

Pathways to STEM Baccalaureate Degrees: *Partnerships for Student Success*

Action Lab II
Ramping Up for STEM Success
Association of American Colleges & Universities

Frankie Santos Laanan
March 21, 2012
Seattle, WA



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Learning Goals

Participants will learn:

- Strategies to prepare diverse students for successful STEM transfer;
- Pathway2STEM Degree web site resource; and
- Promising practices that facilitate a seamless pathway from community college to four-year university in STEM disciplines.

Motivation to Study Student Transfer and STEM Pathways

- Former CC transfer student (swirler, multi-attendance patterns, multiple 2- and 4-year institutions).
- Over 20 years studying transfer phenomenon (“me-search – research).
- Desire to develop new theoretical and conceptual frameworks to study complex phenomenon.
- Argue that transfer process is a multidimensional phenomenon.
- Engaged in on-going research and committed to translating research to practice and policy.

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CCLP | Community College Leadership Program
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Welcome to CCLP

Welcome to the Community College Leadership Program (CCLP) website. Here you will find information about graduate programs and professional development opportunities for community college professionals, as well as information about the Office of Community College Research and Policy (OCCRP).

News and Events

- ▶ Hagedorn discusses financial aid, cost of college on IPR
- ▶ Lannan, Friedel advise Guam education leaders on career and technical education
- ▶ Survey for Transfer Students
- ▶ Ignacio Hernandez Accepted to AAHHE Graduate Fellows Program
- ▶ STEM article featured in Community College Times
- ▶ OCCRP Team presents research at STEM Pathway Conference
- ▶ "Two minutes with Larry Ebbers"
- ▶ Starobin and Laanan study community college role in STEM
- ▶ Laanan is commencement speaker at Southwestern Community College
- ▶ Linda Serra Hagedorn assists effort to export U.S. community college model to Indonesia
- ▶ Larry Ebbers : a NASPA Legacy
- ▶ Linda Serra Hagedorn serves as ASHE president.
- ▶ Frankie Santos Laanan serves as ACTER president.

[Archive](#)

Video



ISU Community College Leadership Programs
Higher Education Administration

▶ [Watch Video](#)

About OCCRP

- The Office of Community College Research and Policy (OCCRP) at Iowa State University is focused on *creating, sharing, and applying knowledge in the context of community college education*.
- The mission of the OCCRP is to *articulate and analyze the issues affecting policy and practice* by conducting rigorous research which impacts students, faculty, administrators, and policymakers.
- The OCCRP is *committed to sharing our research with diverse constituents* through dissemination efforts such as publications, conference presentations, and professional workshops



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New Map Identifies STEM Centers Around the Country

Robert Noyce Scholarship Informational Session to be held February 2nd

National Governors Association Issues Key Report on STEM Education

Iowa State Faculty Member, Sarah Roberts,

28 Jan 2012, 8:00 AM - 5:00 PM - Ames Laboratory/Iowa State University High School Science Bowl, Iowa State University

30 Jan 2012, 2:30 PM - 4 PM - Vicki Gray Retirement Celebration @ N047 Lagomarcino, Hosted by the Department of Curriculum & Instruction, ISU

2 Feb 2012, 4:00 PM - Robert Noyce

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INTRODUCTION



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Resources for students. View More	Resources for Community College transfer advisors. View More	Information and resources for Community College and University STEM Faculty. View More

HIGH SCHOOL STUDENTS Videos

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Preparing the 21st Century Technician
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Critical Aspects of ATE Programs

- Improve Student Learning
- Design Novel Curriculum and Pedagogy
- Disseminate Innovative Material
- Develop Transformational Leadership

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STEM Student Enrollment and Engagement through Connections

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The STEM Student Enrollment and Engagement through Connections (SEEC) project seeks to increase the number of engineering graduates at Iowa State University by approximately 100 per year. The means to that end are connections rooted in community: learning communities, community colleges, and Iowa communities. The project is collaborative between Iowa State University (ISU) and Des Moines Area Community College (DMACC). The cornerstone of SEEC is the success of learning communities for recruitment and retention, and the project builds upon Iowa State's established learning community infrastructure, leadership, and expertise. Retention at DMACC and ISU will be increased by a new learning community model called a learning

Fast Facts about ISU Engineering

The College of Engineering continues to be ranked among the top 25 public engineering colleges in the country, according to the graduate and professional school rankings.

The programs are among the top 10 in the Midwest among all engineering colleges (USN & WR ranking).

Data Briefs

[SEEC Data Brief: Engineering Admissions Partnership Program \(E-APP\) \(PDF\)](#)
November 2010

[SEEC Data Brief: Engineering Orientation \(EGR 100\) \(PDF\)](#)
November 2010

[SEEC Data Brief: SEEC Engineering Transfer Student Profile \(PDF\)](#)

www.eng.iastate.edu/seec

Special Issue

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Role of community colleges: broadening participation among women and minorities in STEM
Soko S. Starobin, Frankie Santos Laanan, Carol J. Burger

Changing STEM associate's degree production in public associate's colleges from 1985 to 2005: exploring institutional type, gender, and field of study
David E. Hardy, Stephen G. Katsinas

Math and science success and nonsuccess: journeys within the community college
Linda Serra Hagedorn, Daniel DuBray

Women in male-dominated career and technical education programs at community colleges: barriers to participation and success
Jaime Lester

From community college to PH.D.: educational pathways in science, technology, engineering, and mathematics
Soko S. Starobin, Frankie Santos Laanan

Role of community colleges in STEM education: thoughts on implications for policy, practice, and future research
Elizabeth Hoffman, Soko S. Starobin, Frankie Santos Laanan, Marisa Rivera

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Profile of Today's CC Student

- Almost half (44%) of all undergraduate students enrolled in U.S. colleges/universities attend CCs
- CCs enroll significant number/percentage of first-generation, low-income students
- Growth of full- and part-time students higher compared to four-year
- Over 35% of CC students are of racial-ethnic backgrounds (significant growth of URM enrollment)

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Profile of Today's CC Student

- About 21% of all students are women of color
- Over 26% of CC students in lowest income levels
- Veterans use GI Bill to enroll in CCs
- Largest percentage of students with disabilities attend CCs
- Diverse students enrolled in Minority Serving Institutions (MSIs) – HSIs, HBCs, Tribal Colleges
- Over 44% of S&E graduates had CC experience; highest among URMs (Tsapogas, 2004)

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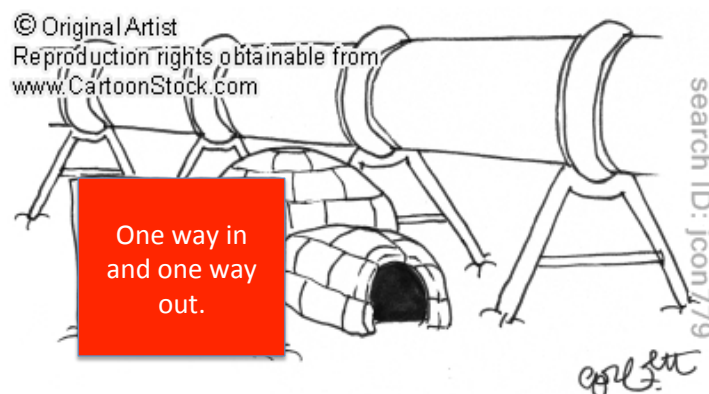
Pathway to STEM Degree: 101

- Inputs (student background characteristics, etc.)
- Pre-STEM academic preparation (e.g., socialization and STEM Student Success Literacy)
- Transfer and articulation policies (formalized vs. not formalized)
- Role of teaching and learning
- Career and Technical Education [CTE] Pathway to Advanced Technological Education (ATE)
- “Community College Effect”
- Transfer Student Success at 4-year

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Debunking Metaphors

From Pipeline to [Educational] Pathways to STEM Degrees

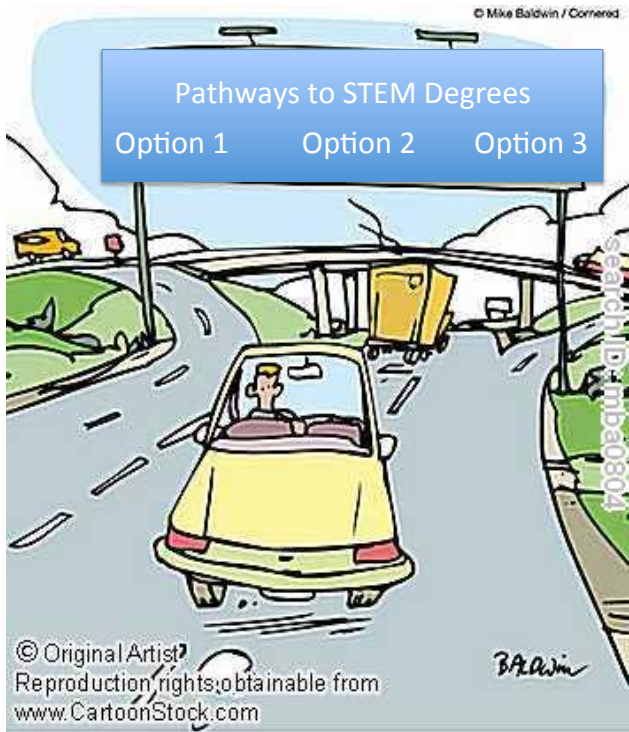


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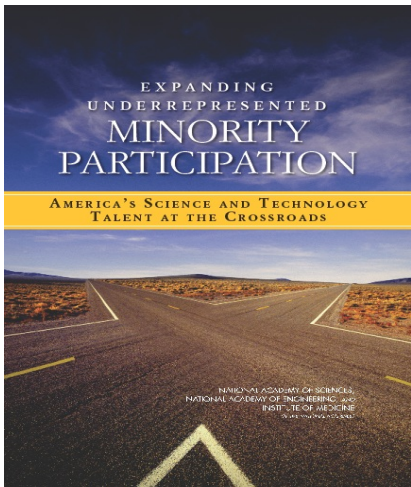
Pathways to STEM Baccalaureate Degree

NEW WAYS OF THINKING:

- Multiple Pathway Options
- Multiple “entry points” or access points” to pursue STEM degree
- Move beyond “one size fits all” model



Talent at the Crossroads



Broadening Participation:

- Our sources for the future S&E workforce are uncertain.
- The demographics of our domestic population are shifting dramatically.
- Diversity is an asset.

Institutional Roles

- **Community Colleges:** *To facilitate and increase the successful transfer of underrepresented minorities in STEM to four-year institutions, an increased emphasis on and support for articulation agreements, summer bridge programs, mentoring, academic and career counseling, peer support, and undergraduate research at two-year institutions is recommended.*
- **Minority-Serving Institutions:** MSIs have a legacy of recruiting, retaining, and graduating a disproportionate number of minorities, especially at the undergraduate level. With additional support, MSIs can expand their effectiveness in recruiting, retaining, and graduating an increased number of minorities, especially at the baccalaureate level.

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Fixing the Problem

- Academic preparation (K-12 education, achievement gaps, etc.)
- Access and Motivation
- Affordability
- Academic and Social Support

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Using Community Colleges to Build a STEM-Skilled Workforce

Source: Issue Brief (June 24, 2011). NGA Center for Best Practices. National Governor's Association: Washington, D.C.

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STEM Professionals in Demand

- High-level STEM occupations include professionals such as computer engineers, mathematicians, software designers, and engineers and technicians in the life and physical sciences.
- STEM is the 6th largest occupational cluster and will provide the 6th largest share of job openings in the economy over the next decade.
- At least 8 million of the jobs available to college graduates in 2018 will be in STEM professions.
- About half of these positions will be entirely new occupations and remaining positions will be in jobs vacated by retiring professionals.

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Highlights

- Education and skills in STEM are important in a global economy increasingly focused on high-growth, technology-driven occupations.
- Community colleges play a critical role in statewide STEM initiatives.
- Policy Gaps:
 - ✓ Lack of alignment between CC degree production and employer skill needs
 - ✓ Lack of real-world application in CC courses and programs
 - ✓ Low degree completion rates
 - ✓ Ineffective mathematics remediation
 - ✓ Lack of articulation agreements that ensure credits

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Assets of Community Colleges

- *Uniquely positioned* to grow the pipeline of STEM professionals and produce more STEM-skilled workers to meet the demand for middle- and high-skill jobs.
- *Convenience of CCs* is a crucial asset: 90% of the U.S. population lives within 25 miles of a CC, which makes these institutions highly accessible to many people.
- By 2030, *people of color will make up 45% of the working-age population* – up from just 18% in 1980.
- *Inexpensive option* for many low-income, low-skilled adults who want to boost their education and training (\$2,544 CC mean annual cost vs. \$7,020 at 4-year public college).

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Community College Transfer Students

- Movement *from* community colleges *to* baccalaureate-granting institutions continues to grow steadily (Planty, Hussar, & Snyder, 2009)
- Community college transfer students are complex, transfer process is multidimensional (Laanan, Starobin, & Eggleston, 2010)
- Diversifying human capital while bridging the socioeconomic gap at baccalaureate-granting institutions (Dowd, Cheslock, & Melguizo, 2008)

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Community College Transfer Students

- Demographic and population shifts during the next 10 years will likely alter the profile of the *typical* community college transfer student (Lester, 2006)
- Transfer students describe community college classrooms as “breeding grounds” for interest in the sciences and university lecture halls as “weeding grounds” to relieve impacted majors (Chang, 2006)

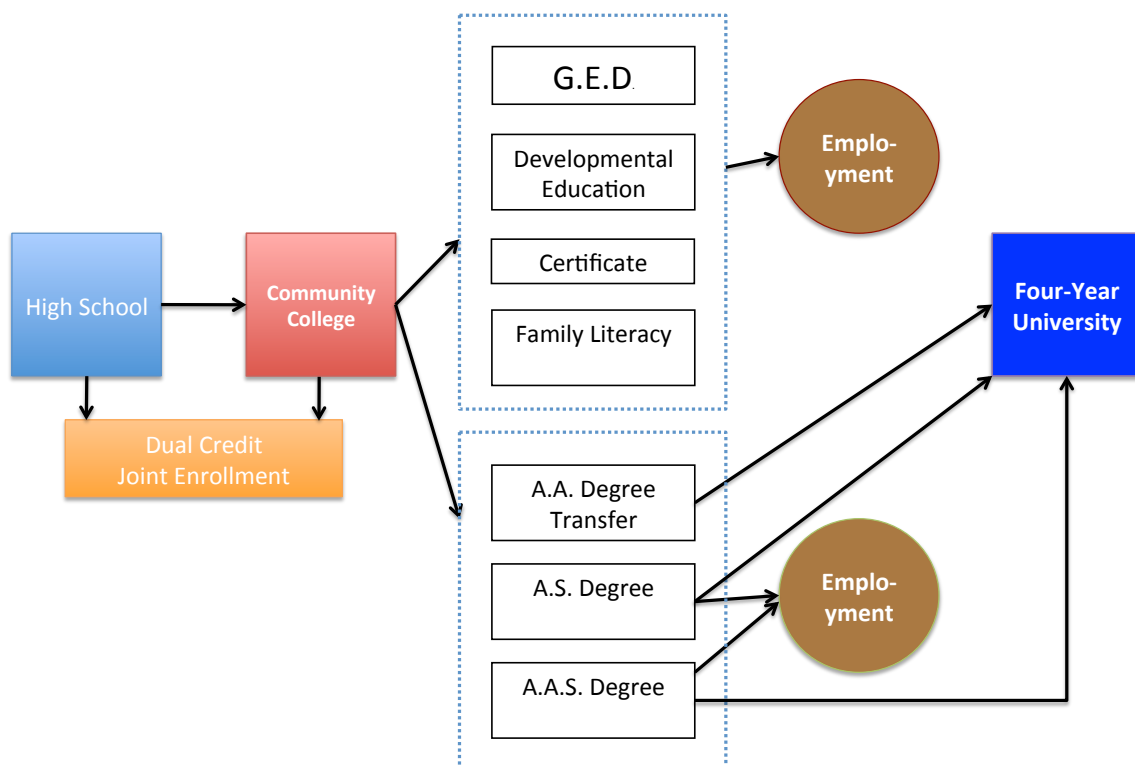
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Community Colleges and STEM

- STEM fields have become drivers of economic growth and competitiveness. From 1950 to 2000, the number of individuals in science and engineering occupations grew significantly (National Science Board, 2008)
- Community colleges serve a vital role in stimulating the numbers of STEM degree recipients and skilled workers completing associate degrees (Hoffman, Starobin, Laanan, & Rivera, 2010)
- NSF initiatives such as STEM Talent Expansion Programs (STEP) and Advanced Technological Education (ATE) seek to increase STEM transfer rates (National Science Foundation, 2001)

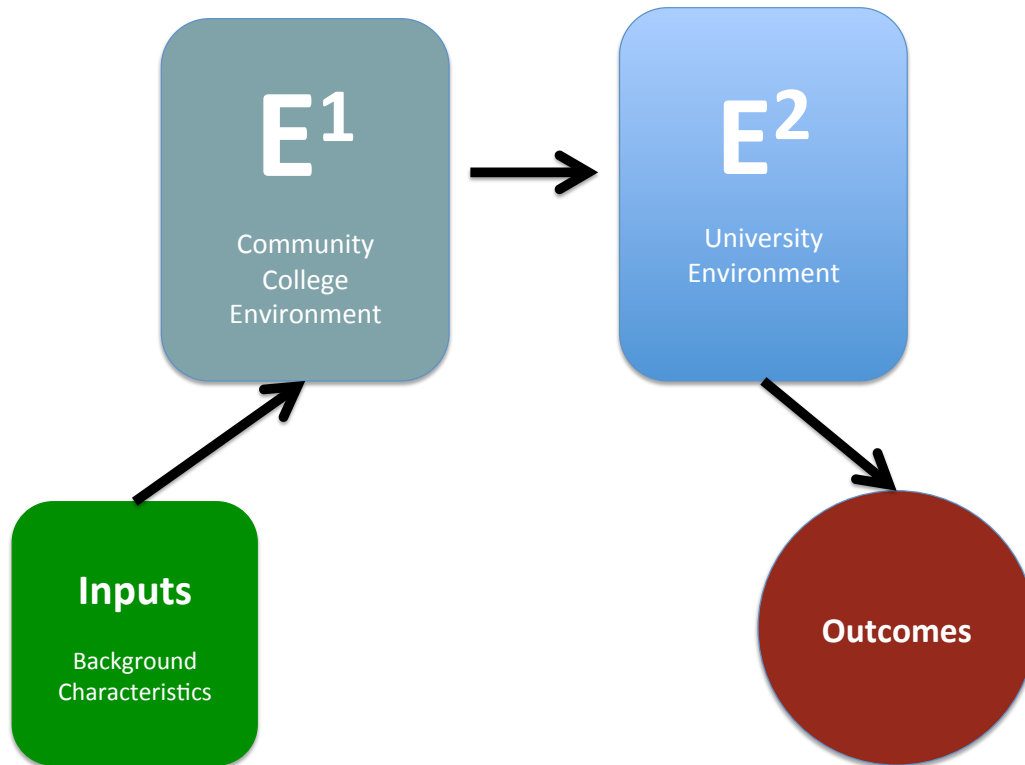
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Figure 1. Conceptual Framework of Educational Trajectories via Community College

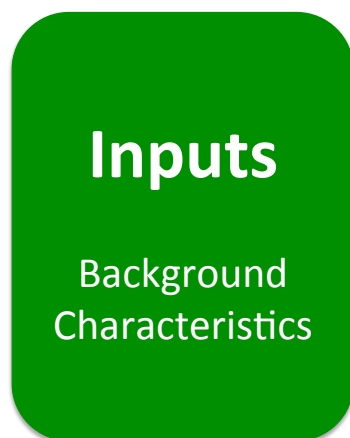


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Figure 2. Conceptual Framework of Understanding Transfer Students' College Experiences and Transition to 4-Year University



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- Age
- Race/Ethnicity
- First-Generation Status
- Low-income
- Socio-economic status
- Parental Education
- Parental Income
- High school achievement/preparation
- English Language Learners
- Placement Test Scores
- Other variables

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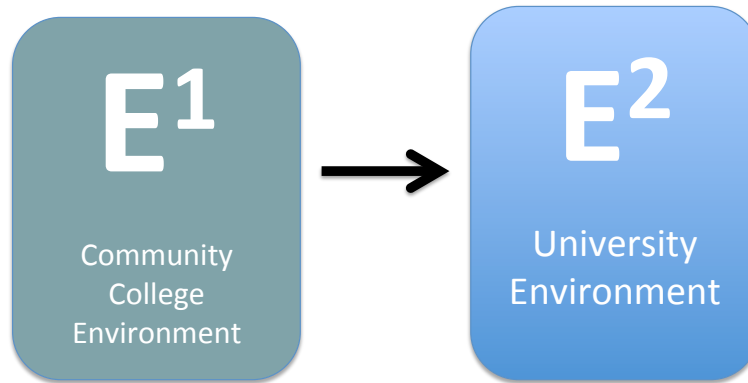
Community
College
Environment

- Employment
- Hours spent on CC campus
- Developmental Courses
- General Courses
- Academic Advising / Counseling Services
- Transfer Process
- Course Learning
- Experiences with Faculty
- Participation in 2 YR-4 YR partnerships (transfer and articulation)
- Bridge Programs
- CC GPA
- Learning and Study Skills

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University
Environment

- Employment
- Academic Major
- Learning Community
- Course Learning
- Experience with Faculty
- General Perceptions of University (e.g., accessibility of faculty, friendly “Transfer Culture”)
- Adjustment Process (e.g., social and academic, transfer shock, transition issues)
- College Satisfaction



“Building Bridges between two islands”

- Transfer Process
- Transfer Academic Preparation
- Socialization and Transfer Student Capital
- Course rigor and expectations (2- and 4-year STEM faculty) – share course syllabi, learning outcomes, books, etc.
- Transfer Adjustment Process
- Etc.



- University GPA
- Retention in STEM major
- Leave STEM major
- Retained at University (non-STEM)
- Leave University
- Graduate with STEM degree
- Job Placement
- Self-Concept / Self-Confidence
- Graduate degree in STEM discipline

Strategies to prepare diverse students for successful STEM transfer

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Challenges to Pursuing a STEM Degree

- Chilly climate for women and minorities in classroom (Hurtado et al., 2007)
- Lack of academic preparation (Perna et al., 2009)
- Absence of role models (Seymour & Hewitt, 1997)
- Gender stereotypes (Low et al., 2005; Seymour, 1995)
- Self-confidence (Pajares, 2005)
- Financial concerns (Oseguera et al., 2006)

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Research on Women and Underrepresented Populations in STEM

Factors that impact recruitment and retention of females in STEM fields:

- Positive and supportive academic environments and informal student interactions at the CC and university
- Academic preparation in math and science positively affect experiences of women in STEM
- Structural and cultural academic factors such as chilly classrooms discourage participation of women and URM students in STEM at 4-year institutions
- Mentee-mentor relationships and support systems at both types of institutions are influential factors for students in STEM majors
- Student interactions with faculty were significant regarding self-confidence, retention, and degree aspirations
- Early encouragement (faculty and advisors) and motivation to pursue STEM areas of study

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Recommendations for Increasing Student Gains in STEM Fields

- Peer and faculty support (Cole & Espinoza, 2008)
- Begin preparation earlier for students – start in middle school (Elliott et al., 1996)
- Research opportunities foster success and interest in STEM (Carlone & Johnson, 2007)
- Relevance of coursework to lives increases persistence (Bonous-Hammarth, 2000)
- Show a clear pathway to a baccalaureate degree (Starobin & Laanan, 2008)
- Build bridges between institutions – have a clear articulation agreement for transfer (NSF, 2001)

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Women's Experiences in STEM CC STEM Pathway

Persistence in STEM: Experiences before Transfer

- Inspiring professor encouraged STEM pursuit
- Grateful for peer academic support
- Appreciation for helpful advising
- Value of family support
- Flexibility in work schedules facilitated college-going
- Limited finances as stressors, barriers, and influencers

Source: Packard, Gagnon, LaBelle, Jeffers & Lynn (2011). Women's experiences in the STEM community college transfer pathway. *Journal of Women and Minorities in Science and Engineering*, 17(2), 129-147.

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Women's Experiences in STEM CC STEM Pathway

Persistence in STEM: Experiences After Transfer

- Negative course experiences
- Poor experiences with four-year advisors
- Campus as unwelcoming
- Financial pressures and work challenges
- Shifting fields encouraged participation
- Finding a helpful professor or advisor influenced persistence
- Access to co-transfer support boosted belongingness

Source: Packard, Gagnon, LaBelle, Jeffers & Lynn (2011). Women's experiences in the STEM community college transfer pathway. *Journal of Women and Minorities in Science and Engineering*, 17(2), 129-147.

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Northwest Engineering Talent Expansion Partnership (NW-ETEP)

- NSF-funded STEP Project
- Collaboration among community colleges and four-year universities in WA
- **Objective:** Increase the number of women who earn engineering degrees by providing support programs
- **Program Components:** comprehensive CC faculty and student service providers; on-site CC coordinator; academic support, major and career exploration, and transfer assistance; experiential / problem-based learning.

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Northwest Engineering Talent Expansion Partnership (NW-ETEP)

Voices of Students:

- “Wish I knew before”
- “See a Clear Pathway”
- “Believing Becomes Persistence”

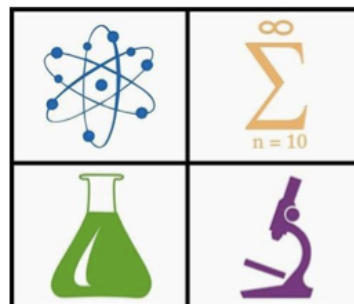
Source: Starobin & Laanan (2008). Broadening female participation in STEM: Experiences at community college. *New Directions for Community Colleges*, 142, 37-46.

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San Diego City College: Model Program

Summer Academy and STEM Success Culture

- SDCC is a member of the Mathematics, Engineering, and Science Achievement (MESA) program
- Since 2001, SDCC has served as a leading college in STEM for economically disadvantaged and underrepresented students.
- Mesa Program offers academic support and transfer program, which creates a “culture of success” with a “language of success” for students to be able to take responsibility for their learning and academic success.
- In 2011, SDCC developed an Academy for STEM Success
 - three-day on-campus summer bridge program for incoming high school graduates, designed to teach them about the “culture of success”, study skills and provide them with the opportunity to meet with mentors, faculty, administrators, and role models from business and industry in STEM
- Two Academy sessions were designed exclusively for female and male students..



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Program Information	Program Components
Math, Engineering, Science Achievement (MESA) Community College Program (MCCP) http://mesa.ucop.edu/programs/mesaccpp.html	<ol style="list-style-type: none"> 1. Academic excellence workshops 2. Orientation course. 3. Academic advising/counseling. 4. Student study center. 5. Assistance in the transfer process. 6. Career advising. 7. Links with student and professional organizations. 8. Professional development. 9. Industry Advisory Board.
San Diego City College Academy for STEM Success http://www.sdcity.edu/AcademicPrograms/ProgramsofInstruction/AcademyforSTEMSuccess?2899Nav= &NodeID=7364	Student objectives for this program: <ul style="list-style-type: none"> • Learn about the City College STEM <i>culture of success</i> and <i>language of success</i> • Be trained on the best learning strategies and develop necessary study skills • Take the StrengthsQuest assessment to learn their five most dominant strengths • Meet professors from STEM departments • Receive guidance from City College Counselors about educational planning • Be mentored by successful City College students in STEM majors • Receive career advice from local STEM professionals • Meet City College staff and learn about available student services • Receive sample school supplies for organizing class notes and materials • Make new friends and build community with 99 other STEM majors • Have fun!

Promising Practices – Facilitate seamless STEM Pathway from CC to 4-year

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Tools & Instruments

STEM Student Success Literacy (SSSL)

- Designed to examine STEM student success literacy.
- Three key factors are measured:

Self Efficacy

Social Capital

Transfer
Knowledge

- Demographic information and open-ended questions also included.
- A pilot study that adopt SSSL survey to measure STEM student success literacy at community colleges will be conducted.

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Measures

- SSSL survey instrument:
 - Using the Self-Efficacy Scale (SES; Sherer et al., 1982) to measure the self efficacy construct;
 - Social capital is measured by a sub-scale of the CIRP Freshman Survey (HERI, 2011), as well as a sub-scale from Campus Life and Learning Survey (CLL; Byrant et al., 2006)
 - Transfer knowledge is measured by a sub-scale of TSQ survey (L-TSQ; Laanan, 1998)

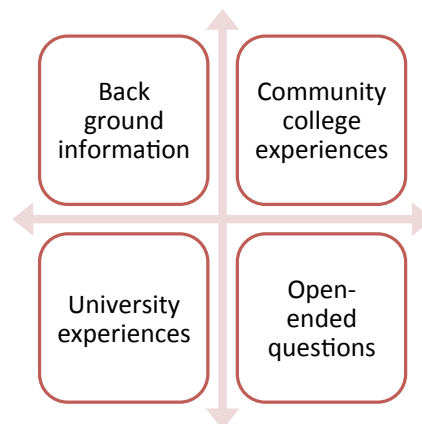
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Tools & Instruments

Laanan-Transfer Students' Questionnaire (L-TSQ)

(Laanan, 1998, 2007, 2010)

- Focusing on transfer students and their academic/social experiences at two year and two year institutions.
- Four sections are included:



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Laanan-Transfer Students' Questionnaire (L-TSQ)

- Survey Instrument

- Laanan-TSQ[©] (1998, 2007, 2010)

- Social demographics
- Community College Experiences
- University Experiences
- Measures non-cognitive or affective traits
- Likert-type scales: levels of agreement, frequency

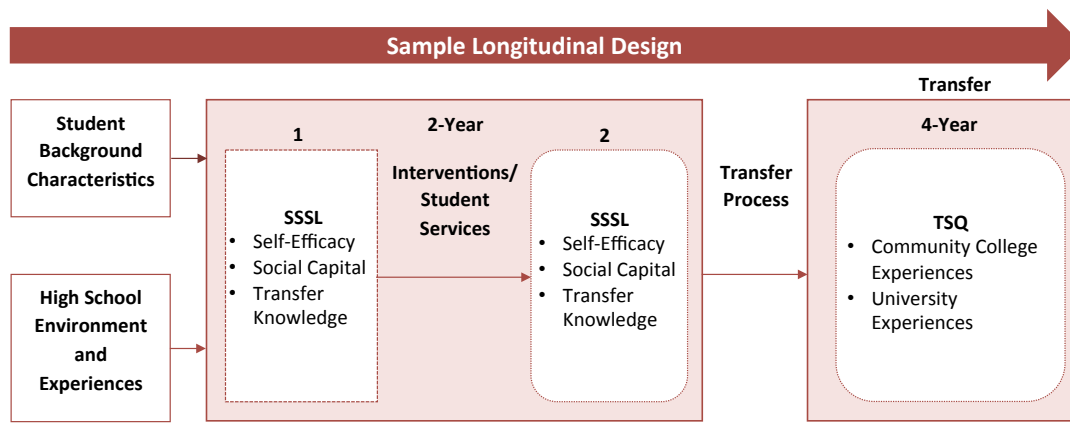
- Open-ended questions

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Research Design

Longitudinal Design

- Follow students from entry to the community college through the conclusion of their academic experience.



--L-TSQ: Transfer Student Questionnaire

SSSL: STEM Student Success Literacy

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Iowa Community College Transfer Students

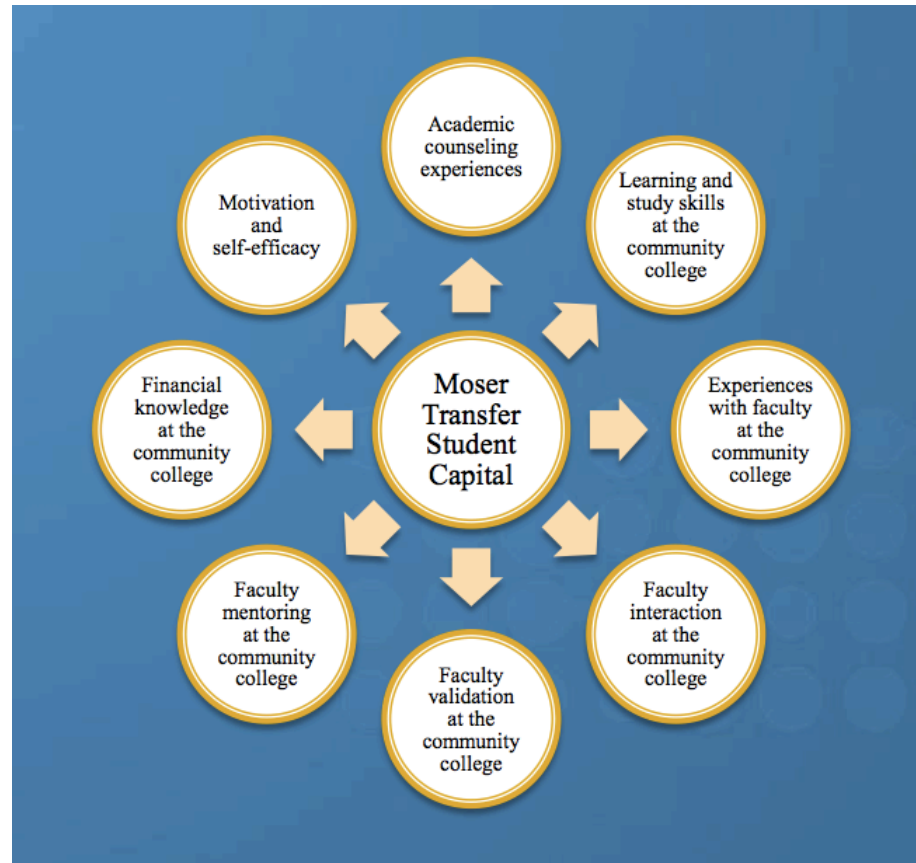
Profiles, Experiences, and Perceptions

Transfer Student Capital (TSC)

- Defined by Laanan (2006), TSC is a conceptual lens to understand transfer students' socialization and development of knowledge, skills, and expertise.
- TSC refers to the experiences of community college students who transfer to 4-year institutions.
- TSC indicates how community college students accumulate knowledge in order to negotiate the transfer process, such as understanding transfer and articulation policies, transfer plans/agreements between colleges, grade requirements for admission into a desired major, and course prerequisites (Laanan, Starobin & Eggleston, 2010).
- ***The more TSC a student possesses, the greater the likelihood of this student to successfully transfer from a community college to a 4-year institution and achieve a seamless adjustment process.***

Transfer Student Capital [TSC] – Revised Model

Source:
Moser (2012)



<h2>STEM Student Enrollment and Engagement through Connections</h2>		
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<ul style="list-style-type: none"> Home About Advisory Boards Team Members Initiatives News Events Newsletters Reports & Resources Big 12 STEP Network Quick Links Iowa State University Des Moines Area Community College ISU College of Engineering E2020 Scholars Program ISU Extension ISU Office of Community College Research and Policy 		<p>Fast Facts about ISU Engineering</p> <p>The College of Engineering continues to be ranked among the top 25 public engineering colleges in the country, according to the graduate and professional school rankings.</p> <p>The programs are among the top 10 in the Midwest among all engineering colleges (USN & WR ranking).</p> <p>Data Briefs</p> <p>SEEC Data Brief: Engineering Admissions Partnership Program (E-APP) (PDF) November 2010</p> <p>SEEC Data Brief: Engineering Orientation (EGR 100) (PDF) November 2010</p> <p>SEEC Data Brief: SEEC Engineering Transfer Student Profile (PDF)</p>
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This project is supported by the National Science Foundation.
Award Number: 0507882

SHARE

www.pathway2stemdegree.org

Pathway2STEM Degree Web Site

- NSF-funded project; Gender in Science and Engineering [GSE]
- Dissemination project
- Objectives:
 - to develop media presentations in the form of educational videos that educate the public and college students about the pathway to a STEM baccalaureate degree from two-year colleges;
 - to develop a **STEM Pathway: Transfer Student Guide (TSG)** for prospective students attending two-year colleges that educates students about the transfer process; and
 - to develop a web site that will be used to disseminate educational resources to educators (two- and four-year institutions), academic counselors/advisors, Transfer Center coordinators, students in two-year colleges, business and industry, researchers, policymakers, and the public.

Tour of Pathway2STEM web site

www.cclp.hs.iastate.edu

Discussion Questions

1. Outline the elements of the existing pathways for STEM transfer students within your community college-university transfer system. What is required for students to be successfully prepared for four-year degree completion?
2. What are the existing challenges for students in navigating these pathways? Where are the gaps?
3. How do you know that your students are successful in preparation and completion of STEM degrees?
4. What action steps are needed to overcome these challenges or close the existing gaps?

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Aha moment(s)

Closing comments

ww.cclp.hs.iastate.edu

Ramping UP STEM Success: Pathways for STEM Student Transfer



March 21, 2012



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Welcome

Thank you for visiting the electronic resources web site prepared by the Office of Community College Research and Policy (OCCRP) at Iowa State University. We hope that you will take advantage of all the resources available to you. The purpose of the web site is to share books, research articles, references, etc. that will be informative to you as you continue your important work for the Action Lab II.

These materials were prepared for AAC&U Project Kaleidoscope (PKAL) – Advancing what works in STEM Education – "Ramping Up for STEM Success: Pathways for STEM Student Transfer."

If you have any questions about the contents or the resources, please do not hesitate to contact me.

Regards,

Frankie Santos Laanan, Ph.D.

Creating a Transfer Receptive Culture

- Developing a culture of evidence
- Learning communities
- Targeted messaging
- Bridge programs
- Undergraduate research for transfer students
- Scholarships

www.cclp.hs.iastate.edu

Creating a Transfer Receptive Culture

Honoring the Presence and Contributions of Community College Students

- Connecting transfer students to the four-year campus culture
- Orientation
- Transfer Centers
- Transfer Skills Courses
- Transfer Student Housing

www.cclp.hs.iastate.edu

Best Practices for Increasing Numbers in STEM Fields

- Peer and faculty support (Cole & Espinoza, 2008)
- Begin preparation earlier for students – start in middle school (Elliott et al., 1996)
- Research opportunities foster success and interest in STEM (Carlone & Johnson, 2007)
- Relevance of coursework to lives increases persistence (Bonous-Hammarth, 2000)
- Show a clear pathway to a baccalaureate degree (Starobin & Laanan, 2008)
- Build bridges between institutions – have a clear articulation agreement for transfer (NSF, 2001)

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Continue Courageous Conversation with your partners

- What are the critical issues facing STEM education in community colleges?
- What is the role of community college and university faculty in mentoring future scientists?
- How do we increase more women and URMs in the Pathway to STEM Degree?
- How do community colleges and 4-year institutions work effectively to increase a seamless transition for pre-STEM majors?
- How do we ensure student academic preparedness?

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