



THE UNIVERSITY
OF ARIZONA

Culturally Responsive Engagement, Articulation, and Research (CREAR): Increasing Latinx STEM Student Success

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AGENDA

- Overview
- CUREs
- Culturally Responsive Curriculum
- CR STEM Learning Communities
- Community College – Articulation Mapping



PURPOSE OF THE TITLE III HSI STEM

“ The purpose of the Hispanic-Serving Institutions - Science, Technology, Engineering, or Mathematics (HSI STEM) and Articulation Programs is to:

- (1) increase the number of Hispanic and other low-income students attaining degrees in the fields of science, technology, engineering, or mathematics; and
- (2) to develop model transfer and articulation agreements between two-year and four-year institutions in such fields.

U.S. DEPARTMENT OF EDUCATION WEBSITE

Barriers for UArizona Latinx & Pell Grant STEM Students

- Culture within STEM
- Gaps in DEW rates in STEM gateway courses
- Low representation in STEM directed research experiences
- Gaps in graduation rates in STEM for first time full time Latinx students and Pell Grant recipients
- Gaps in graduation rates in STEM for community college transfer students



PROJECT CREAR OVERVIEW

KEY ACTIVITIES

1

STEM LEARNING COMMUNITIES

Build student sense of belonging and STEM Identity and scaffold STEM research opportunities focused on problems that have social impact in Latinx student's communities

2

ACADEMIC SUPPORT: DEGREE MAPPING

Develop online tools for first-time students and transfer students to plan balanced articulated pathways between community colleges and UArizona

3

UNDERGRADUATE RESEARCH

Expand access to authentic research experiences through faculty training in the CURE Training Institute and preparing students for internship opportunities

4

CULTURALLY RESPONSIVE & INCLUSIVE TRAINING

Change STEM culture with tailored faculty, staff, and student training in culturally responsive and inclusive pedagogy

Impact of Undergraduate Research on Retention

Undergraduate research is a high impact educational practice that leads to increased retention.

UREs, particularly during the academic year, are especially effective at increasing interest and persistence in STEM, particularly for underrepresented minorities (Hurtado, 2009; Lopatto, 2004; Russell, 2007; Schultz et al., 2011).



[CBE Life Sci Educ](#), 2016 Summer, 15(2): ar20. PMID: PMC4909342
doi: [10.1187/cbe.16-03-0117](https://doi.org/10.1187/cbe.16-03-0117) PMID: [27252296](https://pubmed.ncbi.nlm.nih.gov/27252296/)

Early Engagement in Course-Based Research Increases Graduation Rates and Completion of Science, Engineering, and Mathematics Degrees

[Stacia E. Rodenbusch](#)[†], [Paul R. Hernandez](#)[‡], [Sarah L. Simmons](#)[§] and [Erin L. Dolan](#)^{†*}

Jennifer Knight, Monitoring Editor:



Article
pubs.acs.org/jchemeduc

Incorporating Course-Based Undergraduate Research Experiences into Analytical Chemistry Laboratory Curricula

Melissa A. Kerr and Fei Yan*

Department of Chemistry, North Carolina Central University, Durham, North Carolina 27707, United States.

Issues with the Traditional Apprenticeship Model

- ❑ Targeted for juniors and seniors
- ❑ Unwritten rules – difficult for first gen students
- ❑ Biases of faculty - (GPAs, cc transfer students, etc.)
- ❑ Volunteering - Privileged students



<https://www.cur.org/what/projects/current/transformations/>

2018 – One of 12 institutions selected for CUR Transformations Project

To scaffold research into the curriculum

Partnered with the Chemistry and MCB Departments

Scaling Up Access to Research Through the CURE Training Institute

CUREs: Course-Based Undergraduate
Research Experiences

CUREnet:

CUREs involve whole classes of students in addressing a research question or problem of interest to stakeholders outside the classroom. During a CURE, students will engage in scientific practices, such as collecting and analyzing data and developing and critiquing arguments. [Auchincloss et al., 2014](#)



Annual CURE Training Institute

Expanded through Project CREAR

- 2 ½ day workshop led by Dr. Sara Brownell (ASU)
- Originally small, introductory CUREs
- 25 CUREs developed or in development since 2020 (through PIF, TRIF, & CREAR)
- 2023: 40 faculty in attendance, including community colleges & tribal colleges

<https://ur.arizona.edu/cure-training-institute>



Annual CURE Training Institute

Partnerships

- Organized by: Office of Societal Impact and Student Engagement and Career Development (SECD)
- Leadership team:
 - College associate & assistant deans
 - The VP of Research, Innovation and Impact
 - Associate Vice Provost, Office of Instruction and Assessment
 - The Directors of the Office of Societal Impact and SECD



Course	Instructor	Capacity
PSY 197E (1 unit) <i>Engaging in Psychology Research</i>	Dr. Janet Nicol	15
GEOS 197E (1 unit) <i>Experiences in Geochronology</i>	Dr. Martin Pepper (no longer at UAZ)	10
NSCS 397 (3 units) <i>VIP-CURE: Brain Communication Network</i>	Dr. Martha Bhattacharya	24
GEOS 275 (3 units) <i>Dendrochronology</i>	Dr. Bryan Black & Kiyomi Morino	18
ECOL182L (1 unit) <i>Introductory Biology Lab II</i>	Ryan Ruboyianes	743 (Fall) 906 (Spring)
MCB195 (3 units) <i>Name TBD</i>	Dr. Frans Tax & Dr. Susan Hester	24 (est.)
HWRS 349 A&B / 350 (3 units)* <i>Principles of Hydrology</i>	Dr. Martha Whitaker	24 (est.)

Note: ECOL182L serves over 1300 students each academic year. As of Fall 2023, all in-person sections will be taught with the CURE curriculum.

Note: Six COS CUREs are scheduled to be taught during the 2023-2024 academic year.

College	Course	Capacity	College	Course	Capacity
CALS: 7 courses 157 total capacity	CALS 297E (2-3 units) <i>Discovering Biodiversity</i>	20	College of SBS: 4 courses 159 total capacity	POL 297B (3 units) <i>The Origins of Data in Politics and Policy</i>	40
	NCS 395B (3 units) <i>Participation in the integrated stress response pathway research techniques</i>	20		SOC 403B (3 units) <i>Care, Health, and Society (CHS) in the Wild: Conducting Ethnographic Studies of Health and Medicine in Action</i>	75
	BAT 102 (3 units) <i>Data Science Heroes: An undergraduate research experience in Open Data Science Practices</i>	35		LING 299 (1-3 units) <i>Community-led Language Technology Development</i>	20
	RNR 297A (1-3 units) <i>Natural Resources Workshop</i>	10 (est.)		ANTH 211 (3 units)* <i>Biosocial Interpretations of Reproduction</i>	24 (est.)
	PLS299 (3 units)* <i>Applied Plant Genetics Lab</i>	24 (est.)	College of Humanities: 3 courses 58 total capacity	AFAS 299 (1-3 units) <i>Community Responsive Digital Humanities Research</i>	10
	ENVS 270L (1 unit)* <i>Critical Zone Science Lab</i>	24 (est.)		HNRS 209 (3 units) <i>Decolonizing the Narrative of Cabeza de Vaca: A Digital Humanities Mapping Project</i>	24
	AREC 397C (Variable units)* <i>Name TBD</i>	24 (est.)		RELI 406 (3 units)* <i>Religious Diversity in Healthcare</i>	24 (est.)
	CAST: 2 courses 54 total capacity	APCV 361 (3 units) <i>Data Analysis and Visualization</i>	30	College of Fine Arts	MUS496S (Variable units) <i>Music, Health, and Wellness Story Lab</i>
APCV 303 (3 units)* <i>Data Fluency for All</i>		24 (est.)	College of Education	TLS 299 (2 units) <i>Intro to Education Research Methods: STEM Education, College Access, & Equity</i>	8
			Honors College	HNRS 314 (3 units) <i>Ideas into Action: An Introduction to Civic Engagement</i>	24

Converting STEM Lab Courses Into CUREs

Scale up access

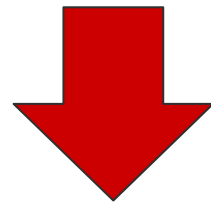
- **Funding to convert Biology II lab**
 - .25-.65 FTE for Director of Introductory Biology Labs
 - .5 FTE for Instructional Specialist (1 year)*
 - .5 FTE Graduate Student**
 - Stipend to attend **CRCDI**
- **Future: Convert 2nd STEM lab**

CUREs Developed or in Development	Capacity
Small CUREs	484 students
Biology II lab	1400 students
Future STEM lab	500-1000 students

**Partial funding from TRIF*

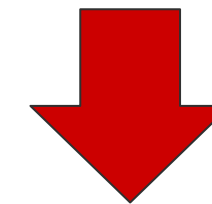
***50% funding from the College of Science*

Next steps



Scaling up Biology 182 into a semester-long CURE

(UAZ TRIF funding)



Converting Biology 182 lab into a CURE

(Title III HSI STEM funding)



Both 182s will be aligned across institutions

Culturally Responsive Curriculum Development Institute

84

Faculty
Participated

30,000

Students
Served

88

Courses
Redesigned



The CRCDI is a week-long, summer immersion focused on coaching faculty and instructors towards implementation of culturally responsive practices and pedagogy into existing courses of all modalities, including distance and online learning environments.

CRCDI: Years 1 & 2 Progress

STEM Gateway Courses:

- CHEM 197B: General Chemistry Chemical Thinking Supplemental Instruction (Fall 22 - 200)
- CHEM 197C: General Chemistry Lecture II: Chemical Thinking Supplemental (Spring 23 - 200)
- CHEM 151: General Chemistry I (Fall 22 – 200)
- CHEM 152: General Chemistry II (Spring 23 – 200)
- ECOL 182L: Biology Lab (Fall 22 – 400; Spring 23– 800)
- ECOL 182R: Biology Lab (Fall & Spring 23, 24 – 800)
- MCB 181R: Intro to Biology I (Fall 23 – 4600)

Additional STEM Focused Courses, not identified as gateway courses:

- SLHS 574: Speech Disorders 2 (Spring – 25)
- NURS 478: Nursing Leadership & Management in Health Systems (Fall & Spring – 100)
- CSC 110: Computer Programming I (Fall – 450)
- PSY150A: The Structure of Mind & Behavior (Fall – 450)

Target Number of Students Reached:
1,000

Estimated Number of Students
Reached: 8,600

CRCDI: Collaborators & Structures

Collaborators

- Office of Strategic Initiatives
- HSI Initiatives
- Faculty Affairs
- College of Science
- College of Education
- University Center for Assessment, Teaching, & Technology
- Center for University Education Scholarship
- Research, Innovation, & Impact
- HEERF Funds
- Northern Arizona University - Yuma
- Facilitators
- University Libraries

Structures

- Buy-In
- Faculty, Deans, Dept Heads
- Space / Location
- Time (June)
- Stipend
- Title III grant / Project CREAR
- College of Science partnership

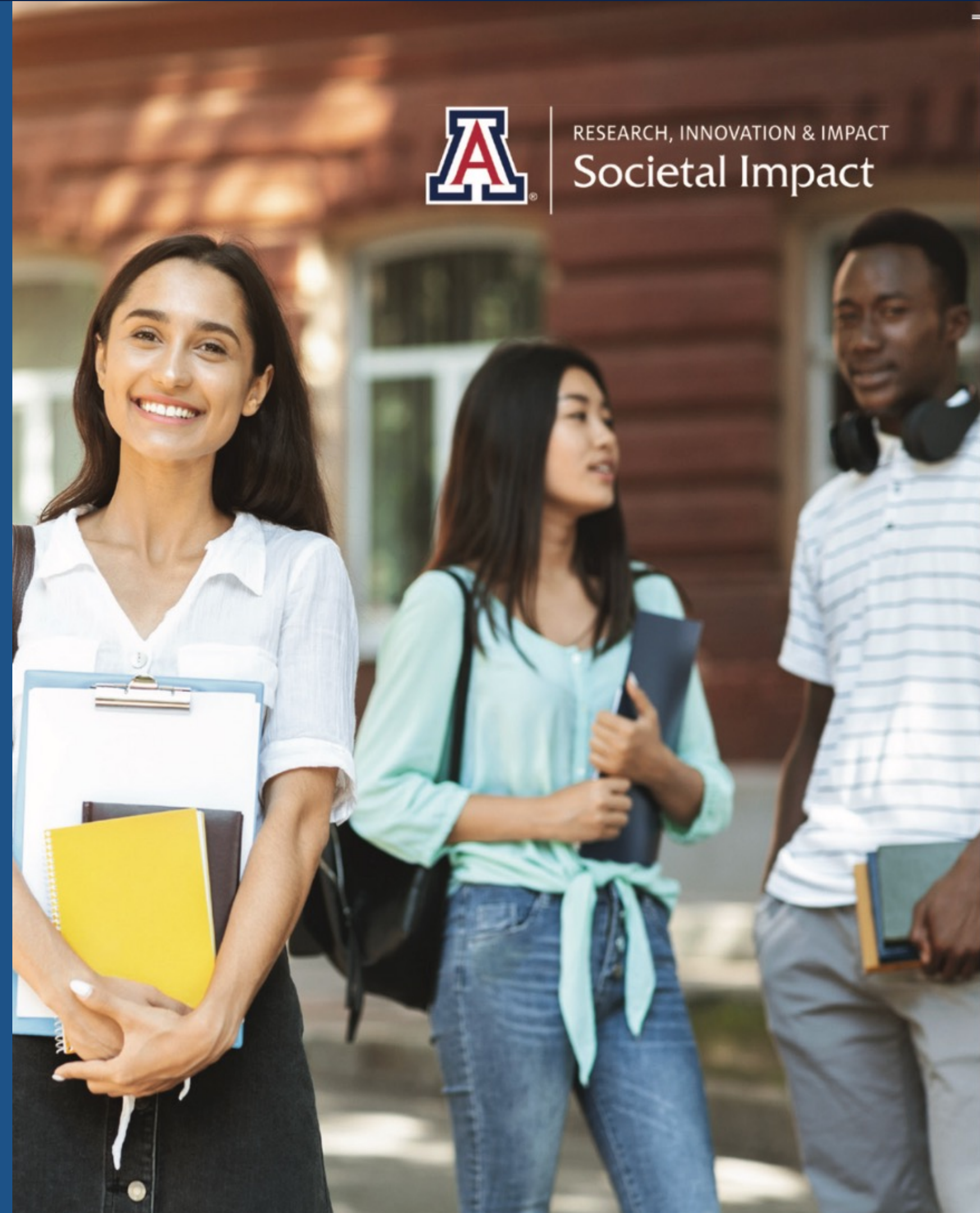


CREAR STEM

Learning Communities

Background

- High Impact Practices
 - Learning Communities
 - First Semester Seminar
- ASEMS & Catapult



RESEARCH, INNOVATION & IMPACT
Societal Impact



CREAR STEM Learning Communities

- **Sense of Belonging:** Perceived social support, connectedness, mattering.
- **STEM Identity:** Development of a social identity as a scientist, self-perception.

STEM Learning Communities



- First Semester Seminar – Peer Educator
 - Success in STEM focus on UN Sustainable Goals
- Success specialists – ASEMS & Catapult
 - Staff one on one support
- Cohort experience
 - Cohorted classes & additional programming offered by ASEMS & Catapult

CREAR STEM Learning Communities Cohorts

Cohorted by student experience:

- Math Lab or Algebra
- Adv. Math: Pre-calculus and beyond
- Chemistry
- Introduction to Engineering
- or Animal Sciences

STEM SUCCESS COURSE:

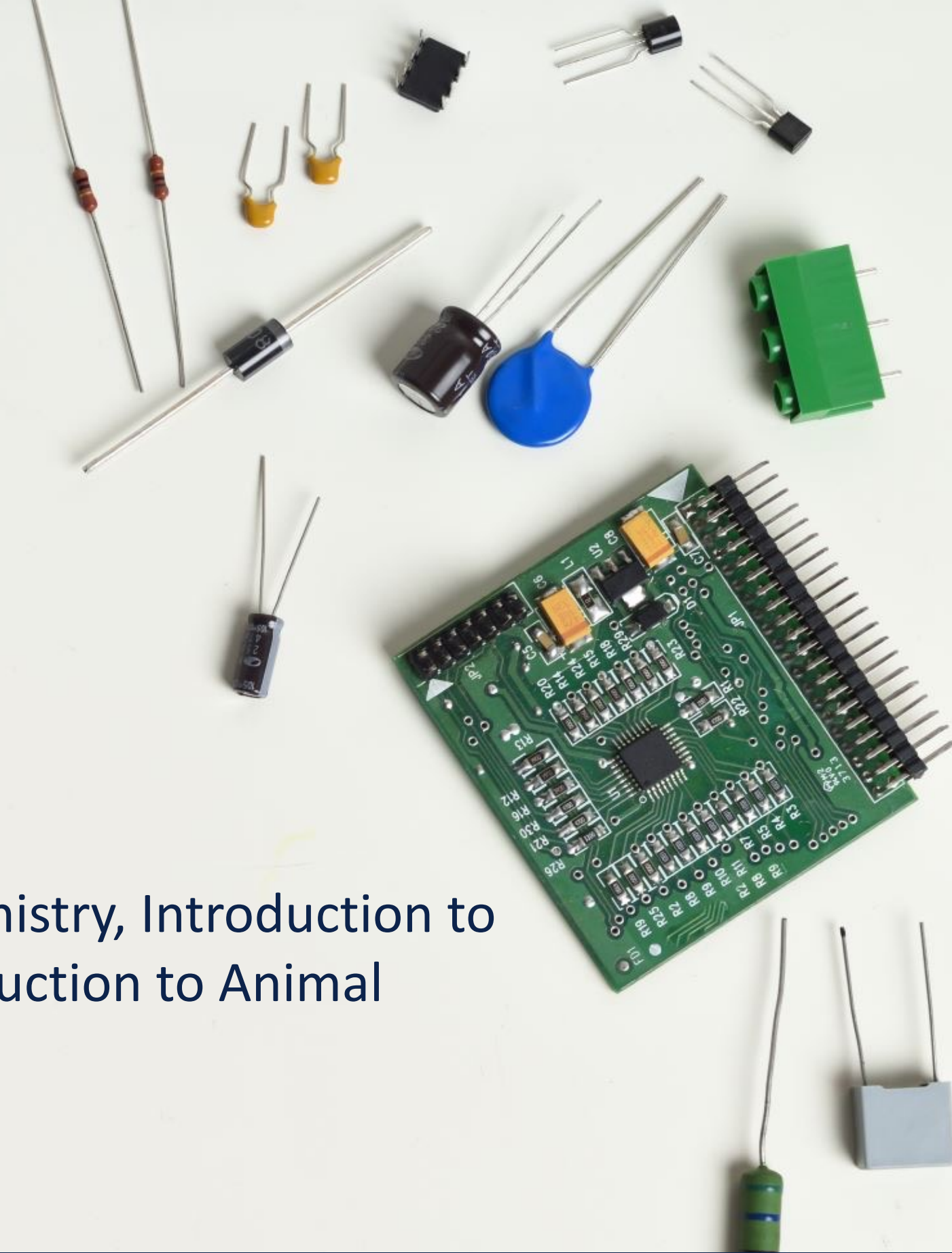
Designed to increase belongingness and STEM identity

- First semester seminar: Success in STEM or
- Research Readiness

LINKED COURSE:

STEM Course:

Mathematics, Chemistry, Introduction to Engineering, Introduction to Animal Sciences

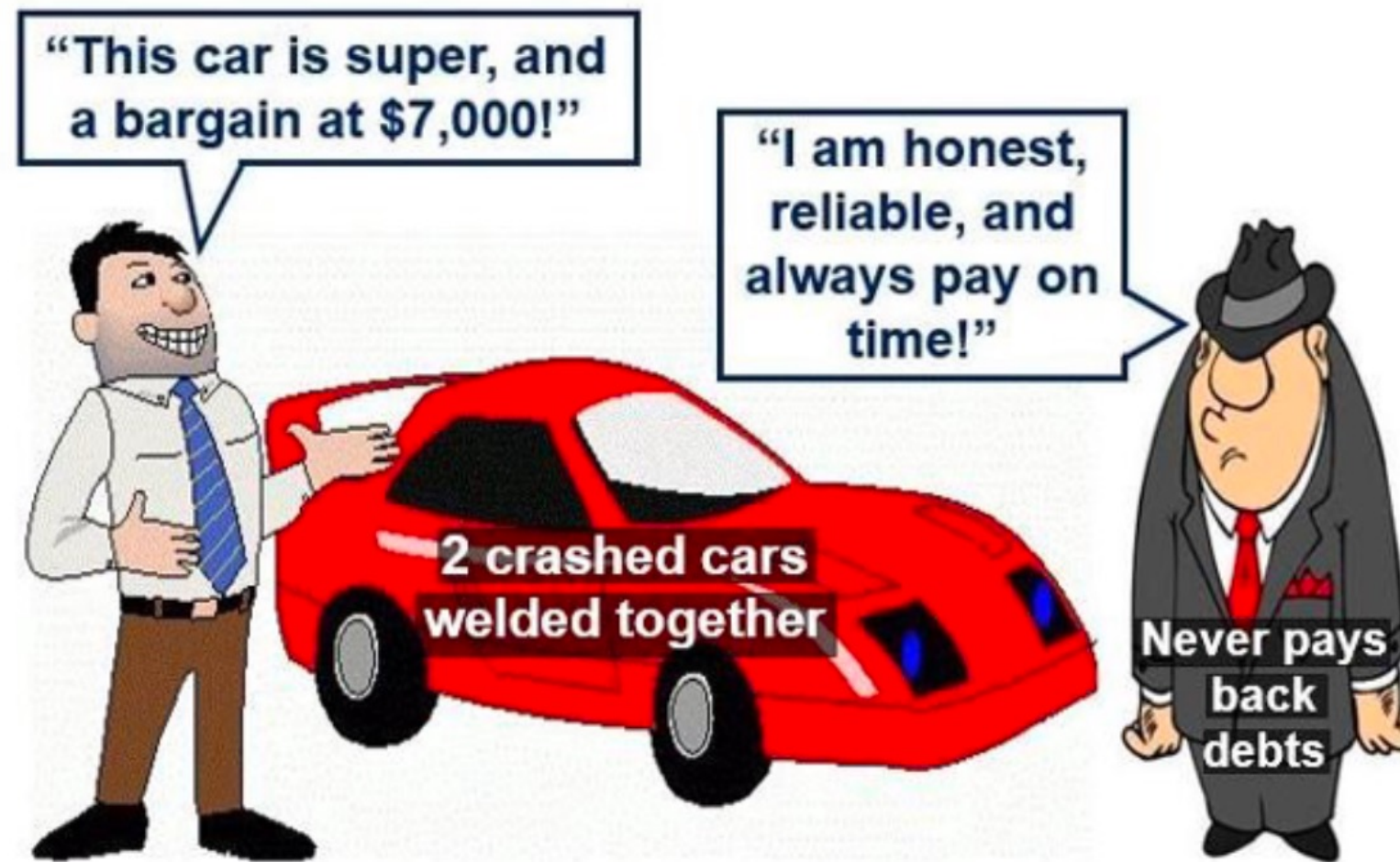


Transfer Articulation – A Structural Inequity



- ❑ Of the approximate 23 million students in higher education at any one time, about 35% of them will transfer at least once and 11% twice during their academic careers.
- ❑ According to a U.S. Department of Education survey, students will on average lose the equivalent of one year of course work with each transfer.
- ❑ Community colleges are disproportionately functioning as a primary entry point for students from historically underrepresented race and ethnicity groups and low-income families.

George Akerlof demonstrated in 1970 how the quality of goods exchanged in a market (e.g., used cars) degrades when information asymmetry exists.



Information Asymmetry



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Transfer Articulation and Information Asymmetry



▶ Transfer Process: Example

Colorado State University ☆

2 Matches

2 Maybe

The matches below indicate specific courses you may be awarded after completing and transferring, assuming you earned a passing grade in the transferred course. Matches may change depending upon your major.

Courses from:

Central New Mexico Community College

[Expand all notes](#)

- CSCI2201 MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE 2021 → MATH2++ ⓘ

Pima Community College

[Expand all notes](#)

- CIS119 NETWORK ESSENTIALS 2021 → CS1++ ⓘ

4 Matches

2 Maybe

The courses below have not yet been reviewed by this school, they may or may not transfer. [Contact the school for more information.](#)

Courses from:

Central New Mexico Community College

- CSCI1152 INTRODUCTION TO COMPUTER PROGRAMMING AND PROBLEM SOLVING 2021
- CSCI2251 INTERMEDIATE COMPUTER PROGRAMMING AND PROBLEM SOLVING 2021

Community College

University

Associate Degree Program

Bachelor's Degree Program

Degree Requirements

Degree Requirements

Curriculum

Curriculum

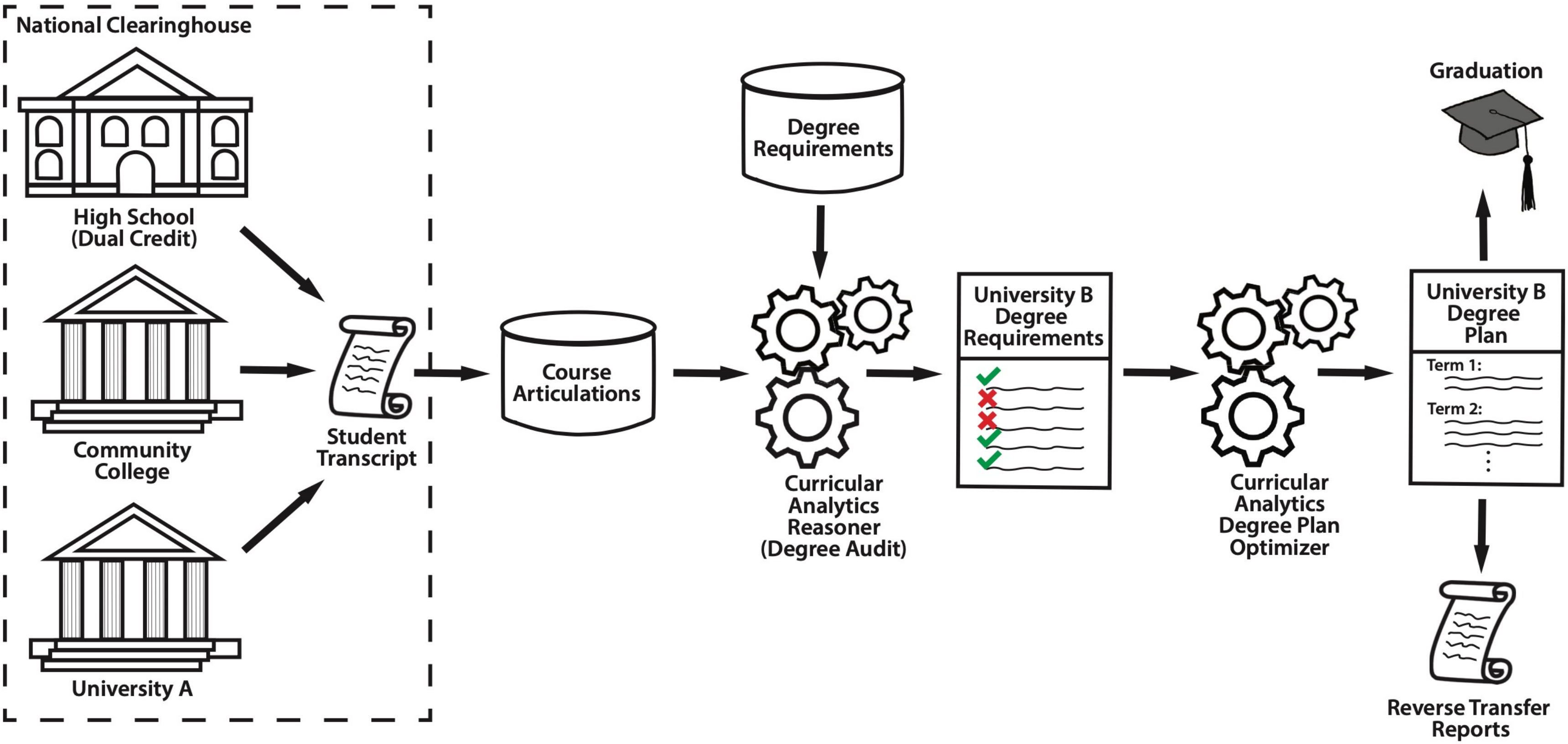
Degree Plan

Degree Plan

course
equivalencies

2-year to 4-year Transfer Roadmap

Transfer Articulation Portal





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Gracias
