanded collaboration with WISE are described in the **section on Plans for the Next Reporting Period**.

#### Professional Development and Training Involving Team Members

All ISU team members and several DMACC and KCC members participated in a research and evaluation retreat held at the end of fall semester, which was facilitated by ECSEL research and evaluation leaders. Project team members attended education and professional conferences during the year, representing and disseminating various aspects of the project. Several team members attended or led sessions related to education and inclusion at ASEE, IEEE, WEPAN, AERA, LSAMP and other conferences. Through conference and webinar dissemination, ECSE and STEM education and higher education communities have been introduced to project concepts, resources and research. For example, researcher Sarah Rodriguez co-presented a CIRTl event, “Equity-Oriented, Inclusive Teaching in STEM,” <https://www.event.iastate.edu/event/44735> .

Project team members from all three collaborating institutions also leveraged related NSF projects to share with and learn from others. Diversity, inclusion, and student and faculty development are key objectives of IINSPIRE LSAMP (<http://www.iinspirelsamp.org/2017-2018-annual-conference/> ), CIRTl INCLUDES (<https://cirtlincludes.net/community-college-pathways/> ), and CIRTl AGEp (ISU-led NSF-funded AGEp Transformation Alliance, CIRTl AGEp – Inclusive Excellence and Improved Climate for Future Faculty ([https://www.nsf.gov/awardsearch/showAward?AWD\\_ID=1647104](https://www.nsf.gov/awardsearch/showAward?AWD_ID=1647104) )). Several ECSEL team members have leadership roles on these projects. ECSEL researcher Sarah Rodriguez is a co-PI for CIRTl AGEp (<https://rodriguezsarah.weebly.com/agep.html> ), and ECSEL ECE faculty members Mani Mina and Diane Rover have been trained as facilitators to help with workshops around campus. Although a focus of the workshop is graduate research groups, the workshop objectives and materials are broadly applicable to improve inclusion. The workshops include resources developed by experts Dr. Becky Martinez and Dr. Derald Wing Sue. ISU ECSE faculty participated in a CIRTl AGEp Inclusion Workshop held during the department’s fall retreat. Faculty and staff also have access to an extensive array of ISU CELT programming and resources on inclusive practices (<http://www.celt.iastate.edu/teaching/creating-an-inclusive-classroom/> ).

This partnering across projects is a strength of all projects involved – as addressed by Dr. Rodriguez in her talk, “Working in Interdisciplinary Teams: Lessons Learned in Influencing STEM Change”, in the February 2018 ASCN webinar on “Developing and Sustaining Effective Partnerships to Advance Change in STEM Higher Education.” ([https://ascnhighered.org/ASCN/webinars/effective\\_partnerships/](https://ascnhighered.org/ASCN/webinars/effective_partnerships/) )

Team members attended various programming in addition to conferences for their own professional development in areas related to the project. For example, Sarah Rodriguez participated in the NASPA Emerging Faculty Leaders Academy and the Iowa State Teaching Partners Program. Several team members completed training for the new ISU IRB Manager system. The ECSEL Student Experience Coordinator, Alicia Herron-Martinez, attended a four-part CELT workshop on course design. She also completed training in Green Dot Bystander Intervention (<https://www.studentwellness.iastate.edu/greendot/> ) and RESPOND (<https://www.counseling.iastate.edu/outreach/RESPOND> , how to help individuals experiencing mental health distress).

### Graduate Student Research Training and Mentoring

Six graduate research assistants have been involved with research and other project activities at ISU. The following graduate students worked with the identity research team and were supervised and mentored by Dr. Sarah Rodriguez:

Kelly Cunningham: Received her Ph.D. degree in Applied Linguistics & Human Computer Interaction

Ronnia Estes: Masters student, School of Education

MacKenzie Sissel: Masters student, School of Education

Maria L. Espino: Ph.D. student, School of Education

A graduate student in psychology, Kent Crick, worked with the motivation research team and was supervised and mentored by Dr. Lisa Larson.

A Ph.D. graduate student in computer engineering and information assurance, Megan Reiman, assisted the PI team with scholar programming and project communications and was supervised and mentored by Dr. Doug Jacobson.

#### 4) How have the results been disseminated to communities of interest?

##### Dissemination

The publications, presentations and website listed in the **Products section** of the report support ECSEL dissemination to various audiences. Research venues included 2017 Iowa Educational Research and Evaluation Association Annual Conference, 2018 AERA Annual Meeting, and 2018 ASEE Annual Conference. Several broader presentations that covered ECSEL and other work by ECSEL researcher Sarah Rodriguez were delivered through other regional and national venues including an ASCN webinar talk, “Working in Interdisciplinary Teams: Lessons Learned in Influencing STEM Change” ([https://ascnhighered.org/ASCN/webinars/effective\\_partnerships/](https://ascnhighered.org/ASCN/webinars/effective_partnerships/)); a CIRTL event, “Equity-Oriented, Inclusive Teaching in STEM” (<https://www.event.iastate.edu/event/44735>); and the Consejos Colectivos: Improving STEM Success at HSIs presentation, “Collaborations for STEM Change: Crafting Interdisciplinary Teams and Leveraging Expertise.”

Engineering identity research results, referenced in **section 1.5.1.2** of the main report, were presented through the following products.

S.L. Rodriguez, K. Cunningham, R. Estes, and M. Sissel, “SSTEM Successes and Challenges: Engineering Identity Development for Women in Computer, Electrical, and Software Engineering,” presentation at the American Educational Research Association, New York, April 2018.

See the handout uploaded with this report (**Products section**). A paper is in preparation.

R. Friedensen, E. Doran, S. Rodriguez, “Documenting Engineering Identity: Electrical and Computer Engineering Departmental Documents and Student Identity,” Proc. ASEE Annual Conference, Salt Lake City, June 2018. <https://peer.asee.org/30343>

This work is relevant to the ECSEL project and was initiated through the department’s NSF RED RIDE project.

Abstract excerpt: ... One broad theme was a lack of attention to identity; another showed emphasis on technical skills/competencies. ... Overall, analysis indicated that the department does not cultivate holistic engineering student identities. The resultant implications are by no means irrelevant—a focus on identity over specific skills could increase retention, increase student satisfaction, and produce better future engineers.

ECSEL team members also participated and presented in several events involving others from engineering education and inclusion communities, e.g., IEEE Frontiers in Education Conference in October 2017, IEEE Global Engineering Education Conference (EDUCON) in April 2018, and the Collaborative Network for Engineering and Computing Diversity (CoNECD) Conference (including WEPAN) in April/May 2018.

## Communication

Aspects of the project continue to be communicated to multiple audiences through several channels in addition to the dissemination activities above. A number of news articles directly or indirectly related to the project appeared on the web and/or in department newsletters or brochures. Several articles are uploaded with this report (**uploaded document #3**). The department's 2017 Impact Report brochure highlighted the ECSEL project on its research pages. An article posted by the College of Engineering featured the Grace Hopper Conference participants in fall 2017. The college wrote a story about ECSEL scholar Melissa Hernandez as part of a Women's History Month series in spring 2018. The college also posted a story in spring 2018 about ECSEL's first graduate, Sarah Huber. The college cited the ECSEL project as part of college's new signature research area in engineering education, and posted a news article highlighting ECSEL and "ecosystems of support" among several projects using evidence-based strategies. In addition, ISU News Service released an article about the new CIRTl INCLUDES grant, a synergistic collaboration involving ECSEL partners that has been mentioned several times in this report.

Various articles and presentations also appeared in social media feeds, such as Twitter (samples are shown in the student experience album – **uploaded document #2**).

### **5) What do you plan to do during the next reporting period to accomplish the goals?**

Plans for year 3 are aligned with the project objectives and logic model and draw on research and evaluation findings from year 2. The team will discuss adaptation of planned and ongoing activities in relation to the findings. The evaluation team will follow the timeline in the Evaluation Plan (**uploaded document #1**). The research teams will follow the study protocols in IRB applications. Aspects of project management will be reviewed and improved, including coordination across institutions. Many activities described in this report for year 2 will continue to be implemented. A complete cycle of scholarship recruitment and selection will be conducted at each institution. Elements of the ECSEL student experience will continue to be put in place and fully implemented at each institution.

#### Student Experience Plans

Plans for the ISU ECSEL student experience for year 3 (2018-19) were developed during year 2 using a continuous improvement approach involving stakeholders and incorporating feedback, evaluation and research. These plans reflect the expanded partnering between the ECSEL and WISE programs at ISU, leveraging key programming and expertise and creating the ECSEL Student Experience Coordinator position. The ECSEL Student Experience Coordinator has arranged and adapted programming specifically designed to support current students. Using feedback collected during spring 2018 and input from peer mentors, the programming schedule for year 3 has been organized with an emphasis on sense of belonging, professional development, supportive community, leadership and holistic well-being. The Student Experience Coordinator will facilitate weekly seminars and serve as a liaison between peer mentors, scholars, ECSEL team members and WiSE staff to promote scholar success. The Student Experience Coordinator will also oversee the peer mentoring program, which will be strengthened through improvements in training, supervision, roles and responsibilities, meeting structure, consistency and feedback. The peer mentoring system will model how the peer mentor/mentee relationship is to be cultivated so as to foster meaningful relationships with their peers. There are plans to enhance the ECSEL lab space to create a more inviting space for scholar interaction, collaboration, inspiration and innovation.

An overview of the planned programming, peer mentor responsibilities, and fall 2018 leadership courses for scholars (CPRE/EE 301X for sophomore and above students, and LD ST 270 for first-year students) are uploaded with this report (**uploaded document #4**).

### Research Study Plans

The identity research team (via graduate assistant Espino) began to write sections of a systematic literature review focused on gathering information about professional and engineering development and financial need during summer 2018. This review revealed that there is a lack of terminology that encompasses students who receive aid while being engineers. Also, there has been a void in understanding marginalized identities and the intersections of more than race and sex. This literature review will inform future work.

The motivation research study will select a new sample of students to provide a comparison group to match against the ECSEL participants. The study timeline is:

End of year 2: Logistic regression to examine differences between scholarship students and comparison group on retention

End of year 3: Logistic regression, CFA, or hierarchical linear regression (N = 60)

End of year 5: Structural equation modeling (N = 100)

By year 5, the team expects to discern cohort group effects from different levels of exposure for multiple years as compared to just one year of participation. As previous research has found that participation in multiple learning communities is particularly beneficial, the study will adjust for the number of learning community experiences for each student. By the end of the study, if the volume of data permits, a structural equation model will be estimated (refer to the conceptual model in Figure 1 in **uploaded document #1**).

### Evaluation Plans

Evaluation activities for year 3 will consist of (1) a survey with team members at ISU, DMACC and KCC to examine opinions about activities, progress towards project objectives, and contextual factors (fall 2018), (2) coordination with the research team to prepare and conduct a survey or focus group with ISU ECSEL scholars to examine their experiences in the program (spring 2019), (3) a survey of mentors to examine their accomplishments, challenges and changes in practice and attitudes regarding their mentoring experience (spring 2019), (4) management and submission of the S-STEM student tracking data (2018-19 semesters), and (5) development of an evaluation of broader impacts, including a review of departmental records, influence on pre-college students who attend activities with ECSEL scholars or within ECE, and impact of the cyber security program.

## Section 4: Impact

1) What is the impact on the development of the principal discipline(s) of the project?

### Broader Impacts Summary



Project activities supporting broader impacts during year 2 focused on providing opportunities for low-income academically talented students in ECSE; partnering with community colleges, diversity programs, and researchers to improve diversity and inclusion in ECSE; improving the education pathway through the community college into ECS engineering degree programs; and capacity-building in cyber security (e.g., Iowa Cyber Security Hub). In addition, a new BS program in cyber security engineering has been proposed and is slated for Board of Regents approval to begin in 2019. This program, led by ECSEL co-PI Doug Jacobson, will provide new academic opportunities for students at ISU and pathways for community college students.

<https://www.ece.iastate.edu/cybersecurity/> It is also mentioned in ISU's 12<sup>th</sup> place ranking in the College Choice ranking of Best Bachelor's in Engineering Degrees.

<https://www.collegechoice.net/rankings/best-engineering-degrees/>

Inclusion is a guiding principle in planning and implementation. The research studies are expected to inform departmental and wider efforts in support of marginalized students in ECSE. Preliminary findings from engineering identity research studies are highlighting specific issues. Synergistic projects and partnering within and across institutions and what is learned from/about them are a potential broader impact. This was addressed by ECSEL researcher Sarah Rodriguez in the ASCN webinar presentation, "Working in Interdisciplinary Teams: Lessons Learned in Influencing STEM Change," and in the Consejos Colectivos: Improving STEM Success at HSIs presentation, "Collaborations for STEM Change: Crafting Interdisciplinary Teams and Leveraging Expertise." Refer to the **section on Dissemination to Communities of Interest** and the presentations listed in the **Products section**.

Another emerging broader impact of the project is institutional strategic planning that enhances the visibility of engineering education research and the capacity to conduct such research. The ECSEL project has helped bring attention to and reinforce engineering education research collaborations at ISU and in the college and department (e.g., see **Dissemination to Communities of Interest section**). The College of Engineering now includes engineering education as one of six signature research areas (**uploaded document #1**), <https://www.engineering.iastate.edu/research/signature-research-areas/engineering-education/>. With this, the college is also tracking and reporting research metrics for engineering education research (EER), including research expenditures and number of projects. EER accounts for about 10% of college research expenditures in FY17 (\$10M of \$99M) (in uploaded document). ECSEL ECSE faculty members are helping college leaders develop an EER graduate curriculum across departments drawing substantially on School of Education courses.

#### DMACC Broader Impacts Summary

DMACC is continuing to strengthen our ongoing transfer partnership with ISU's College of Engineering. An Engineering Transfer Conference was held on November 29, 2017, for DMACC students to learn more about the field of engineering and opportunities to transfer to a four-year institution in Iowa to continue their studies. Representatives from ISU and the University of Iowa provided feedback on recommended course sequencing and the importance of internship experiences.

DMACC has also leveraged support from the NSF IINSPIRE LSAMP grant (<https://www.dmacc.edu/lsamp/>), with four LSAMP students selected at ISU to participate in the ECSEL scholars program. The four students completed undergraduate research experiences prior to transferring to continue their baccalaureate degree studies in electrical, software or computer engineering at ISU.

An outstanding collaborative partnership associated with the ECSEL grant is the Iowa Cyber Security Hub (<https://www.iowacyberhub.org/>), having a goal of increasing cyber security professionals to meet the future workforce needs in Iowa. Specific initiatives include: marketing materials to recruit students into cyber security fields, middle school and high school cyber curriculum development, establishment of DMACC Cyber Security Career Academy, enhanced curricular articulation with DMACC focused AS degree to ISU BS degree, development of an AAS Cybersecurity Degree and Professional certificate into an ISU Master Degree in Information Assurance.

#### KCC Broader Impacts Summary

The ECSEL project has contributed to efforts to strengthen transfer pathways in areas of the grant. Kirkwood is working on streamlining the transfer process for Kirkwood students attending ISU. An articulation agreement with the ISU Computer Science Department has been formalized effective fall 2019, and there are continuing discussions with the ISU College of Engineering to formalize a similar agreement for engineering transfer students.

#### Other Impacts

Two complementary research studies are underway to explore how diverse students in ECSE develop and sustain their engineering identities, and to understand how the learning environment can support diverse students to seek out ECSE programs and to persist in completing ECSE degrees. These studies will not only inform and improve project activities, but will also allow us to better influence student success and department culture, through the establishment of a community of practice for ECSE faculty to support inclusive teaching, student mentoring, and understanding of student success. Ultimately the goal is to advance knowledge and support adaptation by others, and towards this goal the larger ECSE education community is being reached through collaboration and networking.

#### 2) What is the impact on other disciplines?

There is an extensive collaboration between the ECSE and education communities within this project. Education and social science researchers at ISU are collaborating with project leaders and conducting research to advance knowledge in their fields and improve understanding of STEM student success.

The project may potentially impact other faculty as they can be assisted with leveraging ECSEL project activities as building blocks for the broader impacts expected in their disciplinary research grants. In this manner, faculty participation in ECSEL will help not only the project/students but also the researcher, the targeted audience, and other stakeholders. Faculty participants will potentially enhance the competitiveness of their research grants.

#### 3) What is the impact on the development of human resources?

As a scholarship program, a primary goal of the ECSEL project is human resource development. Scholarships are supporting cohorts of undergraduate student scholars, including transfer students and students underrepresented in ECSE disciplines. The project emphasizes student development, including mentoring. Graduate research assistants are also being trained and

mentored while working on the project. The **Training and Professional Development section** of this report highlights some of these impacts.

The research studies will also impact student and faculty development, e.g., understanding how ECSE students overcome barriers, make choices, and persist along their educational and career paths. A faculty team member has already reflected that working with scholars has increased their awareness of diversity and inclusion issues as they relate to the classroom environment.

4) What is the impact on **physical** resources that form infrastructure?

At Iowa State University, interactions with the first cohort of ECSEL scholars quickly revealed that a sense of place / belonging would be enhanced through a designated workspace for scholars. Working with the leadership in the Department of Electrical and Computer Engineering, we were able to renovate a previous graduate student research lab into a designated activity room for ECSEL scholars, which has since become a central meeting space, open lab, and project space for organizational activities.

5) What is the impact on **institutional** resources that form infrastructure?

Another potential broader impact of the project is institutional strategic planning that enhances the visibility of engineering education research and the capacity to conduct such research. The ECSEL and RIDE projects have brought attention to and reinforced engineering education research collaborations at ISU. These high impact projects reflect both the college's new strategic research area in engineering education and the university's new visionary theme of global citizen and workforce development. As part of the development of the college's new strategic plan, the following new research area on engineering education has been defined.

**Engineering Education: Strengthening Student Success and Inclusion.** Engineering education is evolving to ensure successful graduates have acquired a combination of highly flexible technical expertise, creativity, an appreciation of societal needs, and the ability to function in an inclusive, collaborative global landscape. Engineering educators use instructional practices known to enhance student engagement and learning, thereby achieving critical student learning outcomes. These practices include the use of evidence-based pedagogical approaches such as project- or problem-based learning and the use of modern delivery methods that blend online learning with interactive classroom sessions. Engineering educators are engaged in partnerships to promote engineering in the K-12 arena to help sustain and grow the pipeline of diverse students who enter the engineering profession.

Focus areas:

- Engineering Epistemologies (Engineering Thinking and Knowing)
- Engineering Learning Mechanisms (Engineering Learning Mechanisms and Approaches)
- Engineering Learning Systems (Engineering Education and Institutional Practices)
- Engineering Diversity and Inclusiveness (Pathways into Diversity and Inclusiveness)
- Engineering Assessment (Research Methods and Assessment)

6) What is the impact on **information** resources that form infrastructure?

The ECSEL team has been partnering with diversity programs on campus including WISE, LEAD (multicultural students in engineering) and student organizations such as Digital Women and SWE. Specifically, WISE activities have been an influential model for the ECSEL student experience, and WISE program staff have been directly involved with project planning and activities. Examples of program collaboration between WISE and ECSEL are evident in the project activities described in this report.

Interactions between ECSEL team leaders and admissions, financial aid, advising, and scholarships administrators at the three institutions have created opportunities for information exchange that would most likely not have occurred in the absence of this project.

The program materials, websites, assessment tools, and assessment data are information resources to support faculty, staff, students, and evidence-based practices. The web-based SmartSheet platform allows for compilation of data for viewing, tracking, reporting and management. All data reported by the three institutions in SmartSheet is compiled in worksheets (spreadsheets) that can be accessed and formatted to meet assessment and reporting needs. Included in SmartSheet is a student database for each of the institutions that allows project directors to track student participation, persistence in ECSE disciplines, graduation, and placement.

7) What is the impact on technology transfer?

Nothing to report.

8) What is the impact on society beyond science and technology?

Project outcomes will have a longer-term impact on industry, the economy, and ultimately their products and services through workforce development. The ECSEL program is creating a student-centered, inclusive learning environment that is attractive to diverse students, thus helping to develop leaders and strengthen the ECSE workforce.

Uploaded file #1

Documents in this file:

1. ECSEL project logic model
2. ISU scholarship and enrollment tables
  - Table 1. Summary of ISU ECSEL scholarship recipients as of fall 2018.
  - Table 2. Undergraduate enrollment in ECSE majors at ISU as of fall 2017.
  - Table 3. Undergraduate enrollment in ECSE majors at ISU as of fall 2018.
  - Table 4. Undergraduate enrollment percentages and changes for diverse students in ECSE majors at ISU.
3. ISU ECSEL informational flyer
4. Motivation research study figure: conceptual model for analysis
5. ECSEL evaluation plan
6. College of Engineering webpages for Signature Research Area of Engineering Education (includes ECSEL)
7. College Research Expenditures Graph (includes Engineering Education Research)
8. List of mentoring resources
  - Overview of ECSEL faculty-scholar mentoring program
9. Introduction to mentoring slides

**Logic Model**  
**NSF S-STEM: ECSEL Scholarship Program (Electrical, Computer, and Software Engineering as Leaders)**

Resources	Activities	Outputs	Outcomes	Impacts
<ul style="list-style-type: none"> <li>• NSF funding</li> <li>• PI team (ISU, DMACC, KCC)</li> <li>• Leadership team (ISU, DMACC, KCC)</li> <li>• Faculty mentors (ISU, DMACC, KCC)</li> <li>• Peer mentors (ISU, DMACC, KCC)</li> <li>• Graduate assistants (ISU)</li> <li>• Research team (ISU)</li> <li>• ECPE Department chair and External Advisory Board</li> <li>• ISU Research Institute for Studies in Education (RISE) (external eval.)</li> <li>• ISU programs/resources: PWSE, LC, CELT</li> <li>• ISU offices: Financial Aid, Institutional Research, Registrar</li> <li>• ISU College of Engineering: Engineering Student Services, Engineering Career Services</li> <li>• ISU Digital Women student organization</li> <li>• DMACC offices/resources: Institutional Research, Financial Aid, Foundation, Program Development, Pathway Navigators, STEM clubs</li> </ul>	<ul style="list-style-type: none"> <li>• Meetings of various team members</li> <li>• Meetings with external evaluator</li> <li>• Coordination and management of the project</li> <li>• Website development and maintenance</li> <li>• Implementation and integration of scholarship application and review processes</li> <li>• Management of scholar information</li> <li>• Design and implementation of the scholar student experience based on PWSE and ECPE activities and enhancements (see ECSEL Student Experience)</li> <li>• Promotion and adoption of inclusive teaching practices</li> <li>• Promotion of and preparation for industry and research internships for rising sophomores and juniors as part of the ECSEL Experience</li> <li>• Mentor training (faculty, peers)</li> <li>• Design and administration of participant and stakeholder surveys and interviews</li> </ul>	<ul style="list-style-type: none"> <li>• Scholarships</li> <li>• ISU scholar database</li> <li>• DMACC scholar database</li> <li>• KCC scholar database</li> <li>• Scholar portfolios</li> <li>• Scholar recognition (e.g., news articles, social media)</li> <li>• Website and web analytics</li> <li>• Dissemination through presentations and publications</li> <li>• Data briefs</li> <li>• Reports</li> <li>• NSF S-STEM online database</li> <li>• Academic advising guidelines</li> <li>• ECSEL experiential learning kits</li> <li>• Recruiting and outreach marketing materials</li> <li>• Training and professional development resources</li> <li>• Research datasets</li> </ul>	<p><b>S-STEM Student Outcomes</b></p> <ul style="list-style-type: none"> <li>• Degrees granted in electrical, computer, and software engineering</li> <li>• Students transferring from an associate to a baccalaureate degree program</li> <li>• Students successfully completing the Engineering Basic Program</li> <li>• Doubling the enrollment of women in ECSE majors (240), including transfers</li> <li>• 1-year (86%) and 2-year (80%) retention rates for female students in ECSE majors</li> <li>• 6-year graduation rate (55%) for female students in ECSE majors</li> </ul> <p><b>Other Student Outcomes</b></p> <ul style="list-style-type: none"> <li>• Increased student motivation, satisfaction and retention</li> <li>• Increased professional identity as an ECS engineer</li> <li>• Placement in ECS engineering-related jobs and graduate programs</li> <li>• Increased percentage of women enrolled and graduating with degrees</li> </ul>	<ul style="list-style-type: none"> <li>• Outcomes lead to impacts on students, faculty, department culture, institutions, disciplines, and research knowledge base</li> </ul> <p><b>Broader Impacts</b></p> <ul style="list-style-type: none"> <li>• Expanding opportunities for low-income academically talented students with financial need</li> <li>• Increased partnerships with community colleges, industry, diversity programs, and researchers to broaden participation of women in ECS engineering majors</li> <li>• Development of a diverse workforce in ECS engineering fields</li> <li>• Improved education pathway through the community college into baccalaureate ECS engineering programs</li> <li>• Increased understanding of and engagement with ECS engineering by prospective students, parents, teachers (e.g., experiential learning kits)</li> </ul>

Resources	Activities	Outputs	Outcomes	Impacts
<p>on each campus, learning communities</p> <ul style="list-style-type: none"> <li>• KCC offices/resources</li> <li>• Cross-institutional programs: E-APP, IINSPIRE LSAMP</li> <li>• Institutional data</li> <li>• Statistical expertise</li> <li>• Conferences for student professional development and networking (such as Grace Hopper Conference, SWE Annual Conference)</li> <li>• Relevant literature, knowledge and evidence base</li> <li>• ISU Digital Repository</li> <li>• Center for Integrating Research, Teaching, and Learning (CIRTL) Network</li> <li>• WEPAN Engineering Inclusive Teaching (EIT) resources</li> <li>• NCWIT resources</li> </ul>	<ul style="list-style-type: none"> <li>• IRB updates as needed</li> <li>• Compilation of assessment and evaluation information</li> <li>• Review of project outcomes</li> <li>• NSF S-STEM data collection and reporting</li> <li>• NSF annual reporting</li> <li>• Third-year review</li> <li>• Meetings of grantees and other researchers</li> <li>• Faculty/staff professional development related to inclusion and equity</li> <li>• Role-model training (students)</li> <li>• Outreach and recruitment through pre-college activities: IT-Olympics (HyperStream), Taking the Road Less Travelled, SWE University, ECPE Take Your Adventure Home, DMACC Discover/Explore Engineering, PLTW</li> <li>• Creation of ECSEL experiential learning kits</li> <li>• Marketing to prospective students</li> <li>• Design and administration of research studies</li> <li>• Dissemination of effective practices and research findings</li> </ul>		<p>in ECS engineering</p> <ul style="list-style-type: none"> <li>• Advancement of leadership knowledge, skills and abilities</li> </ul> <p><b>Other Program Outcomes</b></p> <ul style="list-style-type: none"> <li>• Improved messaging and marketing to prospective students</li> <li>• Increased student-faculty interaction</li> <li>• Positive and coordinated student experience</li> <li>• Increased attention to evidence-based practices to support diverse students</li> <li>• Collaborative structures across units to effectively and efficiently support students</li> </ul> <p><b>Process Outcomes</b></p> <ul style="list-style-type: none"> <li>• Extent to which proposed activities are completed and achieving project objectives and outcomes</li> <li>• Extent to which contextual factors help and/or hinder progress toward project goals</li> <li>• Extent to which assessment, evaluation, and research results are used as inputs for continuous improvement</li> <li>• Effect of the project on individual and group attitudes/behaviors</li> </ul>	<ul style="list-style-type: none"> <li>• Capacity building in cyber security to support national security</li> </ul>

Table 1. Summary of ISU ECSEL scholarship recipients as of fall 2018.

<b>ECSEL Entry Semester</b>	<b>N</b>	<b>NC</b>	<b>NI</b>	<b>Yr1 Now</b>	<b>Yr2 Now</b>	<b>Yr3 Now</b>	<b>Yr4+ Now</b>	<b>Grad</b>	<b>Women</b>	<b>URM</b>	<b>CCT</b>	<b>NT</b>	<b>CE</b>	<b>EE</b>	<b>SE</b>
<b>Spring 2017</b>	10	10	0	0	0	3	4	3	10	2	0	2	4	2	4
<b>Fall 2017</b>	23	10	13	0	13	7	3	0	22	4	1	0	9	5	9
<b>Spring 2018</b>	6	6	0	0	2	3	1	0	4	5	2	0	2	1	3
<b>Fall 2018</b>	24	2	22	20	1	3	0	0	16	9	4	3	11	8	5
<b>TOTAL</b>	<b>63</b>	<b>28</b>	<b>35</b>	<b>20</b>	<b>16</b>	<b>16</b>	<b>8</b>	<b>3</b>	<b>52</b>	<b>20</b>	<b>7</b>	<b>5</b>	<b>26</b>	<b>16</b>	<b>21</b>

N: Number of new scholars added in corresponding entry semester  
 NC: Number of current students (already in ECSE majors) entering the program  
 NI: Number of incoming students (first-year or transfer students) entering the program  
 Yr# Now: Year in school as of fall 2018  
 Grad: Number of graduates  
 Women: Number of women students  
 URM: Number of underrepresented minority students  
 CCT: Number of community college transfer students  
 NT: Number of nontraditional students  
 CE: Number of computer engineering students  
 EE: Number of electrical engineering students  
 SE: Number of software engineering students

ECSEL Entry Semester refers to the first semester in which a student was awarded a scholarship and entered the ECSEL Program. On entry into the ECSEL Program, a student is either a current student in an ECSE major or an incoming student new to ISU. In incoming student may be either coming from high school and in their first year, or transferring to ISU from a community college. Of the student demographics summarized in the table, nontraditional refers to students who are 25 years old and over, or who are under 25, but are married, have children, commute, or were in the military (i.e., generally have responsibilities which differ from that of a traditional age student).



Table 2. Undergraduate enrollment in ECSE majors at ISU as of fall 2017 (after year 1 of grant).

Academic Year	15-16	16-17	17-18	15-16	16-17	17-18	Change F16 – F17	
<b>Total ECSE Students</b>	1792	2003	2065				+62	+3.1%
<b>Total ECSE Women</b>	159	190	204	8.9%	9.5%	9.9%	+14	+7.4%
<b>Total ECSE Minority</b>	252	305	340	14.1%	15.2%	16.5%	+35	+11.5%
<b>Computer Engineering</b>	725	806	836				+30	+3.7%
<b>Women</b>	56	62	66	7.7%	7.7%	7.9%	+4	+6.5%
<b>Women (Minority)</b>	11	14	24	1.5%	1.7%	2.9%	+10	+71.4%
<b>Minority</b>	106	130	151	14.6%	16.1%	18.1%	+21	+16.2%
<b>Electrical Engineering</b>	614	629	546				-83	-13.2%
<b>Women</b>	61	63	57	9.9%	10.0%	10.4%	-6	-9.5%
<b>Women (Minority)</b>	12	14	16	2.0%	2.2%	2.9%	+2	+14.3%
<b>Minority</b>	74	76	72	12.1%	12.1%	13.2%	-4	-5.3%
<b>Software Engineering</b>	450	566	682				+116	+20.5%
<b>Women</b>	42	65	81	9.3%	11.5%	11.9%	+16	+24.6%
<b>Women (Minority)</b>	12	18	17	2.7%	3.2%	2.5%	-1	-5.6%
<b>Minority</b>	72	99	117	16.0%	17.5%	17.2%	+18	+18.2%

Table 3. Undergraduate enrollment in ECSE majors at ISU as of fall 2018 (after year 2 of grant).

Academic Year	17-18	18-19	17-18	18-19	Change F17-F18		Change F16-F18	
<b>Total ECSE Students</b>	2065	2144			79	3.8%	141	7.0%
<b>Total ECSE Women</b>	204	236	9.9%	11.0%	32	15.7%	46	24.2%
<b>Total ECSE Minority</b>	340	382	16.5%	17.8%	42	12.4%	77	25.2%
<b>Computer Engineering</b>	836	802			-34	-4.1%	-4	-0.5%
<b>Women</b>	66	74	7.9%	9.2%	8	12.1%	12	19.4%
<b>Women (Minority)</b>	24	30	2.9%	3.7%	6	25.0%	16	114.3%
<b>Minority</b>	151	144	18.1%	18.0%	-7	-4.6%	14	10.8%
<b>Electrical Engineering</b>	546	557			11	2.0%	-72	-11.4%
<b>Women</b>	57	63	10.4%	11.3%	6	10.5%	0	0.0%
<b>Women (Minority)</b>	16	16	2.9%	2.9%	0	0.0%	2	14.3%
<b>Minority</b>	72	91	13.2%	16.3%	19	26.4%	15	19.7%
<b>Software Engineering</b>	682	785			103	15.1%	219	38.7%
<b>Women</b>	81	99	11.9%	12.6%	18	22.2%	34	52.3%
<b>Women (Minority)</b>	17	24	2.5%	3.1%	7	41.2%	6	33.3%
<b>Minority</b>	117	147	17.2%	18.7%	30	25.6%	48	48.5%

Table 4. Undergraduate enrollment percentages and changes for diverse students in ECSE majors at ISU

	15-16*	16-17*	17-18*	18-19*	Change F16 → F18**
<b>Total ECSE Students</b>	–	–	–	–	7.0
<b>Total ECSE Women</b>	8.9	9.5	9.9	11.0	24.2
<b>Total ECSE Minority<sup>^</sup></b>	14.1	15.2	16.5	17.8	25.2
<b>Total CPE</b>	–	–	–	–	-0.5
<b>CPE Women</b>	7.7	7.7	7.9	9.2	19.4
<b>CPE Minority<sup>^</sup></b>	14.6	16.1	18.1	18.0	10.8
<b>Total EE</b>	–	–	–	–	-11.4
<b>EE Women</b>	9.9	10.0	10.4	11.3	0.0
<b>EE Minority<sup>^</sup></b>	12.1	12.1	13.2	16.3	19.7
<b>Total SE</b>	–	–	–	–	38.7
<b>SE Women</b>	9.3	11.5	11.9	12.6	52.3
<b>SE Minority<sup>^</sup></b>	16.0	17.5	17.2	18.7	48.5

<sup>^</sup> In this dataset, racial/ethnic minority students include Asian American.

\* Percentage of diverse students (women or minority) among total students for indicated year (e.g., women were 11% of all ECSE students in fall 2018)

\*\* Percentage change in enrollment of specified student population over two-year period (e.g., the number of EE minority students increased by 19.7% percent from fall 2016 to fall 2018)



# ECSEL/IOWA STATE

## Electrical, Computer, and Software Engineers as Leaders

**Renewable \$8000/academic year scholarships!**

### Scholarship Requirements

- U.S. Citizen
- Enrolled in Electrical, Computer or Software Engineering at Iowa State
- Demonstrated financial need through FAFSA



### ECSEL student experience through WiSE and ECE Department

- Learning communities
- Leadership development
- Professional development
- Academic advising and support
- Mentoring
- Co-curricular and extracurricular activities



For more information and to complete application: <https://ecsel.ece.iastate.edu/students/interested-students/>



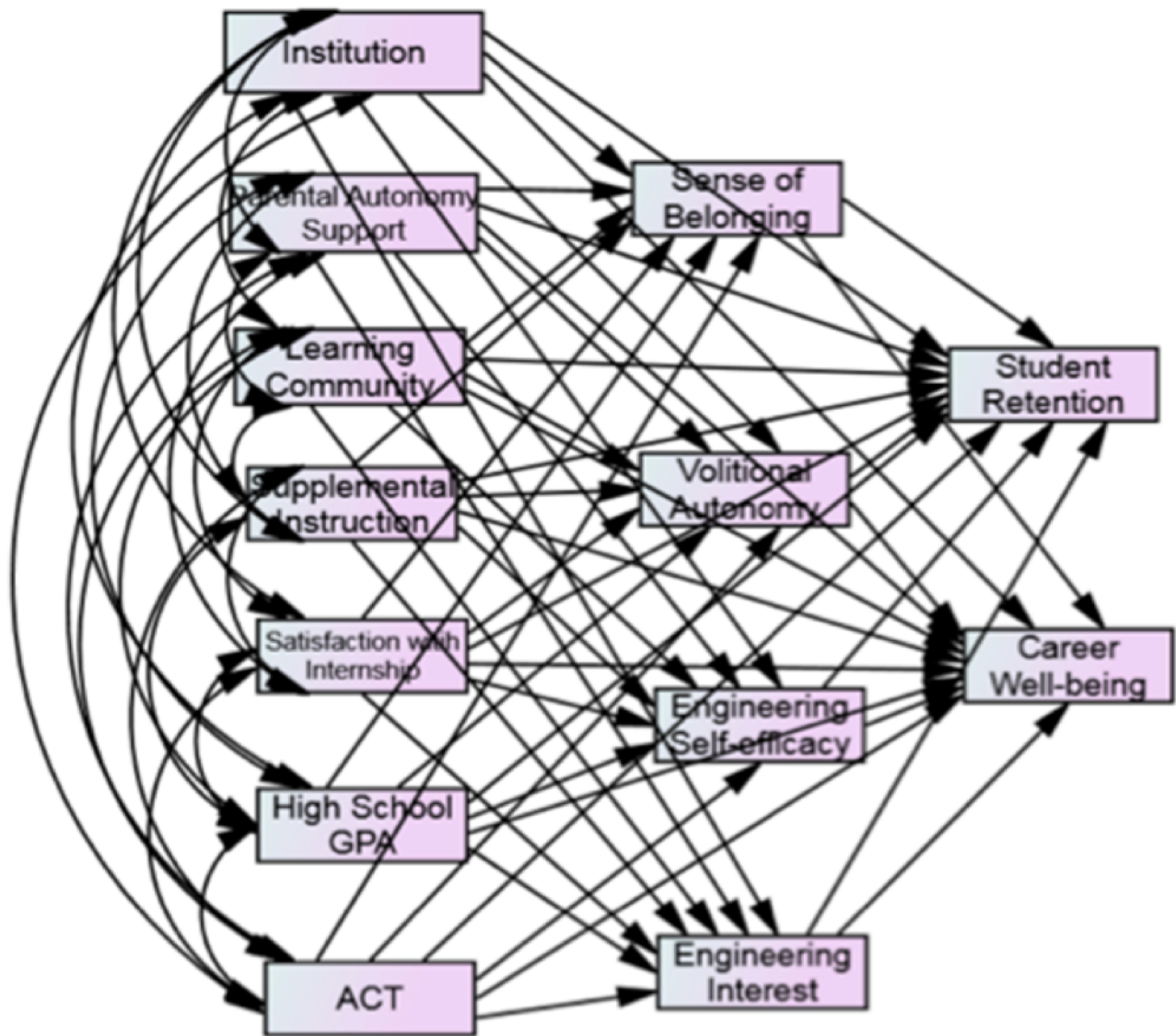


Figure 1. Conceptual Model for Analysis

**ECSEL Evaluation Plan**

<b>Method</b>	<b>Conceptual Areas to Explore</b>	<b>Timing</b>
ECSEL Team Survey	Accomplishments Challenges Annual activities, helpfulness of activities in moving forward Collaboration and partnership with DMACC and KCC Unanticipated/unintended outcomes/leverage	Annually
ECSE Mentors Survey	Accomplishments Challenges Changes in practice and attitudes Value of mentoring Unanticipated/unintended outcomes/leverage	Annually
ECSE Scholar Experience Survey	Level of engagement in the program Feedback regarding benefits and improvements needed	Annually
Broader Impacts Survey	Feedback regarding programming Participant engagement and interest in content area	Years 3-5
NSF Data Collection and Additional Data Tracking	Tracking patterns in scholar achievement, retention, attrition, career plans, graduation, diversity, participation in activities, post-college employment, and graduate education	Each semester

# Engineering Education

## Strengthening Student Success and Inclusion

Engineering education is evolving to ensure successful graduates have acquired technical expertise complemented with creativity, an appreciation of societal needs, and the ability to function in an inclusive, collaborative global landscape. Engineering educators use instructional practices known to enhance student engagement and learning, thereby achieving critical student learning outcomes. These practices include the use of evidence-based pedagogical approaches such as project- or problem-based learning and the use of modern delivery methods that blend online learning with interactive classroom sessions. Engineering educators are engaged in partnerships to promote engineering in the K-12 arena to help sustain and grow the pipeline of diverse students who enter the engineering profession.

### Focus Areas

- Engineering Epistemologies (Engineering Thinking and Knowing)
- Engineering Learning Mechanisms (Engineering Learning Mechanisms and Approaches)
- Engineering Learning Systems (Engineering Education and Institutional Practices)
- Engineering Diversity and Inclusiveness (Pathways into Diversity and Inclusiveness)
- Engineering Assessment (Research Methods and Assessment)



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# Ecosystems of support

## Promoting an accessible, responsive approach to engineering education

A new initiative in the Department of Electrical and Computer Engineering will help a pool of talented students pursue a degree in engineering.

The project, called ECSEL: Electrical, Computer, and Software Engineers as Leaders, is part of the National Science Foundation's Scholarships in Science, Technology, Engineering, and Mathematics (S-STEM) program, which provides financial support to help low-income, academically talented students obtain STEM degrees and enter the workforce or graduate study.

The program will fund 582 scholarships over the next five years for students majoring (or preparing to transfer) in electrical engineering, computer engineering and software engineering.

"We're also creating what we are calling an ecosystem of academic and co-curricular support for these students, providing them with an experience that will not only encourage them to stay in their STEM field of choice but also give them the tools to excel," says **Joe Zambreno**, associate professor of electrical and computer engineering and principal investigator of the project.

The program is a multi-institutional, collaborative partnership between the Department of Electrical and Computer Engineering, Program for Women in Science and Engineering, Des Moines Area Community College and Kirkwood Community College, and Zambreno says the group will leverage the individual successes of each partner as the program grows.

"We are looking at the entire process of earning a degree in STEM and identifying ways to make it better, whether it's making sure classes transfer from community college to Iowa State or offering leadership development opportunities that keep the students engaged in their learning and growth," he adds.

An important aspect of the project will be the team's research studies of the ecosystem of supports that will accompany the project. Zambreno says the group will investigate how underrepresented minorities, including women, in STEM fields develop their professional and career identity using both qualitative and quantitative metrics.

"Knowing what motivates individuals can help us make adjustments to the learning environment we offer," he adds. "The more we can do to encourage diversity in thought and culture in STEM, the better the fields will be."



Joe Zambreno, associate professor of electrical and computer engineering

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# Boosting diversity in engineering with evidence-based strategies

## IINSPIRE LSAMP: Thriving in STEM Disciplines

Iowa State leads the \$5 million Louis Stokes Alliances for Minority Participation (LSAMP) Iowa-Illinois-Nebraska STEM Partnership for Research and Education (IINSPIRE) project that aims to increase the number and improve the experience of underrepresented students completing STEM degrees in the Midwest.

IINSPIRE offers students evidence-based academic, professional and social support, including mentoring, hands-on research experiences, transfer partnerships between two- and four-year institutions, and other programming.

Researchers, guided by social cognitive career theory, are studying both micro- and macro-level influences to understand how IINSPIRE students thrive and persist in STEM disciplines. Sixteen public and private colleges and universities and community colleges across three states are participating in IINSPIRE

, providing a rich collaboration to study shared challenges alliance-wide.

IINSPIRE is led by principal investigator **Jonathan Wickert**, Iowa State senior vice president and provost and professor of mechanical engineering, and alliance director **Diane Rover**, University Professor of electrical and computer engineering. IINSPIRE is funded by the National Science Foundation.



Jonathan Wickert, Iowa State senior vice president and provost

## RIDE: Collaborative, Inclusive Instructional Models

An interdisciplinary team of Iowa State researchers are developing new instructional models for course design in electrical and computer engineering, with a goal of better preparing the next generation of engineers for working in ever complex systems and broadening the participation of underrepresented students, especially women.

The Reinventing the Instructional and Departmental Enterprise (RIDE) project is funded by \$2 million from the NSF to develop new approaches to teaching and learning in electrical and computer engineering, especially in relation to design and systems thinking, professional skills, such as leadership and inclusion, contextual concepts and creative technologies. Researchers are developing and evaluating human-centered, collaborative and interactive teaching practices in new courses each semester, continually evaluating and improving strategies.

RIDE co-principal investigators are **Diane Rover**, University Professor of electrical and computer engineering, and **Joe Zambreno**, professor of electrical and computer engineering.

## ECSEL: Ecosystems of Support

Cyclone Engineers, together with colleagues at two community colleges, are examining the entire process of earning electrical, computer and software engineering degrees to help improve diversity and inclusion in the fields.

The Electrical, Computer and Software Engineers as Leaders (ECSEL) project research team, led by professor of electrical and computer engineering **Joe**

**Zambreno**, is adapting, implementing and studying an evidence-based student experience model that forms an entire ecosystem of supports, ranging from scholarships for low-income, high-potential students, to professional development activities and study abroad opportunities – all with a goal of doubling the number of women enrolled in the degree programs.

Research questions address how women and other diverse students develop and sustain their engineering identities and what motivates underrepresented students to persist and thrive in electrical, computer and software engineering degree programs. ECSEL is funded by the NSF.



Joe Zambreno, professor of electrical and computer engineering










Diane Rover, University Professor of electrical and computer engineering, is alliance director for the \$5 million Louis Stokes Alliances for Minority Iowa-Illinois-Nebraska STEM Partnership for Research and Education and co-principal investigator for the Reinventing the Instructional and Departmental Enterprise project, both of which seek to boost diversity in STEM fields.

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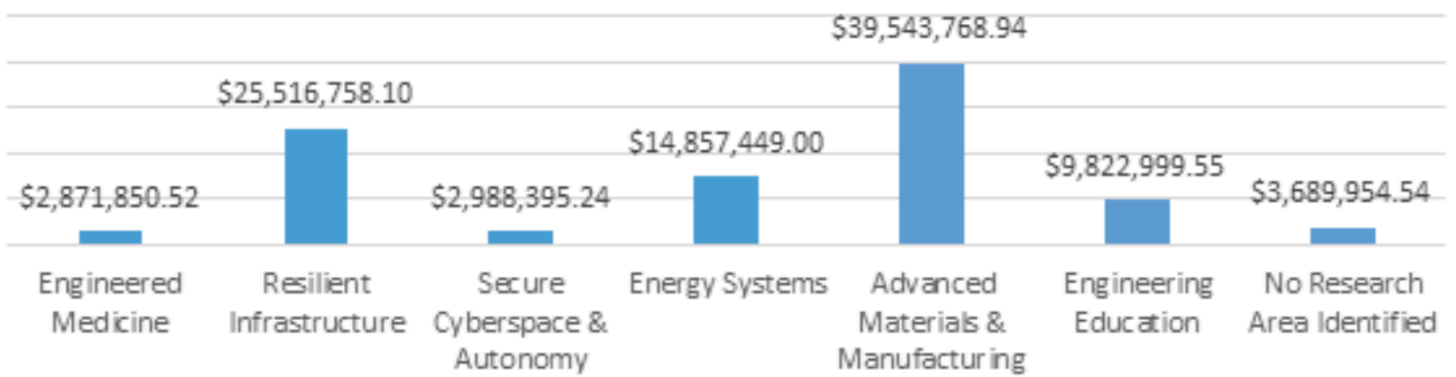
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### Strategic Research Areas



## ECSEL Program – Mentoring Resources

The mentoring training and activities draw primarily from the following set of resources:

- a) Becky Wai-Ling Packard, My Personal Board of Directors, 2008.
- b) Secrets of Success in Engineering, Talk to Me slides, NSF Engage in Engineering, WEPAN.
- c) Talk to Me Tips for Students, NSF Engage in Engineering, WEPAN.
- d) Lois J. Zachary, The Mentor's Guide, Second Edition, Jossey-Bass, 2011.
- e) Catherine Amelink, Overview: Mentoring and Women in Engineering, SWE-AWE-CASEE ARP Resources, 2008. <http://www.AWEonline.org>
- f) Matt Eliot and Jennifer Turns, Constructing Professional Portfolios: Sense-Making and Professional Identity Development for Engineering Undergraduates, ASEE Journal of Engineering Education, October 2011, 100(4), pp. 630-654.
- g) "Talk To Me": A Toolkit for Engineering Educators, NSF Engage in Engineering, WEPAN, EngageEngineering.org.
- h) Denise M. Driscoll, Mentoring and Diversity: A Handbook for Faculty Mentoring LSAMP Indiana Students in Science, Technology, Engineering, and Mathematics Field, Purdue University, 2007.
- i) Beronda L. Montgomery, Mapping a Mentoring Roadmap and Developing a Supportive Network for Strategic Career Advancement, SAGE Open, April-June 2017.
- j) NCWIT Tips: 8 Ways to Give Students More Effective Feedback Using a Growth Mindset, NCWIT.
- k) Becky Wai-Ling Packard, Quick Summary on Inclusive, Intentional Mentoring.
- l) James Cawthorne and Audeen Fentiman, Mentoring: For Graduate School and Beyond, Student Edition, College of Engineering, Purdue University, 2015.

Items a, b, and c are provided to students. All items are provided to the faculty mentors.

## **ECSEL Program – Faculty-Scholar Mentoring Information**

Scholar groups have been formed. Students in a group generally have the same major. Each group has students from multiple cohorts.

A group has been assigned to a faculty mentor according to their major. There is currently one group per faculty mentor.

A group will meet monthly with their faculty mentor, as a group, for a minimum of three meetings per semester (e.g., Fall: September, October, November; Spring: February, March, April).

An upper-level student in the group will serve as the meeting organizer, getting schedules and coordinating with the faculty mentor.

Students and faculty mentors have access to introductory information about mentoring (in Cybox).

Before the first meeting of the group, everyone should prepare by reviewing the First Meeting Agenda and Planning Worksheets in the file named “mentoring-getting-started.pdf” (available in Cybox).

Agendas for the second and third meetings will be added for guidance based on input.

Scholars will be assigned two or three reflection assignments during the semester. These must be completed as part of the ECSEL Scholarship Program.

Students are welcome to meet individually with their faculty mentor based on interest and availability.

Faculty mentors will meet as a group with ECSEL team members twice during the semester (after the first mentor-mentee meeting and at the end of the semester).

A group will rotate to a new faculty mentor after one or two semesters. This will support a wider range of student-faculty interaction.

# Mentoring

A journey of connections and growth

Mani Mina

**"I've learned that people will forget what you said, people will forget what you did, but people will never forget how you made them feel."**

**-Maya Angelou**

There are amazing and inspirational leaders who inspire us over our lives.....they help us to continue taking steps in our journey of lives....

Mentors

What are their roles?



# Mentoring

- mentor |'men,tôr'men,tər|
- noun
  - an experienced and trusted adviser: *he was her friend and mentor until his death in 1915.*
  - an experienced person in a company, college, or school who trains and counsels new employees or students.
- verb [*with object*]
  - advise or train (someone, especially a younger colleague).
- ORIGIN
  - mid 18th century: via French and Latin from Greek *Mentōr*, the name of the adviser of the young Telemachus in Homer's *Odyssey*.

# Bob Dylan a mentor to Beatles

- The second major influence Bob Dylan had on the Beatles was that he freed them from the conventions of pop music.
- This resulted in an increased use of acoustic rather than electric instruments in Beatles recordings
  - as well as a dramatic rise in their compositional craftsmanship.



# About Dylan's influence

- Then I started being me about the songs, not writing them objectively, but subjectively. ... I'd started thinking about my own emotions. ... Instead of projecting myself into a situation, I would try to express what I felt about myself. ... It was Dylan who helped me realise that”  
(Anthology page 158)

# What is mentoring?

- "Mentoring is to support and encourage people to manage their own learning in order that they may maximise their potential, develop their skills, improve their performance and become the person they want to be."

Eric Parsloe, The Oxford School of Coaching & Mentoring



A word cloud centered around the word "mentoring". The word "mentoring" is the largest and most prominent, written in a bold, orange, lowercase sans-serif font. Surrounding it are various related terms in different sizes, colors (orange and blue), and orientations. The words are arranged in a roughly circular pattern around the central word.

**mentoring**

Success Wisdom Skill Group Positive Coach Techniques Mentor

Speed Coaching Partnership

Confidence Satisfaction development

Informal Learning Advancement

Mosaic functional Career

One-on-one

Development Mentee Leading

Mentoring Departmental Teaching Relationship Role-model Support Sharing Knowledge

Departmental Teaching Relationship Role-model Support Sharing Knowledge

Personal Guides Peer

Opportunity

# Mentoring is .....

- A powerful personal development and empowerment tool.
- An effective way of helping people to progress in their careers and is becoming increasingly popular as its potential is realised.
- A partnership between two people (mentor and mentee)
  - normally working in a similar field or sharing similar experiences.
- A helpful relationship based upon mutual trust and respect.

- A mentor
  - Is a guide who can help the mentee
    - to find the right direction
    - A person who can help mentees to develop solutions to career issues.
  - Mentors
    - Rely upon having had similar experiences to gain an empathy with the mentee and an understanding of their issues.
- Mentoring provides the mentee with
  - an opportunity to think about career options and progress.

# A Mentor Should

- Facilitate the mentee to believe in herself and boost her confidence.
- Ask questions and challenge, while providing guidance and encouragement.

# Mentoring

## Message to mentees

- Allows the you to explore new ideas in confidence.
- Is a chance to look more closely at yourself, your issues, opportunities and what you want in life.
- Is about becoming more self aware, taking responsibility for your life and directing your life in the direction you decide, rather than leaving it to chance.

# Qualities/Abilities of GOOD MENTEE ...

- **Personal commitment to be involved with another person for an extended time.**
  - want to be a full partner in the mentoring connection and be invested, over the long haul, to be there long enough to realize a difference. To that end, they prepare and do the appropriate "homework" for meetings with their mentor. They work to gain the skills, knowledge, and abilities to grow.
- **Flexibility.**
  - Recognize that relationships take time to develop and that communication is a two-way street. They're flexible, listen to their mentor, and consider new options. They take initiative, seeking the mentor's advice when needed. And they focus on the goal, not getting lost in the process.
- **Openness.**
  - know and be able to discuss their needs and objectives with their mentor. This means that he or she has to look inside themselves to identify areas that may need work and share them with the mentor.



# Qualities/Abilities of GOOD MENTEE ...

- **Ability to recognize that mentoring is only ONE development tool.**
  - Mentors can save you time plus inspire, teach, and encourage you.
  - They can be excellent role models for what you want to do and become.
  - At the same time, you can also learn from many other sources.
  - By recognizing that you can benefit from a variety of sources, perspectives and styles – even those quite different from your own – you will open yourself up to new ideas, valuable information, and a wide range of viewpoints. Consider one or more mentors as part of your overall personal development strategy.
  
- **Ability to listen and to accept different points of view.**
  - Need to be able to receive feedback and look at the situation from the mentor's perspective to gain a more objective viewpoint.
  - One of the biggest values of the mentoring connection is the ability to have a more experienced person's viewpoint. The mentee has to be willing to try new things, to consider different ways of "getting there from here."

# SOME NOT-TO-DO!

- Bring to the first formal meeting a long shopping list of things you want the mentor to do for you
- Expect the mentor to be available for you, whenever you want them (heroes never need sleep!)
- Regard the mentor as your prime source of gossip to pass on
- Expect the mentor always to have the answer - that's why they are more senior
- Expect the mentor to decide when to meet and what to talk about
- Boast about the relationship to your colleagues at every opportunity
- Never challenge what the mentor says - s/he knows best
- Blame the mentor whenever advice doesn't work out - s/he should have known better
- Treat mentoring sessions as mobile - the easiest item in the diary to move at the last minute
- Enjoy the opportunity to have a good moan or whine, whenever you meet - especially if no-one else will listen to you
- Make it clear to the mentor that you want to be just like them - adopt their style of speaking, dress and posture
- Never commit to doing anything as a result of the mentoring session. If, by accident, you do, simply forget to follow the commitment up. (Why spoil the fun of discussion with outcomes?)



Some interesting mentoring stories...

Helen Adams Keller American author, political activist, and lecturer.

She was the first deaf-blind person to earn a bachelor of arts degree.

[https://en.wikipedia.org/wiki/Helen\\_Keller](https://en.wikipedia.org/wiki/Helen_Keller)

A. Graham Bell, Keller, and Nancy S.



# IOWA STATE UNIVERSITY

Department of Electrical and Computer Engineering

## Professional Exploration



**ECSEL**/IOWA STATE

# Professional Formation and Identity



ECSEL/IOWA STATE

- Engagement with professional activities and demonstration of knowledge and skills
- Involvement with social (professional) networks
- Discovery of personal and professional interests and goals (sense-making)
  - Understanding yourself and professional opportunities and responsibilities

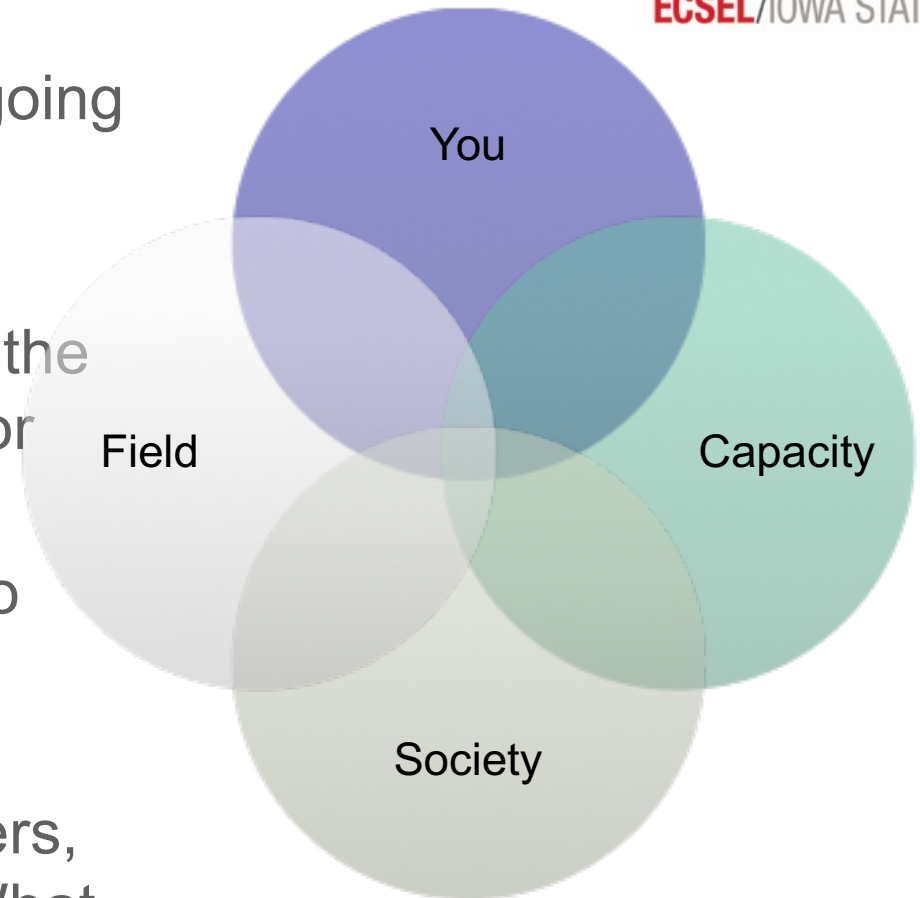


# Professional Formation and Identity



ECSEL/IOWA STATE

- What are your interests?
- What are your motivations for going into this field?
- What is your hidden potential?
- How are you hoping to change the world or make life better, and for whom?
- What do you need to develop to reach your goals?
- What assets (people, tools, expertise, organizations, partners, etc.) do you have access to? What do you need?



Uploaded file #2

Documents in this file:

1. ISU Student Experience Description
2. Photo album with various depictions of the ECSEL student experience and ECSEL project
  - ECSEL scholars leading and giving back at outreach events such as WISE Taking the Road Less Traveled and IT-Olympics.
  - ECSEL scholars organizing and participating in hackathons, building community and competencies.
  - ECSEL scholars learning and networking through local and national conferences, international experiences, and seminars.
  - News stories and tweets recognizing and sharing contributions of ECSEL scholars and team members.



## ISU Student Experience Description

This description provides supporting details for **section 1.2 Student Experience Planning and Implementation** in the main report.

During fall and spring semesters of year 2, ECSEL scholars met weekly with ECSEL ECE team members. A welcome open house was held for all ECSEL scholars at the start of fall semester. Cardinal scholars and gold scholars met as separate groups during fall semester. Some gold scholars also attended cardinal scholar meetings. Three peer mentors from the gold scholar group (one for each ECSE major) helped bridge the activities and relationships across groups. Small peer groups consisting of gold and cardinal scholars were also formed. ECSEL team members serving as faculty mentors also participated in scholar meetings for both groups. Fall semester meeting topics included: orientation; mentoring; conference participation; professional networking; internship and career advising; sketchnoting; project-based service learning and outreach volunteering; and positive thinking for finishing the semester. The peer mentors organized a mid-semester retreat for the scholars. Scholars were recognized at the department's annual scholarships and awards banquet in the fall. In addition to using email and Blackboard/Canvas, scholars also set up a Slack workspace for communication, which was also available to team members. All scholars have access to the ECSEL Lab, a newly allocated space in Coover Hall dedicated for their use. Scholars are treated to donuts and bagels on Friday mornings in the lab. All incoming first-year scholars participate in a formal learning community (WISE, CPE, EE, and/or SE, <https://www.lc.iastate.edu> ) as part of their ECSEL student experience.

For spring semester, all scholars met weekly in a one-credit seminar class. Spring semester meeting topics included: mentoring; StrengthsQuest; career advising; project-based service learning and outreach volunteering; engineering skills and mindsets; design thinking; plus/delta feedback; and tech talks by ECSEL faculty mentors. A StrengthsQuest workshop was led by WISE director and ECSEL team member Lora Leigh Chrystal over two class meetings early in the semester. The workshop supported scholars in their personal/professional development and let them get to know each other better and build community. The design thinking workshop was led by a postdoc with the department's NSF RED project and represents collaboration between these grants. The peer mentors organized a resume workshop before the career fair. ECSEL faculty mentors presented the following three tech talks during class meetings.

January: Doug Jacobson, Cyber Security: The Threat Landscape

February: Joe Zambreno, The Promise and the Practice of Reconfigurable Application Acceleration

April: Kristin Rozier, From Design Time to Run Time: Formal Methods for Ensuring the Safety of Safety-Critical Aerospace Systems

The April tech talk was also attended by members of the DACC ECSEL program as a networking activity between ISU and DACC.

In addition to seminar meetings and mentoring activities, other activities are integral to the ECSEL student experience, including professional networking and experiential and service learning. Nine scholars and the ECSEL graduate assistant attended the Grace Hopper Conference in Orlando in October 2017. Several scholars also attended Iowa State's day-long "WE Lead: Women's Empowerment and Leadership Conference" in November 2017. One scholar attended the WiCys (Women in Cybersecurity) Conference in Chicago in March 2018, joining a faculty member and graduate student. Several scholars participated in the Diversity in Technology networking event in January hosted by Workiva, headquartered in Ames and

named as One of the 2018 Best Workplaces in Technology. Several scholars attended Cultivating a Diverse Workforce: An Employer Panel in March hosted by ISU's oSTEM student organization in concert with SACNAS, WISE, Alliance for Disability Awareness Club, and Vocational Rehab. Panelists from Workiva, Rockwell Collins, Merck, Exelon, Cerner and Corteva spoke about their company's culture of inclusion and diverse workforce needs.

Starting in fall semester and continuing through spring, cohort-building and leadership development were fostered through an outreach service learning project to create and offer workshops for the WISE Taking the Road Less Traveled (TRLT) conference (<https://www.wise.iastate.edu/outreach/taking-the-road-less-traveled-career-conference-> ) for middle and high school girls in April 2018. Teams of scholars designed and led workshops to provide participants with a fun hands-on creative activity involving ECSE skills and technology. Two workshops were offered, both were held on each of two conference dates, and they engaged over fifty participants.

<b>Computer/Software Engineering: Spinning Your Own Website</b>
In this hands-on workshop, participants will learn the fundamentals of programming in HTML and CSS and how it affects their daily lives. They will then use what they learn to create their own personal website.
<b>Electrical Engineering: Charge Up Your Artwork with Electricity</b>
In this hands-on workshop, we will explore the use of paper circuits. Participants will learn the basics of circuits. They will then use their knowledge to light up their own artwork with electronics.

Two scholars volunteered to help at IT-Olympics in April 2018, a capstone event for high school students who participate in IT-Adventures, in which students showcase their IT talents and knowledge in competitions and presentations. Teams from across the state compete in different venues. It was held at ISU in coordination with the Technology Association of Iowa under the direction of ECSEL co-PI Doug Jacobson. Two scholars volunteered to help with a FIRST Robotics team visit to labs in the department in February. Several scholars served in leadership roles and participated in the HackISU hackathon in fall 2017 and spring 2018 (<http://hackisu.org> ). During spring, these scholars also helped organize the Digital Women Code Camp, also sponsored by Major League Hacking. One scholar participated in the WISE study abroad program in London during spring break. The program focuses on a comparative analysis of issues facing women in science and engineering in the United States and how those issues are different/similar for women internationally. One scholar participated in ISU study abroad programs in Spain and Costa Rica during 2017-18.

ECSEL scholars leading and giving back at outreach events such as WISE Taking the Road Less Traveled and IT-Olympics.

**WISE Iowa State**  
@WISE\_ISU

Following

It's FINALLY here! It's TRLT day! We are SO excited to have everyone! Today we have 19 schools & over 360 participants from all over Iowa, with 24 different STEM sessions throughout the day!! (Comment BELOW a 📷 of your TRLT squad for a chance to be on our insta story 🍌) #TRLT18



**TAI** Technology Association of Iowa  
@TechnologyIowa

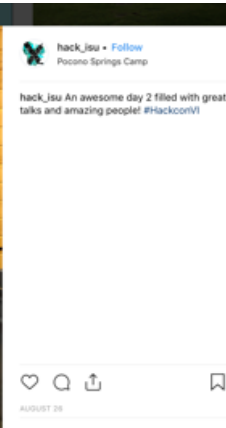
Follow

The #ITOlympics are off and running at Hilton Coliseum!



11:49 AM - 20 Apr 2018

ECSEL scholars organizing and participating in hackathons, building community and competencies.



**HackISU (SquirrelHacks)**  
@HackISU

Music is more than the 0s and 1s that make up it's files. That's why project #4 "Music Visualizer" wanted to bring a visual aspect to it.



8:20 AM - 22 Oct 2017

**Major League Hacking** ✓  
@MLHacks

Follow

Special thanks to the awesome organizers who helped make this year's Hack ISU an awesome time! @HackISU



2:33 PM - 25 Mar 2018

**DIGITALWOMEN CODE CAMP**

24-hour female focused hackathon  
No programming experience needed  
Free for all students

April 6-7 • Coover Hall TLA

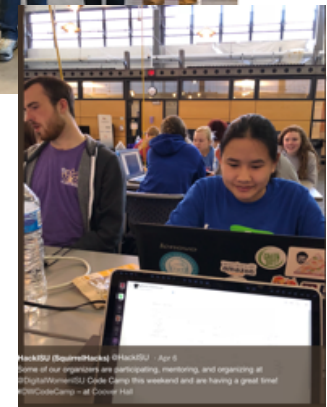
Register @ [bit.ly/2o7YEWb](http://bit.ly/2o7YEWb)

• Food • Swag • Technical Workshops • Mentors •



**hack\_isu** • Follow  
Iowa State University

hack\_isu We have TWO winners! HackISU Organizer's Lauren, Jamie, Chandler, & Jason won Best Domain Name from Domain.com for their hack, "Minority Underflow". HackISU Organizer Mitchell won Best Educational Hack with his hack, "HQ Appraisal". Congratulations Organizers & all other Code Camp winners! #codecamp



HackISU (SquirrelHacks) @HackISU · Apr 8  
Some of our organizers are participating, mentoring, and organizing at @DigitalWomenCodeCamp this weekend and are having a great time! #DigitalWomenCodeCamp - at Coover Hall

ECSEL scholars learning and networking through local and national conferences, international experiences, and seminars.



"I never thought I would be able to see over 100 women in tech in a room, let alone 18,000," Full story: [goo.gl/2xkTvD](http://goo.gl/2xkTvD)



**ECpE Women Inspired By Grace Hopper Celebration**

[Read More](#)

1:26 PM - 11 Dec 2017



Following



**WISÉ Iowa State**  
@WISÉ\_ISU

Thank you @Syngenta for our WISE tour of your Jealot's Hill research facility!  
#WISÉinLondon



9:48 AM - 16 Mar 2018



**The Promise and the Practice of Reconfigurable Application Acceleration**

Joseph Zambreno  
Department of Electrical and Computer Engineering  
Iowa State University

[www.ece.iastate.edu/~zambreno](http://www.ece.iastate.edu/~zambreno)  
[rcl.ece.iastate.edu](http://rcl.ece.iastate.edu)

ECSEL Seminar Series  
February 28, 2018

**Straight from the Headlines...**

Introduction Formal Methods Specifications Model Checking Runtime DSM Current/Future Work

**From Design Time To Run Time: Formal Methods for Ensuring the Safety of Safety-Critical Aerospace Systems**

ECSEL Seminar

Kristin Yvonne Rozier  
Iowa State University of Science and Technology  
April 25, 2018

**Cyber Security:**

The threat landscape

Doug Jacobson  
Information Assurance Center  
[www.iac.iastate.edu](http://www.iac.iastate.edu)

**Outline**

- The past (slides from 1998 talk)
- What are the threats
- What is the state of the art in defense
- Where should we focus our efforts



# News stories and tweets recognizing and sharing contributions of ECSEL scholars and team members.

**ISU ECpE** @ISU\_ECpE  
Following

"She is a hardworking student who is dedicated to applying her software engineering skills to make a difference in the world." Read the story of first-generation ECpE sophomore Melissa Hernandez and her journey to academic success.

[news.engineering.iastate.edu/2018/03/27/melissa-hernandez](https://news.engineering.iastate.edu/2018/03/27/melissa-hernandez)



11:31 AM - 27 Mar 2018

**ISU ECpE** @ISU\_ECpE  
Following

We are excited to welcome @WISE\_ISU Taking the Road Less Traveled students, hosted by @ECSEL\_ISU! These young women in STEM made basic circuits today!



12:59 PM - 5 Apr 2018 from Coover Hall

**ISU ECpE** @ISU\_ECpE  
Following

We are excited to welcome @WISE\_ISU Taking the Road Less Traveled students again today! Students made paper circuits and learned how to code today, in sessions hosted by @ECSEL\_ISU!



11:37 AM - 12 Apr 2018

**Sarah Rodriguez** @PRG@iastate  
Following

Join our FREE ASCN webinar this month on Developing and Sustaining Effective Partnerships to Advance Change in #STEM #higherEd! Excited to share from my work on interdisciplinary collaborations with NSF-RED, AGEF, LSAMP, & SSTEM projects. [@ISUSOE](https://bit.ly/2DS8RjW)



12:38 PM - 30 Jan 2018

**WEPAN** @WEPAN  
Following

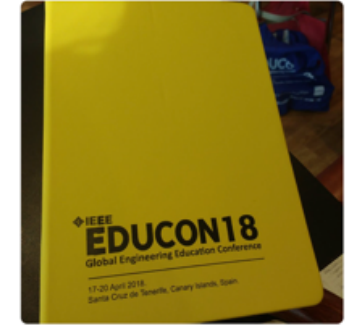
Congrats to @ISU\_CoE @WISE\_ISU, #WEPAN Women in Engineering Initiative Award recipient. #WEPAN Awards Ceremony at @CoNECD18 - Congrats!



2:56 PM - 30 Apr 2018

**Sarah Rodriguez** @PRG@iastate  
Following

Ready to talk international engineering education! Loving the discussion of #DiversityAndInclusion at #Educon18



1:45 AM - 19 Apr 2018

**ISU ECpE** @ISU\_ECpE  
Following

Sarah Huber faced the unique challenges of being a female in the male dominate world of STEM. Her perseverance paid off because now she's working @Tesla. Read More: [goo.gl/F8EqRZ](https://goo.gl/F8EqRZ)



10:56 AM - 29 Mar 2018

**ECSEL ISU** @ECSEL\_ISU  
Following

@ECSEL\_ISU's very own Alum, Thank you for visiting us today @SarahHuber5! We appreciate your words of wisdom and best of luck in your future endeavors. Stay brave, your courage is inspiring! #leaveyourmark #CyclONEnation



2:56 PM - 30 Apr 2018



**Black History Month: ECpE's Phillip Jones on Inclusion in Engineering**

February 26, 2018 • Kristin Clague

Iowa State's Department of Electrical and Computer Engineering is celebrating Black History Month with a series highlighting alumni, faculty and students. Click here for more Black History Month coverage.



Uploaded file #3

Documents in this file:

1. ECE Department 2017 Impact Report (ECSEL project highlighted on its research pages)
2. "ECPE women inspired by Grace Hopper Celebration," COE News, Dec. 11, 2017
3. "Women's History Month: Melissa Hernandez: Cracking the academic code," COE News, March 27, 2018
4. "Engineering a career with Tesla," COE News, March 29, 2018
5. "Boosting diversity in engineering with evidence-based strategies," COE News, Sep. 13, 2018
6. "Iowa State part of \$10 million effort to encourage a diverse faculty in STEM fields," ISU News, Sep. 6, 2018

# Research

## Leading the Nation in ECE Education

### ISU 1 of 7 programs in the U.S. to receive \$2 million NSF RED grant

- Reinventing the Instructional and Departmental Enterprise, known as RIDE, is the new **collaborative instructional** model for course design and integration of professional and sociotechnical topics
- RIDE model will broaden **participation** in the field of electrical and computer engineering
- Project activities will emphasize design thinking and **inclusive teaching practices** and **learning** experiences in the classroom
- RIDE will serve as a **model** for electrical and computer engineering departments nationwide

### NSF grants multimillion-dollar S-STEM award to ISU ECpE

- Provides **scholarships** and student experiences for diverse, academically talented students with financial need
- Awarded a **\$4 million** grant from **NSF** over the next five years, with an additional \$1 million to community college partners
- One curricular area is **cybersecurity**
- Project will perform research on how diverse students develop and sustain their **engineering identities** and what drives these students to persist in these programs
- One of the **first** multi-million dollar S-STEM awards in the United States



RIDE faculty and staff members: (L-R) Mani Mina, Mari Kemis, Ashfaq Khokhar, Diane Rover, Sarah Rodriguez, Megan Heitmann, Mack Shelley.



Ten ECpE women at Iowa State were selected to be the first cohort of students benefiting from S-STEM.



**Department News**[Aerospace Engineering](#)[Agricultural and Biosystems Engineering](#)[Chemical and Biological Engineering](#)[Civil, Construction, and Environmental Engineering](#)[Electrical and Computer Engineering](#)[Industrial and Manufacturing Systems Engineering](#)[Materials Science and Engineering](#)[Mechanical Engineering](#)**University News**[News Service \(Opens new window\)](#)[Inside Iowa State \(Opens new window\)](#)[ISU Athletics \(Opens new window\)](#)**Follow Team PrISUm across the Outback**

## ECpE women inspired by Grace Hopper Celebration

December 11, 2017 Megan Sager



Twenty Iowa State University students had the opportunity to attend the world's largest gathering of women technologists in Orlando, Florida, from Oct. 4-6.

Students from the Department of Electrical and Computer Engineering (ECpE), along with students from the student organizations Digital Women and Electrical, Computer and Software Engineers and Leaders (ECSEL), traveled to the event.

The Grace Hopper Celebration (GHC) is hosted by AnitaB.org, formerly known as the Institute for Women in Technology, in partnership with the Association for Computing Machinery (ACM).

In 2013, GHC played host to 4,500 attendees; this year the conference had over 18,000.

"Grace Hopper [GHC] was an incredible experience. I never thought I would be able to see over 100 women in tech in a room, let alone 18,000," said Ashley Dvorsky, a software engineering senior.

In 1994, Anita Borg, computer scientist and founder of the Institute for Women in Technology, co-founded GHC, which was inspired by Grace Murray Hopper. With the mission to create a space for women technologists, the goal of the conference was to offer women a chance to improve their technical skills and connect with each other.

Hopper was a computer scientist and United States Navy rear admiral. She was a pioneer in computer programming and invented one of the first compiler-related tools.

During the early history of computers, Hopper discovered something unusual between a relay in the machine. The team had discovered a moth trapped in the computer. In her log book, she wrote, "First actual case of bug being found," and it was the first time someone had used the word "bug" to describe a computer glitch.

**Recent Videos**

Iowa State University College of Engineering



ISU Alums Make Waves in Silicon Valley



Bridgestone World Solar Challenge Video Profiles: Matthew Swift

**In the Media**

ECpE senior recreates Nintendo's Switch November 28, 2017

Two MSE and ISU Startup Factory Companies Receive IEDA Innovation Funding November 28, 2017

Winter is coming. What if roads and runways could de-ice themselves? October 3, 2017

more In the Media

**College Events**

Fall Commencement Friday, December 15, 2017

Graduate Student Pre-Commencement Reception with Live Webcast Friday, December 15, 2017

More events

Because of Hopper's discovery, ISU ECpE adopted the moth as symbol of the department, which can be seen in the marble sculpture on the west side of Coover Hall.

The GHC offered attendees many valuable resources, from a student opportunity lab to a track designed specifically for faculty attendees. Not to mention, this was one of the largest career fairs in the U.S.. Additionally, there were a variety of seminars the women could attend.



Inspirational and educational speeches were given by big names in tech like Melinda Gates, co-chair, Bill and Melinda Gates Foundation ; and Debbie Sterling, founder and CEO of GoldieBlox ; as well as ISU alumna Cassidy Williams.

"Debbie was relatable, and to my surprise, a mechanical engineer," said Rachel Shannon, an electrical engineering (EE) senior. "She spoke passionately about her failures and successes while trying to get GoldieBlox going."

Several of the Iowa State women who attended also enjoyed Melinda Gates' speech, as she addressed the key issue of decreasing numbers in graduating women in technology.

Iowa State houses a variety of programs with a focus on women technologists, all with the common goal to assist, inspire and maintain women in technology-related fields.

Just a few of the STEM student organizations are Digital Women, ECSEL, Women in Science and Engineering (WiSE) and the Society of Women Engineers. All four offer women in computer science, software engineering, electrical engineering, computer engineering, management information systems and other related fields, networking opportunities and educational support.

Seventy-four percent of young girls have expressed interest in STEM, according to AnitaB.

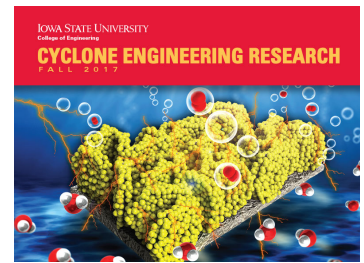
Additionally, while 71 percent of women receive negative feedback about their personalities in the workplace, 81 percent of men receive constructive feedback about their workplace personalities.

GHC also was created with the goal to implement new programs and work with organizations and individuals to address the gender gap. Women technologists are increasingly joining forces to support each other through networking opportunities like GHC.

"One of the most empowering parts of Grace Hopper was learning how to speak for myself in a male-dominated setting," said Dvorsky. "At the conference I developed skills to question the biases surrounding race, gender, LGBT and other underrepresented minorities in the tech space."



## Cyclone Engineering Research



View Fall 2017, Volume 7

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During the event-packed days at Grace Hopper, attendees were invited to a career fair featuring a staggering amount of big name companies, like Amazon, Apple, Google, Microsoft, Facebook, Target and The Walt Disney Company. Full list here.

At the career fair, EE senior Sarah Huber met representatives from Tesla, where she will be working full-time starting in February. As a program manager for power electronics, she will be working with things like the car plug, superchargers and SolarCity, a subsidiary of Tesla that specializes in solar energy services.

"It was so nice because when we were interviewed, it was by women," said Huber. "Between sessions, we would see professionals attending, running to charge their phones or take a call or answer an email. They were all still working while being there."

GHC offered attendees amazing insight and hope within the male-dominated technology industry. By providing attendees with knowledge and a powerful network of women, the Iowa State attendees have returned feeling more inspired than ever.



"I didn't know everyone on this trip, but now I have 20 peers who are supporting and encouraging me," Dvorsky said. "When I have hard days here, I can count on one of them to remind me I am a competent and capable programmer who will change the world."

📅 December 11, 2017

📁 Academics, Alumni, CoE News, Electrical and Computer Engineering,

Students

### Leave a Reply

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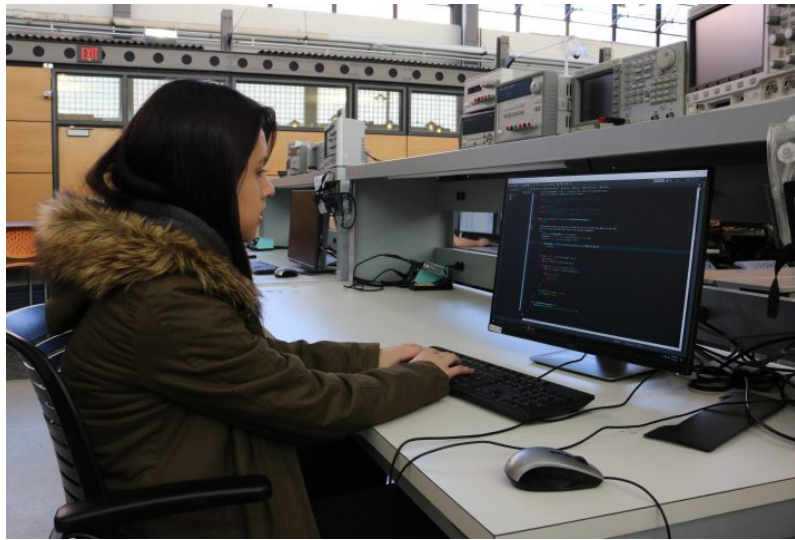
#### Comment

Name \*

**Department News**[Aerospace Engineering](#)[Agricultural and Biosystems Engineering](#)[Chemical and Biological Engineering](#)[Civil, Construction, and Environmental Engineering](#)[Electrical and Computer Engineering](#)[Industrial and Manufacturing Systems Engineering](#)[Materials Science and Engineering](#)[Mechanical Engineering](#)**University News**[News Service \(Opens new window\)](#)[Inside Iowa State \(Opens new window\)](#)[ISU Athletics \(Opens new window\)](#)**Women's History Month**

# Women's History Month: Melissa Hernandez: Cracking the academic code

📅 March 27, 2018 👤 Emily Benda



Most days, you can find Iowa State University software engineering sophomore Melissa Hernandez near her laptop working out a coding problem. Her professors describe her as hardworking and dedicated to her studies. However, Melissa admits she wasn't always so confident in her schoolwork.

"Last semester, all my grades were good, which was a huge turning point for me," Melissa said. "Before then, I was doing really poorly. I was about to give up."

Melissa is a first-generation student. She grew up in a single parent household near Dallas, Texas. All her life. Melissa worked hard in school and was excited to consider a college close to home. However, as her high school graduation drew closer, Melissa began to realize how much more Iowa State cared about her success and decided to make the move to Iowa last minute.

The first year of college was not exactly what Melissa pictured. While she was happy with her choice of Iowa State, she began to feel overwhelmed with all college and software engineering in the Electrical and Computer Engineering (ECpE) department entailed. She was working more than she was in class and felt that she had nowhere to go for help with her studies.

"I think because I was first-generation, I didn't pay too much attention to my grades," Melissa said. "No one told me how to study, and I was barely scraping by."

By the end of her freshman year, Melissa knew she couldn't continue the pattern she had developed. She took a couple of summer classes and began to rethink her studying methods and her priorities. In all of this, Melissa said her biggest motivator was her mother for always cheering her on and being supportive of her and her younger brother.

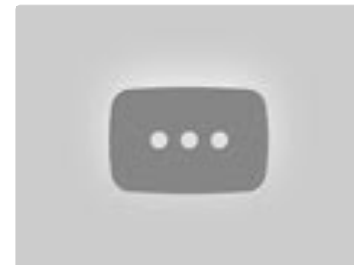
"I took the time to re-evaluate what was going on in my life and knew I had to make school my priority," Melissa said. "I reinvented myself. It was a big learning process, but I'm so glad I didn't give up."

**Recent Videos**

Iowa State University College of Engineering



Frank Peters named C. G. "Turk" and Joyce A. Therkildsen Professor in IMSE



ME grad student receives tribology research award

**In the Media**

Engineering a career with Tesla March 29, 2018

Women's History Month: Pioneering female electrical engineers: Carol Fisher March 28, 2018

ECpE moves up in U.S. Engineering School Rankings March 26, 2018

more In the Media

**College Events**

Mechanical Engineering Design Expo Tuesday, April 24, 2018

Engineering Graduate College Pre-Commencement Reception and Ceremony

Melissa is more confident in her studies now. Recently, she joined the Electrical, Computer and Software Engineers as Leaders (ECSEL) program, aimed at improving diversity and inclusion in electrical, computer and software engineering programs. She said the program has empowered her to be surrounded by students who have similar goals and interests.

Joe Zambreno, professor in ECpE and adviser to ECSEL said Melissa shows promise in her field, which is why she was chosen to join ECSEL.

"She is a hardworking student who is dedicated to service and applying her software engineering skills to making a difference in the world," Zambreno said.

With a couple years left of her studies, Melissa said she is excited to continue exploring software engineering and is interested in the growing possibilities. She hopes to travel abroad and eventually work in augmented reality. She is inspired by its possibilities, especially in the automotive industry, and hopes to be part of innovative change.

Melissa is looking to start a support group for fellow first-generation students. She hopes a group will help students like her and keep them motivated to continue their education.

"Seek help if you know you're struggling. Don't wait," Melissa said. "It's so important to talk to someone and take advantage of the resources at Iowa State. They say there are so many resources on campus, and there are."



Thursday, May 3, 2018

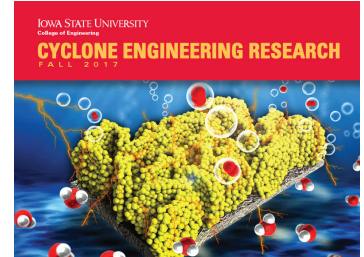
Spring 2018 Graduate Commencement Ceremony  
Friday, May 4, 2018

Undergraduate Pre-Commencement Departmental Receptions  
Saturday, May 5, 2018

Spring 2018 Undergraduate Commencement Ceremony  
Saturday, May 5, 2018

More events

### Cyclone Engineering Research



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📅 March 28, 2018

📁 CoE News, Electrical and Computer Engineering, Women's History Month 2018

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College of Engineering

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Department News

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Industrial and Manufacturing Systems Engineering

Materials Science and Engineering

Mechanical Engineering

University News

News Service (Opens new window)

Inside Iowa State (Opens new window)

ISU Athletics (Opens new window)

Women's History Month

# Engineering a career with Tesla

March 29, 2018 Megan Sager



“Your gender shouldn’t determine what you can and cannot do,” Huber said. Accomplishing a variety of professional experiences, Sarah Huber faced the unique challenges of being a female in the male dominated world of science, technology, engineering and mathematics (STEM).

Sarah Huber graduated with a bachelor’s degree in electrical engineering from the Department of Electrical and Computer Engineering at Iowa State University in December of 2017 and is currently working as a power electronics project manager at Tesla in Palo Alto, California.

Huber, a native of Bettendorf, Iowa, entered Iowa State as an undeclared engineer. By the end of her first semester, she chose to major in electrical engineering.

“At the beginning of my first class in the [electrical engineering] program, I learned an important lesson that kept me going through the challenges of my major,” Huber said. “Dr. Tuttle suggested that we read the book “Outliers” by Malcolm Gladwell; this book states that people in our world who are successful have put in 10,000 hours to reach that point. This helped me realize that my success or failure in engineering would be a result of the time and effort I invested.”

Recent Videos



Iowa State University College of Engineering



Frank Peters named C. G. “Turk” and Joyce A. Therkildsen Professor in IMSE



ME grad student receives tribology research award

In the Media

ENGINEERING A CAREER WITH TESLA  
March 29, 2018

Women’s History Month: Pioneering female electrical engineers: Carol Fisher  
March 28, 2018

ECpE moves up in U.S. Engineering School Rankings  
March 26, 2018

more In the Media

College Events

Mechanical Engineering Design Expo  
Tuesday, April 24, 2018

Engineering Graduate College Pre-Commencement Reception and Ceremony

While at Iowa State, Huber was a co-chair for the Engineering Career Fair, a Student Admissions Representative (STARS), a teaching assistant (TA) for Electrical Circuits, a member of the Kappa Kappa Gamma women's fraternity and Digital Women and received the Outstanding Senior Award.

In addition to her participation on campus, Huber had several professional experiences to add to her resume. She was an electrical manufacturing engineering intern with John Deere, completed a co-op with IBM as a product/systems assurance and validation engineer and was a product marketing engineer intern at Texas Instruments.

Despite all her accomplishments, Huber had many impactful experiences in the classroom, where her gender played a role in how her peers interacted with and spoke to her. She cited that while there is nothing bad or wrong with being different, the obstacles to overcome can become exhausting.

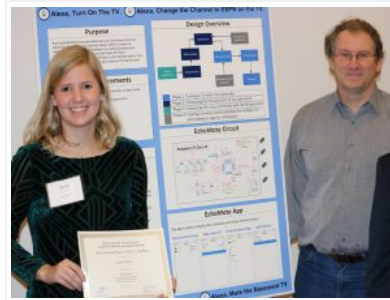
In one of her in-class examples, Huber and her peers were asked to make a person out of asterisks on a computer. She made a stick figure that was wearing a dress, and when her TA came over to approve her work, Huber was told, "I've never seen it done like that before." All of her male peers had made stick figures with square bodies, while hers was triangular.

"That's not an example of your TA being disrespectful, but it was an example of just noticing how different I was in that environment," Huber said.

According to the National Science Foundation (NSF), overall, women have higher college graduation rates compared to men. However, in STEM disciplines, the number of male graduates disproportionately out numbers that of females. Hearing remarks like, "So when are you going to switch your major?" as Huber did, highlights why many women choose areas of study outside of the STEM fields.

To address this challenge, in 2017, Iowa State University received nearly \$10 million in funding from NSF to help improve diversity in STEM fields, for a program known as ECSEL (Electrical, Computer and Software Engineers as Leaders).

As stated when the award, called the S-STEM award, was first granted, "Within Iowa State's department of Electrical and Computer Engineering (ECpE), \$5 million over the next five years will go toward creating 272 individual NSF Scholarships for students from Iowa State, Des Moines Area Community College (DMACC) and Kirkwood Community College, with an emphasis on promoting diversity."



Sarah Huber and Dr. Tuttle stands with her Senior Design poster.

Thursday, May 3, 2018

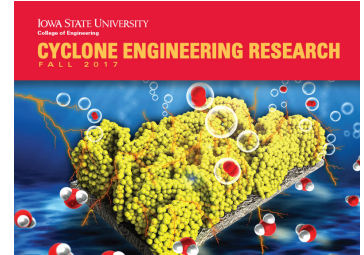
Spring 2018 Graduate Commencement Ceremony  
Friday, May 4, 2018

Undergraduate Pre-Commencement Departmental Receptions  
Saturday, May 5, 2018

Spring 2018 Undergraduate Commencement Ceremony  
Saturday, May 5, 2018

More events

## Cyclone Engineering Research



[View Fall 2017, Volume 7](#)

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Sarah Huber pictured with the other 2017 S-STEM award recipients.

Last spring, 10 women received the S-STEM award based on a variety of criteria, including student involvement, diversity, a short written essay and financial need. Huber was one of the recipients of this award and said, "Some of the best jobs today are in STEM fields. I think it is important that women feel that they belong."

While women are welcomed and often encouraged to join STEM programs, many have shared experiences that are not always positive. Some of these women convey that it takes great courage to stick with their passion for their work while being minorities.

"I am very stubborn. When I say I'm going to do something, I always complete that task, so I never considered leaving as an option," Huber said. "I am excited to have graduated with a degree that I worked really hard for."



Sarah Huber pictured with the 19 other women who traveled to the Grace Hopper Celebration.

During her last semester at Iowa State, Huber and 19 other women traveled to the Grace Hopper Celebration in Orlando, Florida. The inspirational trip was filled with speakers and a career fair featuring over 230 companies, one of which was Tesla.

"Tesla was at Grace Hopper, and I was like, 'well, I better say hi,'" Huber said. "I got an interview there and just continued through the interview process."

In Huber's role as a power electronics project manager, she works on charging products, such as the mobile connector, wall connector and adapters. These charging products are used on all S/X/3 Tesla models.

"My job is to make those projects happen and work with different suppliers to make sure we are hitting deadlines and working with other engineers," Huber said. "I work with everyone on the team to make sure the final product

is done, done well and done on time."

Any new job is overwhelming, and Huber thinks that her first job being Tesla doesn't make it any more so or less so. She said, "I am still learning every day."

In 10 years, Huber sees herself as a manager of a group or a team and hopes to promote more women and be a representative for in engineering.

"I wonder when women will no longer have to have a thick skin in the classroom and can learn in a safe space and be respected just as their male peers?" Huber asked. "The gender disparity in STEM disciplines is not a born difference; it is a learned one."

📅 March 29, 2018

📁 Academics, Alumni, Alumni in the Media, CoE in the Media, CoE News, Electrical and Computer Engineering, Students, Women's History Month 2018

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## University News

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[ISU Athletics \(Opens new window\)](#)

# Boosting diversity in engineering with evidence-based strategies

September 13, 2018 • Breehan Gerleman



Diane Rover, University Professor of electrical and computer engineering, is alliance director for the \$5-million Louis Stokes Alliances for Minority Iowa-Illinois-Nebraska STEM Partnership for Research and Education and co-principal investigator for Reinventing the Instructional and Departmental Enterprise project, both of which seek to boost diversity in STEM fields.

College of Engineering faculty are developing evidence-based strategies to ensure diversity and inclusion in engineering education – all with an aim of boosting diversity in STEM fields. Here are four of our research projects studying teaching methods and student experience.

### Thriving in STEM disciplines

Iowa State leads the \$5 million Louis Stokes Alliances for Minority Participation (LSAMP) **Iowa-Illinois-Nebraska STEM Partnership for Research and Education (IINSPIRE)** project that aims to increase the number and improve the experience of underrepresented students completing STEM degrees in the Midwest.

IINSPIRE offers students evidence-based academic, professional and social support, including mentoring, hands-on research experiences, transfer partnerships between two- and four-year institutions, and other programming.

Researchers, guided by social cognitive career theory, are studying both micro- and macro-level influences to understand how IINSPIRE students thrive and persist in STEM disciplines. Sixteen public and private colleges and universities and community colleges across three states are participating in IINSPIRE, providing a rich collaboration to study shared challenges alliance-wide.

IINSPIRE is led by principal investigator **Jonathan Wickert**, Iowa State senior vice president and provost and professor of mechanical engineering, and alliance director **Diane Rover**, University Professor of electrical and computer engineering. IINSPIRE is funded by the

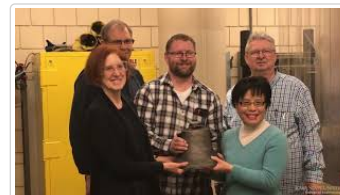
## Recent Videos



IMSE Research Symposium Spring 2018



Boyd Lab



Bell Casting for Campanile Carillon Model Project

## In the Media

ECpE engineer published for Alzheimer's-testing device August 7, 2018

Nanovaccine Institute work on pancreatic cancer featured in ISU news story June 29, 2018

KHOI: CoE researchers discuss NASA-funded research project June 20, 2018  
more In the Media

## College Events

Career Development Seminars:  
Evaluating Offers and Managing Timelines  
Tuesday, November 6, 2018

Fall 2018 Graduate Commencement Ceremony  
Saturday, December 15, 2018

Fall 2018 Undergraduate Commencement Ceremony

### Collaborative instructional models

An interdisciplinary team of Iowa State researchers are developing new instructional models for course design in electrical and computer engineering, with a goal of better preparing the next generation of engineers for working in ever complex systems and broadening the participation of underrepresented students, especially women.

The **Reinventing the Instructional and Departmental Enterprise (RIDE)** project is funded by \$2 million from the NSF to develop new approaches to teaching and learning in electrical and computer engineering, especially in relation to design and systems thinking, professional skills, such as leadership and inclusion, contextual concepts and creative technologies. Researchers are developing and evaluating human-centered, collaborative and interactive teaching practices in new courses each semester, continually evaluating and improving strategies.

RIDE co-principal investigators are **Diane Rover**, University Professor of electrical and computer engineering, and **Joe Zambreno**, professor of electrical and computer engineering.

### Ecosystems of support

Cyclone Engineers, together with colleagues at two community colleges, are examining the entire process of earning electrical, computer and software engineering degrees to help improve diversity and inclusion in the fields.

The **Electrical, Computer and Software Engineers as Leaders (ECSEL)** project research team, led by professor of electrical and computer engineering **Joe Zambreno**, is adapting, implementing and studying an evidence-based student experience model that forms an entire ecosystem of supports, ranging from scholarships for low-income, high-potential students, to professional development activities and study abroad opportunities – all with a goal of doubling the number of women enrolled in the degree programs.

Research questions address how women and other diverse students develop and sustain their engineering identities and what motivates underrepresented students to persist and thrive in electrical, computer and software engineering degree programs. ECSEL is funded by the NSF.

### Inclusive experiences

**Cristina Poleacovschi**, assistant professor of civil, construction and environmental engineering, will lead an interdisciplinary team studying microaggressions in engineering programs in a NSF-funded project.

In an effort to understand and change the low representation of gender and racial minorities in engineering education, the research will study subtle behaviors, known as microaggressions, that students, especially those in a minority gender or race, experience in engineering education.

The research will investigate the effect of these microaggressions on students' experience, success and persistence in engineering programs. The microaggressions will be studied and compared between Iowa State University, as a predominantly white educational setting, and North Carolina A&T, as a historically black college.

Poleacovschi will collaborate with Gloria Janis-Johnson, University Professor of sociology, contributes expertise on the intersectionality of students' unique identity based on both race and gender, as well as quantitative methodological expertise in survey research, and Scott Feinsten, assistant professor of political science, who will focus on drawing attention to the social and political implications of microaggressions.

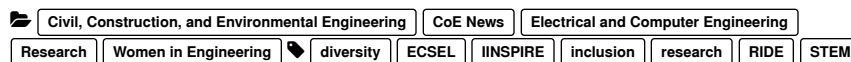
### Cyclone Engineering Research



View Fall 2018, Volume 9

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## Iowa State part of \$10 million effort to encourage a diverse faculty in STEM fields

Posted Sep 6, 2018 8:47 am



A Des Moines Area Community College instructor (in the background) works with students in the robotics lab on the school's Ankeny Campus. [Larger photo](#). *Photo courtesy of Des Moines Area Community College.*

AMES, Iowa – A new grant from the [National Science Foundation](#) will help Iowa State University researchers continue to develop programs that help graduate students prepare to teach science and technology courses at community colleges.

The grant is from the foundation's [INCLUDES program](#), a program designed to enhance U.S. leadership in science, technology, engineering and math (STEM). A major goal of the initiative is to encourage women, minorities and other underrepresented groups to study and work in STEM fields.

The five-year, \$10 million grant will support faculty improvement programs developed by the National Alliance for Inclusive and Diverse STEM Faculty. The alliance is led by the [Association of Public and Land-Grant Universities](#) and the [Center for the Integration of Research, Teaching and Learning](#) based at the University of Wisconsin-Madison. The alliance's primary goals are to help STEM faculty be more inclusive and effective, develop a more diverse

### Contacts

Craig Ogilvie, Graduate College, Physics and Astronomy, 515-294-2219, [cogilvie@iastate.edu](mailto:cogilvie@iastate.edu)

Mike Krapfl, News Service, 515-294-4917, [mkrapfl@iastate.edu](mailto:mkrapfl@iastate.edu)

### Quick look

Iowa State researchers are part of a national alliance that won a \$10 million grant from the National Science Foundation. The alliance will develop programs that increase the diversity and effectiveness of faculty teaching science, technology, engineering and math. Iowa State's part of the project focuses on working with community colleges to recruit and prepare a diverse group of graduate students for teaching careers at community colleges.

### Quote

"These are grassroots, nitty-gritty collaborations among faculty, graduate students and the community colleges."

Craig Ogilvie, an assistant dean for Iowa State's Graduate College and a Morrill Professor of physics and astronomy

help STEM faculty be more inclusive and effective, develop a more diverse STEM faculty and encourage institutional cultures that value diversity in STEM fields.

Partner schools in the alliance are Iowa State, the [University of California, Los Angeles](#) (UCLA), the [University of Texas at El Paso](#) (UTEP) and the [University of Georgia](#).

Iowa State's share of the grant is \$1.4 million. Craig Ogilvie, an assistant dean for Iowa State's [Graduate College](#) and a Morrill Professor of [physics and astronomy](#), will lead Iowa State's effort. Other faculty working on the project are Lorenzo Baber, an associate professor in the [School of Education](#) and head of the higher education division; and Mary Darrow, the Graduate College assistant director for the [IINSPIRE-LSAMP program](#) designed to increase student diversity in STEM studies in Iowa, Illinois and Nebraska.

Iowa State's part of the project focuses on working with community colleges to recruit and prepare a diverse group of graduate students for teaching careers at community colleges.

"There are a small number of graduate students whose career choice is to teach at community colleges," Ogilvie said. "For some, this is why they decided to go to graduate school."

While new community college faculty need to know their subject, as well as the basics of teaching and learning, Ogilvie said current community college faculty have emphasized that graduate students also need to know how to work with students who may have obligations beyond school. Community college classrooms often include a range of student demographics in terms of age, race and experience.

"In community colleges, new faculty often struggle with the fact that work and personal life can intersect with the classroom," he said.

To help with those and other issues in community college classrooms, the Iowa State researchers will work with UCLA and UTEP to build regional collaborations that include teaching workshops, awareness events and mentoring opportunities. Initially, Iowa State's collaboration will include the [University of Iowa](#), the [University of Northern Iowa](#), [Des Moines Area Community College](#), [Kirkwood Community College](#) and [Iowa Valley Community College](#).

The goal is to develop a national network of these regional collaborations. So far, four of the collaborations have been established as part of a pilot study – in Iowa, Southern California, East Texas and West Texas.

"These are grassroots, nitty-gritty collaborations among faculty, graduate students and the community colleges," Ogilvie said.

The project will also work to help community colleges attract diverse faculty

The project will also work to help community colleges attract diverse faculty members. That could start with graduate students who come from all over the world and with all sorts of backgrounds.

“What can we do to more intentionally reach out to them about this career?” Ogilvie said. “And how can we support them and work with them to be competitive candidates?”

Iowa State’s efforts, along with the rest of the work supported by the science foundation’s grant, are aimed at the national goals of the INCLUDES program.

“The successful implementation of NSF INCLUDES will result in substantial advances toward a diverse, innovative, and well-prepared STEM workforce to support our nation’s economy,” says a summary of the program, “and continued U. S. leadership in the global STEM enterprise.”

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Ames, Iowa 50011, (515) 294-4111. Published by: University Relations, [online@iastate.edu](mailto:online@iastate.edu).  
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Uploaded file #4

Documents in this file:

1. Plan for 2018-19 ECSEL student experience model programming
2. Peer mentor job descriptions for 2018-19
3. Syllabus for ECSEL leadership seminar (CPRE/EE 301X) for sophomore and above scholars for fall 2018 (page 1)
4. Syllabus for ECSEL leadership course (LD ST 270) for first-year scholars for fall 2018s

## 2018-19 ECSEL Student Experience Model (Programming)

2018 FR = Programming specifically for new first-year students (direct from high school)

Returning = Any returning scholars

All = All Cardinal and Gold Scholars

TRLT= Taking the Road Less Traveled Conference for 8<sup>th</sup>-10<sup>th</sup> grade girls

**Coordinated by WiSE/ECSEL Position**

ECSEL Team/Faculty

Program/Activity	Date	Scholar
Sign up for WiSE Residential Floor *highly recommended for FR	Deadline: 6/30/18	2018 FR
Receive WiSE Academic Planner	06/2018	All
Enroll incoming first-year students in WiSE LD ST 270 (T/R – 3:10-4:30p) during June Orientation	06/ 2018	2018 FR
Returning Scholars enroll in 4x course		Returning
<b>ECSEL Welcome (food provided)</b> <ul style="list-style-type: none"> <li>• ECSEL Overview of Year/Purpose</li> <li>• Meet faculty and current ECSEL scholars</li> </ul>	Time TBD (recommended prior to the first day of classes)	All
Attend WiSE Kickoff (campus partners, companies, student orgs)	August 19, 2018	All
<i>Optional:</i> Sign up for FREE tutoring (one STEM course) through WiSE	August 2 018	All
<b>WiSE LD ST 270 (ECSEL section), T/R 3:10-4:30 *see syllabus</b>	<b>8/21/18 - 12</b>	<b>2018 FR</b>
<b>ECSEL Fall Retreat</b> <ul style="list-style-type: none"> <li>• Getting to know you activities</li> <li>• Returning Scholars share their experiences/advice</li> <li>• Introduce informal mentoring among ECSEL scholars</li> </ul>	August 25 or September 1 9:30 AM - 2:00 PM	All
Participate w/ ECSEL Research & Evaluation Teams	Fall 2018 Semester	All
Attend WiSE StrengthsQuest First-Year Retreat	9/21/2018	2018 FR
<b>Social Activity (ex. ISU Workspace –students submit ideas and vote)</b>	<b>Fall 2018 Semester</b>	<b>All</b>
<b>Attend WiSE StrengthsQuest Workshop (SO-SR)</b>	<b>Sep. TBD (before Car. Fair)</b>	<b>All</b>
<b>Attend Grace Hopper Conference (recommended SO-JR year)</b>	<b>9/26-28/2018</b>	<b>All</b>
<b>Impostor Syndrome Workshop</b>	<b>October 2018</b>	<b>All</b>
<b>Attend Iowa Technology Summit</b>	<b>October 2, 2018</b>	<b>All</b>
Participate in K-12 Outreach: Assist Faculty with WiSE TRLT	October 2018	All
Attend Women’s Empowerment & Leadership Conference (WE LEAD)	November 2018	All
<i>Optional:</i> Apply for 2019-20 ECSEL & WiSE Peer Mentor Positions	January 2019	All
<i>Optional:</i> Sign up for FREE tutoring (one STEM course) through WiSE	January 2019	All
<b>Attend Spring ECSEL Leadership Retreat</b>	<b>Feb. 2019 (before Car. Fair)</b>	<b>All</b>
<b>Guest Speaker – Cyber Security</b>	<b>Spring</b>	<b>All</b>
Attend ECSEL Networking Event with faculty (ex topic: faculty failures)	March 2019	All
Participate w/ ECSEL Research & Evaluation Teams (snacks provided)	Spring 2019	All
<b>Social Activity (ex. bowling – students submit ideas and vote)</b>	<b>Spring 2019 Semester</b>	<b>All</b>
<b>Attend Job Shadows (ex. Rockwell Collins, Workiva, Union Pacific)</b>	<b>Spring 2019</b>	<b>All</b>
Participate in K-12/Outreach: Assist Faculty with WiSE TRLT Session	April 2019	All
<b>ECSEL Celebration/Wrap-Up/Next Steps (food provided)</b>	<b>April 2019</b>	<b>All</b>



**ECSEL/IOWA STATE**

### **Peer Mentor Job Description 2018-2019 Academic Year**

Iowa State's S-STEM initiative, ECSEL: Electrical, Computer, and Software Engineers as Leaders, is a partnership between the Department of Electrical and Computer Engineering (ECpE), Program for Women in Science and Engineering (WiSE), Des Moines Area Community College, and Kirkwood Community College. The initiative will fund 582 scholarships over the next five years for students majoring (or preparing to transfer) in electrical engineering, computer engineering, and software engineering, as well as implement a student experience model to help participants thrive and succeed in their degree programs.

The ECSEL peer mentor is a student staff member who collaborates with peers, staff, and faculty to enhance the student experience of ECSEL scholars. Throughout the academic year, Scholars will:

- Explore engineering and leadership identities
- Build community with students and connect with faculty members in the department
- Contribute to an environment where students feel safe, welcomed, and included
- Pursue resources that contribute to individual academic and professional success
- Be exposed to different opportunities within related fields

This position will assist the ECSEL Student Experience Coordinator with providing opportunities for Scholars to shape their engineering identities, feel a sense of belonging in their cohorts, and build positive connections with peers, staff, and faculty in the ECpE department. Each week, ECSEL peer mentors will work in pairs to facilitate discussions and lead activities for Scholars in their respective CPR E 490x Seminar section. Peer mentors will also provide support outside of the seminar such as study groups, social activities, and 1:1 or small group meetings.

#### **Qualifications:**

For consideration, candidates must meet the following qualification requirements:

- **Minimum grade point average of 3.0**
- Strong interpersonal communication skills, positive attitude, self-motivated
- Must attend and complete all required trainings/events

#### **Responsibilities:**

The following peer mentor responsibilities are expected to be completed throughout the duration of the 2018-19 academic year:

- Facilitate group discussions and lead interactive/hands-on activities (academic, social, professional, or leadership) occurring each week during the scheduled ECSEL seminar times (Wed. 4:10-5:00p or Thur. 4:10-5:00p)
- Support Scholars in/outside of seminar time (ex. 1:1's/small groups, study groups, or social activities)
- Refer Scholars to appropriate university resources
- Keep Scholars informed of upcoming events, activities, and other related opportunities
- Assist Student Experience Coordinator with



- gathering regular feedback on Student Experience Programs from Scholars (ex. surveys, seminar time for brainstorming ideas, etc.)
- service-learning activities (ex. TRLT)
- leadership and professional development opportunities (ex. StrengthsQuest, Grace Hopper, Retreats, Company site visits)
- welcome (fall) and closing event (spring)
- the ECSEL faculty mentor program and activities that bridge the gap between faculty and students
- Attend weekly staff meetings and bi-monthly individual meetings with Student Experience Coordinator
- Respond to emails and all other forms of communication (ex. Group Me, Slack) in a timely manner
- Other duties as assigned by the Student Experience Coordinator and ECSEL faculty

**Expectations:**

- **Listen with the intent to understand, not the intent to reply.**
- Demonstrate respectful behavior towards all students, staff, and faculty
- Nurture an unbiased, unprejudiced and open environment that will strengthen the support system and knowledge base of Scholars
- Enable participants to converse freely, ask questions and voice their opinions and concerns
- Keep all student information confidential (FERPA)
- Serve as a positive role model for Scholars and appropriately represent the ECSEL program

**Compensation:**

- Peer mentors receive a salary of \$10.00 an hour. Peer mentors work approximately 6-10 hours a week.

**REQUIRED TRAININGS/EVENTS:**

ECSEL Peer Mentor Fall Training ( <b>required</b> )	TBD
Learning Communities Peer Mentor Training	August 13-14, 2018
Learning Communities Peer Mentor Workshops	Fall 2018

**ECSEL Peer Mentor Benefits:**

- Increased understanding of issues that underrepresented individuals face in the STEM fields
- Increased communication and interpersonal skills
- Enhanced leadership and group facilitation skills
- Increased self-confidence and self-efficacy
- Personal satisfaction in helping others and seeing others succeed

**Application Timeline:**

<b>June 22, 2018</b>	Application close
<b>June 25-29, 2018*</b>	Interviewing period (phone or virtual)
<b>July 6, 2018*</b>	Candidates contacted regarding hiring status

*\*tentative*

**Questions about ECSEL Peer Mentor position should be directed to:**

Allie Parrott ([aparrott@iastate.edu](mailto:aparrott@iastate.edu)), 515.294.5278, 218 Carver Hall

# EE 301X: ECSEL LEADERSHIP STUDIO

## SYLLABUS

Department of Electrical and Computer Engineering  
Iowa State University  
Fall 2018

### Instructor Information

**Name:** Alicia Herron  
**Office Location:** Carver 218  
**Office Telephone:** 515-294-7165  
**Office Hours:** TBD  
**Email Address:** [arherron@iastate.edu](mailto:arherron@iastate.edu)

### Course Information

**Credit Hours:** 1  
**Course Days/Times:**  
Section W: Wed., 4:10-5:00pm  
Section R: Thurs., 4:10-5:00pm  
**Classroom Location:** TBD  
**Course Website:** [canvas.iastate.edu](http://canvas.iastate.edu)

### ECSEL Peer Mentor Contact Information

1. Claudia Athens, [cathens@iastate.edu](mailto:cathens@iastate.edu), \*W
2. Smruthi Sandhanam, [smruthis@iastate.edu](mailto:smruthis@iastate.edu), \*W
3. Lauren Arner, [larnar@iastate.edu](mailto:larnar@iastate.edu), \*R
4. Mohamed Gesalla, [mgesalla@iastate.edu](mailto:mgesalla@iastate.edu), \*R, Transfer
5. Iris Top, [imtop@iastate.edu](mailto:imtop@iastate.edu), \*R

### Course Description and Objectives

This introductory leadership course will provide emerging student leaders with an understanding of effective leadership practices, social change strategies, and information on engagement opportunities on campus and in the community. Students will be expected to connect course content to their lives, critically analyze their experiences, and to become civically engaged in society.

### Course Learning Outcomes

As a result of completing this course successfully, you will:

- Build community with other ECSEL scholars in the course
- Participate in campus and external leadership opportunities
- Network with faculty, staff, and peers in the department
- Engage in outreach programs that serve the community
- Learn about diverse perspectives and leadership styles different from your own
- Identify involvement opportunities and resources at Iowa State University and the community
- Enhance communication skills and provide feedback on the ECSEL student experience
- Real world application...

### Class texts and materials

- TBD
- StrengthsQuest
- Articles

### Course Policies and Expectations

- A. **Attendance.** Attendance is required, as it is essential for optimal learning experiences in this class. Material and information will be presented in class that is not found in your text. The only excused absences are documented

# IOWA STATE UNIVERSITY

1

LD ST 270 W – CAMPUS LEADERSHIP DEVELOPMENT

FALL SEMESTER, 2018

PROGRAM FOR WOMEN IN SCIENCE AND ENGINEERING

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## Instructor Information

Name: Tony Andenoro, Ph.D.  
Office Location: Carver Hall 350  
Office Telephone: 515-294-7616  
Office Hours: Wednesdays By Appointment  
Email Address: andenoro@iastate.edu

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## Course Information

Credit Hours: 3  
Course Days/Times: T/R 3:10-4:30pm  
Location: Carver Hall 305  
Course Website: canvas.iastate.edu

---

## WiSE Programs Coordinator

Name: Allie Parrott  
Email Address: aparrott@iastate.edu  
Office: Carver Hall 218

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## Graduate Teaching Assistant

Name: Rachel Barnes  
Email address: rbbarnes@iastate.edu  
Office: Carver Hall 218

---

## Peer Mentor Contact Information

Nest A: Carver 190  
Maeve McCloskey, maevem@iastate.edu  
Hellen Nakachwa, nhellen@iastate.edu

Nest B: Carver 268  
Jayna Farrell, jaynaf@iastate.edu  
Stephanie McMillan, stephmcm@iastate.edu

Nest C: Carver 004  
Downen Kabula, dmkabula@iastate.edu  
Joi Latson, jalatson@iastate.edu

Nest D: Carver 074  
Katelyn Moje, katemoje@iastate.edu  
Paige Schmidt, pschmidt@iastate.edu  
Tiara Turner, tmtturner@iastate.edu

Nest E: Carver 098  
Isabel Neff, ilneff@iastate.edu  
Ashley Trevino, atrevino@iastate.edu

Nest F: Carver 150  
Jamie Sampson, sampson1@iastate.edu  
Rachel Shannon, rshannon@iastate.edu

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## Course Description and Objectives

This introductory leadership course will provide emerging student leaders with an understanding of effective leadership practices, social change strategies, and information on engagement opportunities on campus and in the community. Students will be expected to connect course content to their lives, critically analyze their experiences, and to become civically engaged in society.

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## Course Learning Outcomes

As a result of completing this course successfully, students will be able to demonstrate the following competencies and capacities:

- Knowledge and application of the leadership theory and practices for social change
- Agency for service-learning and community development
- Knowledge and behaviors for advancing personal, team, and societal values
- Effective communication practices for organizational and community advancement
- Identify involvement opportunities at Iowa State University and within the community

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## Class Texts and Materials

- Komives, S. R., Wagner, W. & Associates (2017). Leadership for a better world: Understanding the social change model of leadership development. (2<sup>nd</sup> ed.). San Francisco, CA: Jossey-Bass.
- Kristof, N.D. & WuDunn, S. (2010). Half the sky: Turning oppression into opportunity for women worldwide. New York, NY: Vintage Books.

This course will be an adventure. Each class period will be devoted to dissection of the designated topic. This dissection will include a discussion of prescribed theory or ideology as outlined by the course materials. This discussion will be followed by a candid debate of said theory's applicability. Finally, we will test our perspective using case studies to further enhance our understanding of the concept. Students will also have an opportunity to facilitate activities to enhance their development and the development of their classmates later in the semester.

This course will challenge many of your perspectives and affirm others. Attend class with readiness and an eagerness to defend and debate your perspectives.

**Course Policies and Expectations**

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*Attendance:* It is an expectation that you attend every class session. This will be an intensive attempt at gaining the foundation of leadership theory and its application to practice confined by the university calendar to a 16-week period. Because of this and the value of our class interactions, it is paramount that you are in class barring an unforeseen emergency. Should you be unable to attend class, please contact me prior to the class session you will be absent from.

*Canvas:* All students are expected to check Canvas (<https://canvas.iastate.edu>) on a regular basis. Please ensure that you have access to this service. All grades will be reflected in Canvas.

*Academic Dishonesty:* This class will follow Iowa State University's policy on academic dishonesty. Anyone suspected of academic dishonesty will be reported to the Dean of Students Office.

*Accessibility Statement:* Iowa State University is committed to assuring that all educational activities are free from discrimination and harassment based on disability status. Students requesting accommodations for a documented disability are required to meet with staff in Student Accessibility Services (SAS) to establish eligibility and learn about related processes. Eligible students will be provided with a Notification Letter for each course and reasonable accommodations will be arranged after timely delivery of the Notification Letter to the instructor. Students are encouraged to deliver Notification Letters as early in the semester as possible. SAS, a unit in the Dean of Students Office, is located in room 1076, Student Services Building or online at [www.sas.dso.iastate.edu](http://www.sas.dso.iastate.edu). Contact SAS by email at [accessibility@iastate.edu](mailto:accessibility@iastate.edu) or by phone at 515-294-7220 for additional information.

*Dead Week:* This class follows the Iowa State University Dead Week policy as noted in section 10.6.4 of the Faculty Handbook.

*Discrimination and Harassment:* Iowa State University does not discriminate on the basis of race, color, age, ethnicity, religion, national origin, pregnancy, sexual orientation, gender identity, genetic information, sex, marital status, disability, or status as a U.S. Veteran. Inquiries regarding non-discrimination policies may be directed to Office of Equal Opportunity, 3410 Beardshear Hall, 515 Morrill Road, Ames, Iowa 50011, Tel. 515-294-7612, Hotline 515-294-1222, email [eooffice@iastate.edu](mailto:eooffice@iastate.edu)

*Religious Accommodation:* Iowa State University welcomes diversity of religious beliefs and practices, recognizing the contributions differing experiences and viewpoints can bring to the community. There may be times when an academic requirement conflicts with religious observances and practices. If that happens, students may request reasonable accommodation for religious practices. In all cases, you must put your request in writing. The instructor will review the situation in an effort to provide a reasonable accommodation when possible to do so without fundamentally altering a course. For students, you should first discuss the conflict and your requested accommodation with your professor at the earliest possible time. You or your instructor may also seek assistance from the Dean of Students Office at 515-294-1020 or the Office of Equal Opportunity at 515-294-7612.

*Late Assignments:* Barring an unforeseen emergency, all work is due in class or via email to me by 11:59 PM CST on the assigned date. Should you fail to turn your work into me without contacting me, you will receive a grade of 0.

*Challenge Policy:* This is your education and as such I would like you play an active role in it. Should you feel that I have unfairly graded or inaccurately assessed your work product, you have the ability to challenge. I encourage you to schedule an appointment with me to discuss your perspectives in an effort to change my opinion of your work. If successful, I will be more than happy to change your grade, as part of being an effective leader is effective communication. 3

## Coursework

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**I.** Critical Reflection Analysis (CRA) – 200,000 points (4 x 50,000 points each)

The CRA entries must be 800-1000 words in length, 12-point font, 1-inch margins, saved in .docx or .pdf format, and should address the prompts provided in Canvas. Entries will be evaluated on the following:

- Formal writing which is consistently thoughtful, grammatically sound, properly cited, and well-developed
- Entries should highlight your critical and thoughtful analysis of course material discussions, and experiences with the prompt provided
- Each entry should address at the prompting questions and identify concepts from the textbook, course discussions, service-learning project, common reader, and class activities.

**II.** Leadership Involvement Reflection Videos – 300,000 points (4 x 75,000 points each)

Detailed Guidelines found in Canvas: Students should attend approved events, lectures, and/or clubs on campus as well as service-learning organization events outside of the site visit times. Approved events, lectures, organization events, etc. are listed in Canvas. Student must approve events not on the list with instructor. Students should develop 2-3 minute reflection videos using YouTube and Canvas.

**III.** Service-Learning/Social Change Leadership Project- 500,000 points

As a component of the course students will participate in a service-learning project that incorporates the intersection of scholarship and service as a college student. Students will have the opportunity to partner with a community organization (selected by teaching team) to enhance their understanding of service leadership and their role as a volunteer. In groups, student will visit the site throughout the semester during course meeting time and potentially outside of class. Travel accommodations are available for students, to and from the site. Finally, students will submit a final reflection video and final presentation on the service-learning project toward the end of the semester.

- Note to students: Please note that the community organizations/agencies have been gracious in agreeing to participate in this initiative and are generous to donate their time to you. Please present yourself as a professional and a representative of Iowa State University.

Project assessment will be evaluated on the following components:

1. Site Participation and Effectiveness (50,000 points)
  - a. Quality and Effectiveness of Service – attend all service dates and ONE organization event outside of class time
2. Social Change Project Executive Summary Proposals (100,000 points) - In clusters, students will submit an executive summary proposal for an innovation tied to large-scale social change within the target organization that supports the populations served. Proposal guidelines and information is located in Canvas.
3. Social Change Project Presentation (300,000 points) - In clusters, students will present their innovation tied to large-scale social change through dynamic means for an authentic audience. Proposal guidelines and information is located in Canvas.
4. Group Participation & Peer Evaluation (50,000 points) - Peer, instructor, and peer mentor evaluation of engagement in the service-learning project.

## Student Learning Assessment & Evaluation

Grading - There is a total of 1,000,000 points for this class. Letter grades are awarded as follows:

Scale		Coursework	
Grade	Points Earned	Assignment	Points
A	100,000,000-900,000 (A 94%, A- 90%)	Critical Reflection Analyses	200,000
B	870,000-800,000 (B+ 87%, B 84%, B- 80%)	Leadership Involvement Videos	300,000
C	770,000-700,000 (C+ 77%, 74%, C- 70%)	Service-learning /Social Change Project	500,000
D	670,000-600,000 (D+ 67%, 64%, 60%)	Total	1,000,000
F	599,000-below	Assignment	Points

## Course Timeline

Week	Dates	Topic	Assignments Due
1	T, Aug. 21 R, Aug. 23	Tues.: Expectations & Exploration of the Learning Context Thurs.: Syllabus, Perspectives, & Small Group Organization	
2	T, Aug. 28 R, Aug. 30	Tues.: Exploring Reflection & Creating a Thinking Environment Thurs.: A Space of Inclusion (What Works for You)	
3	T, Sept. 4 R, Sept. 6	Tues.: Discovering Your Strengths Thurs.: Considering Our Strengths	Critical Reflection 1 – How do your strengths create value for our world?
4	T, Sept. 11 R, Sept. 13	Tues.: Core Values, Personal Mantras, & Situational Gravity Thurs.: Development of Our Personal Mantra & Our Flight (Context Visit 1)	Reflection Video for Visit 1
5	T, Sept. 18 R, Sept. 20	Tues: Effective & Non-Violent Communication Thurs: NVC Plan & Application to Significant Relationships	
6	T, Sept. 25 R, Sept. 27	Tues: The Search for Perfection, Failure, & The Growth Mindset Thurs.: Perfection - The Enemy of Great (Context Visit 2)	Critical Reflection 2 – What is your “air of excellence” or plan for quality?
7	T, Oct. 2 R, Oct. 4	Tues.: Identity & Intersectionality Thurs.: Embracing Identity & The Other	
8	T, Oct. 9 R, Oct. 11	Tues.: Personal Branding & Influence Thurs.: Constructing Our Brand (Context Visit 3)	Reflection Video for Visit 2
9	T, Oct. 16 R, Oct. 18	Tues: How Your Brain Learns Thurs.: Action through Neuroplasticity	
10	T, Oct. 23 R, Oct. 25	Tues.: Moral Imagination & Effective Decision-Making Thurs.: Constructing Our Moral Frame & Process for Morality (Context Visit 4)	Critical Reflection 3 – What is your process for moral leadership?
11	T, Oct. 30 R, Nov. 1	Tues.: Understanding Markets, Trends, & Politics Thurs.: Shoe Distribution	
12	T, Nov. 6 R, Nov. 8	Tues.: Organizational Influence & Advancement Thurs.: Taking Our Organization Where It Can Go (Context Visit 5)	Reflection Video for Visit 3
13	T, Nov. 13 R, Nov. 15	Tues.: Accompaniment & The Problems of Our World Thurs.: Mind Mapping Our Passions	

14	T, Nov. 20 R, Nov. 22	Tues.: No Class Thurs.: No Class	Critical Reflection 4 – What is your opportunity for leadership during break and how does it create a foundation for a better world?
15	T, Nov. 27 R, Nov. 29	Tues.: Triple Bottom Line Innovation Thurs.: Application to Group Project & Presentation (Context Visit 6)	
16	T, Dec. 4 R, Dec. 6	Tues.: Final Social Change Project Presentations Thurs.: Final Social Change Project Presentations & Class Commencement	
Finals Week	Dec. 10-14	Finals Week – No Class	Reflection Video for how the course has created a foundation for your leadership future

# SSTEM Successes and Challenges: Engineering Identity Development for Women in Computer, Electrical, and Software Engineering

Dr. Sarah L. Rodriguez, Dr. Kelly Cunningham, Ronnia Estes, MacKenzie Sissel

Iowa State University

## Purpose

While women are enrolling in postsecondary education in high numbers, their enrollment in computer, electrical, and software (CES) engineering fields remains low. One of the challenges women face is a struggle in developing a strong professional identity as an engineer. Using a phenomenological approach, this study examined the experiences of undergraduate women in computer, electrical, and software engineering involved with a National Science Foundation Scholarships in Science, Technology, Engineering, and Mathematics Program (S-STEM) Program at an institution in the Midwest.

## Research Questions

#1 How do undergraduate women in a funded SSTEM program for CES engineering develop their engineering identities during college?

#2 How do other intersectional identities influence the development of an engineering identity for undergraduate women in a funded SSTEM program for CES engineering?

## Theoretical Framework

- ✓ Role identity theory
  - Addresses the meanings that individuals attach to their contexts
  - Identities are more or less salient
- ✓ Recognition – perception of how others view them (family, faculty, peers)
- ✓ Interest – affinity toward a subject; motivation to take on role of engineer
- ✓ Performance/ Competence – understanding knowledge, capability of participating

## Methods

- ✓ Phenomenology
- ✓ 17 undergraduate women, electrical/computer/software engineering, involved in S-STEM program, age 18+,
- ✓ Pre-interview questionnaire; longitudinal, annual interviews (on cycle 2, adding more each year); ongoing reflective journals



## Findings

Research Question #1: How do undergraduate women in a funded SSTEM program for CES engineering develop their engineering identities during college?

- ✓ Within the engineering context feelings of stifled discovery, creativity; makes women not interested in or able to see themselves as engineers; outside internships opportunity to feel like engineer
- ✓ Male faculty lecture women on persistent issues for women in engineering, question credibility; male peers doubt women's place in engineering
- ✓ Façade that all engineering students doing well, no one is struggling
- ✓ S-STEM Community helps women navigate engineering environment, feel more like an engineer
- ✓ S-STEM Faculty mentors reinforce that participants belong; help women in engineering see themselves as engineers
- ✓ S-STEM activities (Grace Hopper, Road Less Traveled) help participants to recognize their role in engineering; complications exist though, in terms of facilitation, relevancy to all participating majors

"I constantly feel like I'm under pressure. I don't even know how the other girls around me do it...College makes me feel like I'm a dumb kid or something. I don't feel like I am getting enough opportunities to innovate and be listened to and like a lot of the decisions are made for me. I don't feel like an engineer here at school because I don't feel like I'm doing a real world application of the skills that I have and the skills that I am developing." – Heather

"[my male classmate said], 'oh, you're in...you really want to be here? You sure you can handle it? ... I don't know, females normally don't come into engineering. Are you sure you're ready for it?'...I know, people always say, 'oh, men are gonna try to discourage you or da da da.' I'm like, 'I don't think in college, the first couple of days of class...' I'm like there's no way, And I was proven wrong." – Roxanne

"[My faculty mentor] really wants us to actually think and learn, and to be a different type of thinker...I always walk out of his class inspired, like, 'wow, we could change the world.' You just get that feeling, like, ok, I can actually do this. This is what engineers actually do'...I definitely feel like he sees me as an engineer. The one thing I love that he does as well is he constantly reminds us, he's like, 'you're all qualified to be here. You're all qualified to be great engineers.' – Roxanne

"[The Peer] Mentors are all super successful, so it's nice talking to them how they navigated through their first, second, and third years...I feel not as confident as my other classmates. They're saying, it's okay and to not worry and it makes me feel better about not being super experienced." – Candy

**Research Question #2: How do other intersectional identities influence the development of an engineering identity for undergraduate women in a funded SSTEM program for ECS engineering?**

- ✓ Gender
- ✓ Age
- ✓ Transfer Status
- ✓ Race/Ethnicity
- ✓ Socio-economic Status
- ✓ Creative Identity

**Implications**

Practice	Future Research	Theory	Policy
<ul style="list-style-type: none"> <li>•Improving community, strengthening relationships; greater truth, authenticity, trust-building</li> <li>•Training of faculty mentors (and greater faculty) on how to discuss issues, support development</li> <li>•More purposeful in seeing scholarship program as site for identity development</li> <li>•Training now all-gender group identity development for engineers; various identity, multiple oppressions</li> </ul>	<ul style="list-style-type: none"> <li>•Considering intersectionality, inequities and oppression</li> <li>•Interrogating disciplinary differences, even within CES (e.g. women’s representation, acceptable behaviors/norms)</li> <li>•Need longitudinal investigation of development (current study, Year 2 of 5)</li> <li>•Perspective of all genders involved in S-STEM project, not just women</li> </ul>	<ul style="list-style-type: none"> <li>•Strong connection between concepts of recognition and need to perform; possibly deriving from gender dynamics</li> <li>•Need for integrated, intersectional theory for engineering identity development</li> <li>•Engineering, especially, CES, may be more heavily influenced by performance, rather than other concepts</li> </ul>	<ul style="list-style-type: none"> <li>•National Science Foundation financial policy and return on investment</li> <li>•Institutional programming versus funding areas with collective impact, cultural shift</li> <li>•Funding allocations versus stated focus on “low-income” and spirit of policy</li> <li>•Role of social science research in projects, including formalized feedback loops for change</li> </ul>

## Past & Upcoming Works From the Team

Rodriguez, S.L., Sissel, M., Estes, R., Doran, E. (2018, April). Engineering Identity for Latina Undergraduate Students: Exploring Development and Intersecting Identities. Preliminary Acceptance for the Collaborative Network for Engineering and Computing Diversity Conference, Crystal City, VA.

Friedensen, R.E., Rodriguez, S.L., Doran, E. (2018, June). Documenting Engineering Identity: Electrical & Computer Engineering Departmental Documents and Student Identity. Preliminary Acceptance for the Annual Meeting American Society for Engineering Education, Salt Lake City, UT.

Rodriguez, S. L., Lu, C., Bartlett, M. (July, 2018). Engineering identity development: A review of the higher education literature. *International Journal of Education in Mathematics, Science and Technology*.

Lu, C., Rodriguez, S. L. (Summer, 2018). Increasing the STEM Pipeline by Strengthening Latin@ Science Identity Development. In T. Yuen, E. Bonner, M. Arreguín-Anderson (Eds.), *(Under)Represented Latin@s in STEM: Increasing Participation Throughout Education and Workplace*. New York, NY: Peter Lang.

Rodriguez, S. L., Lehman, K. (2018). Developing the Next Generation of Diverse Computer Scientists: The Need for Enhanced, Intersectional Computer Science Identity Theory. *Computer Science Education*. doi.org/10.1080/08993408.2018.1457899

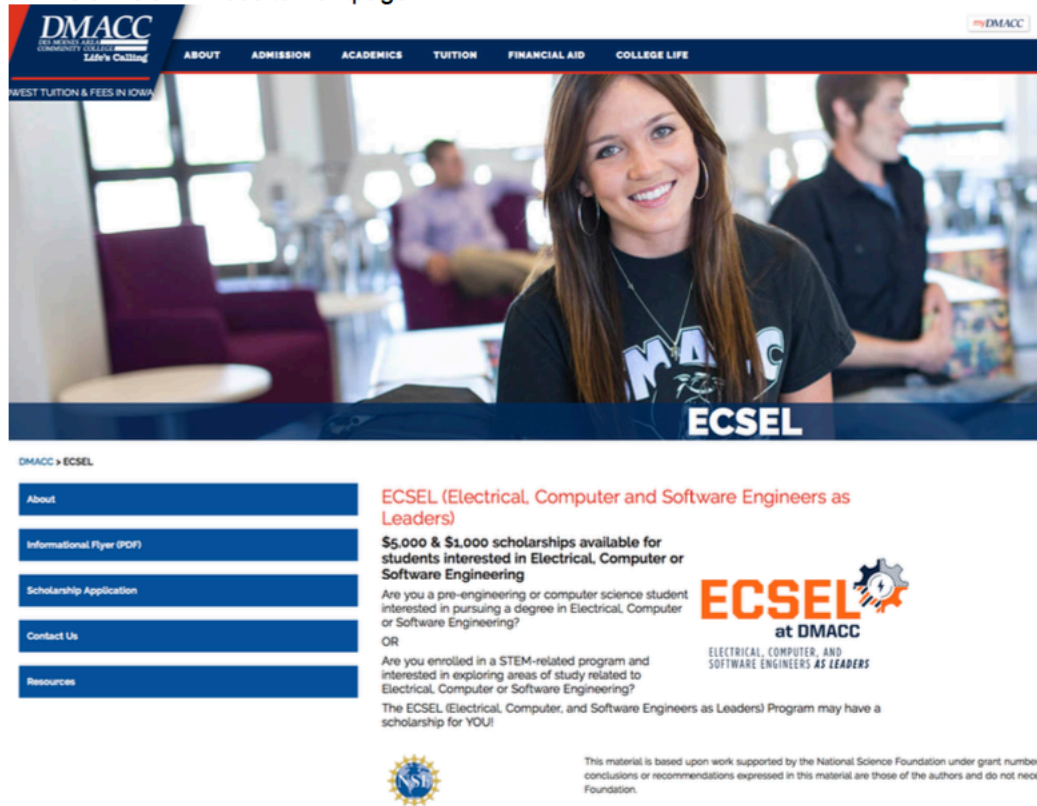
Rodriguez, S. L., Cunningham, K. J., Jordan, A. (2017). STEM Identity Development for Latinas: The Role of Self- and Outside Recognition. *Journal of Hispanic Higher Education*. doi.org/10.1177/1538192717739958

Rodriguez, S. L., Cunningham, K., Jordan, A. (2016). What a Scientist Looks Like: How Community Colleges Can Utilize and Enhance Science Identity Development as a Means to Improve Success for Women of Color. *Community College Journal of Research and Practice*, 41(4-5), 232-238.




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DMACC ECSEL website frontpage:



The image shows the frontpage of the DMACC ECSEL website. At the top, there is a navigation bar with the DMACC logo on the left and a menu with items: ABOUT, ADMISSION, ACADEMICS, TUITION, FINANCIAL AID, and COLLEGE LIFE. Below the navigation bar is a large banner image of a smiling young woman in a black t-shirt with 'DMACC' on it. The word 'ECSEL' is overlaid in white on the bottom right of the banner. Below the banner, there is a sidebar on the left with a blue background and white text, containing links: About, Informational Flyer (PDF), Scholarship Application, Contact Us, and Resources. The main content area on the right has a blue header for 'ECSEL (Electrical, Computer and Software Engineers as Leaders)'. Below this, it lists '\$5,000 & \$1,000 scholarships available for students interested in Electrical, Computer or Software Engineering'. There are two 'OR' options for eligibility: 'Are you a pre-engineering or computer science student interested in pursuing a degree in Electrical, Computer or Software Engineering?' and 'Are you enrolled in a STEM-related program and interested in exploring areas of study related to Electrical, Computer or Software Engineering?'. A small gear icon is next to the 'ECSEL at DMACC' logo. At the bottom, there is a small NSF logo and a disclaimer: 'This material is based upon work supported by the National Science Foundation under grant number 1 conclusions or recommendations expressed in this material are those of the authors and do not neces Foundation.'

ISU/DMACC Iowa Cyber Hub website frontpage:



The image shows the frontpage of the Iowa Cyber Hub website. At the top, there is a dark navigation bar with 'IOWA CYBER HUB™' on the left, 'HOME' in the center, and 'IOWA STATE + DMACC -' on the right. Below the navigation bar is a large banner image with a blurred background of people. In the center of the banner is the Iowa Cyber Hub logo, which features a shield with a keyhole and the text 'IOWA CYBER HUB'. Below the logo, the text 'IOWA CYBER HUB™' is displayed in large, white, sans-serif font. Underneath, there is a paragraph of text: 'Iowa State University (ISU) and Des Moines Area Community College (DMACC) are proud to present a partnership geared towards Cybersecurity. Starting in the Fall of 2018 students are welcome to journey along the pathway towards a degree or certificate in Cybersecurity.' A blue downward-pointing arrow is at the bottom center of the banner.