Community Colleges: Bringing Research Opportunities to Students and Creating Sustainable Pathways

Laurie McConnico, Ph.D.
William R. LaCourse, Ph.D.

This material is based upon work supported by the National Science Foundation (NSF) under Grant No. DUE-1937267. Any opinions, findings, interpretations, conclusions or recommendations expressed in this material are those of its authors and do not represent the views of the AAAS Board of Directors, the Council of AAAS, AAAS’ membership or the National Science Foundation.
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*Please note: The discussion break-out groups following the presentations will NOT be recorded.*
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- Resources
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- NSF IUSE Proposal Preparation Toolkit

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AAAS IUSE Initiative
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Cuesta College: Bringing Research Opportunities to Students and Creating Sustainable Pathways

PI: Laurie McConnico
CO-PI: Jason Curtis

This work is supported by the National Science Foundation under Grant No. 1821351
Overview

• Cuesta College
• Grant award and goals
• Getting started
• Research and UREs at Cuesta
• Early Success and Challenges
• Benefits of collaboration
Cuesta College

• 2-year community college
• California’s Central Coast
• ~10,700 students
• 34% transferring to 4-year colleges (2021)
• Hispanic Serving Institution
• Interest in expanding UREs
• Fulfilling the College Mission

“...Through innovative and challenging learning opportunities, Cuesta College enhances lives by promoting cultural, intellectual, personal, and professional growth...”

www.cuesta.edu
Project Award and Goals

• NSF IUSE Award #1821351
  • Institutional and Community Transformation 2019-2023

• Goals and Objectives
  • Build a culture of undergraduate research
  • Convene an interdisciplinary faculty inquiry (or innovator) group to expand and institutionalize undergraduate research
  • Develop and offer undergraduate research experiences across STEM disciplines
Innovator Team

• Who are we?
  • 1 Fantastic Grant Coordinator
  • 2 PI’s*
  • 6 STEM Faculty

• What do we do?
  • Meet/Discuss
  • Plan & Collaborate
  • Promote
  • Implement Research Programs
  • Promote again, and again and…

Laurie McConnico* (Biology)
Silvio Favoreto Jr. (Biology)
Guillermo Alvarez Pardo (Math)
Kristina Vastine (Grant Coordinator)
Lise Mifsud (Anthropology)
Eltahry Elghandour (Engineering)
Jason Curtis* (VP of Instruction)
Feride Schroeder (Earth Science & GIS)
Jeff Jones (Engineering)
Professional Development Opportunities

- Mentorship training
- Conferences & workshops
- Professional memberships
- Collaborations on & off campus
- Curriculum development
- Engage in research

www.aacc.nche.edu  www.wsn-online.org  https://amatyc.org
Student Surveys and Focus Groups

- **638** students surveyed about knowledge and importance of UREs (2020 & 2021)
- **96%** said research experience is “very” or “somewhat important” for transfer students
- **64%** said doing research at Cuesta College would help them with their academic and career goals
- **71%** want to participate in research activities while they are at Cuesta College
- **92%** had not been involved in a research project or experience at Cuesta College
- Top barriers to participation included: time, lack of opportunities, and cost
How do we define research?

• Council on Undergraduate Research

• “A mentored investigation or creative inquiry conducted by undergraduates that seeks to make a scholarly or artistic contribution to knowledge.”
What does research look like at Cuesta?

• Course-based undergraduate research experiences (CUREs)
• Embedded research
• Study abroad with independent mentored research
• Independent study
• Academic club
Anthropology 201/201L: Physical Anthropology
Anthropology 247: Independent Studies

• Fundamentals in Anthropology with a capstone project (201 and 201Lab)
• Mentored independent research (247)
  • Forensic Osteology/Bioarchaeology
  • Study of human bones in an archaeological context
  • Impacts of burns and cuts to bones
  • Climate impacts to midden sites
• Students write proposals, implement scientific method and present research at conferences (many have advanced to doctoral and master’s programs)

Contact
Lmifsud@cuesta.edu

Photos above: Professor Mifsud promoting her programs, tools of the trade, and anthropology students working to apply the scientific method at a “crime scene.”
Biology 210M: Environmental and Applied Microbiology

• CURE dedicated to biology research (active since 2018)
• Field and lab course
• Long-term monitoring and detection of pathogenic slime mold on eelgrass in a local estuary
• Opportunities for independent research, publications, conferences and community engagement

Contacts
Silvio_favoreto@cuesta.edu
Laurie_mcconnico@cuesta.edu

Photos above: Images of 210M researchers collecting eelgrass in the field and then processing samples for culture and DNA extraction of slime mold, Labyrinthula spp. (bottom right)
Biology 222/222L: Marine Biology in Baja, México

- Non-majors GE course (summer 2018-2019, 2022)
- Affordable experiences abroad ($1000/2wk)
- Mentored independent research in a study abroad setting
- Experimental design, field work, analysis, and presentation of results
- Work products contribute to local knowledge

Contact
Laurie_mcconnico@cuesta.edu
Silvio_favoreto@cuesta.edu

Photos above: Students studying and researching in Bahía de los Ángeles, Baja México. Draft of a shell guide illustrated by student researcher Hunter Larson.
Engineering 248: Introduction to Engineering and SAMPE Club

- Engineering fundamentals with embedded research to design, build, and test composite structures (ENGR 248)
- Design competitions via SAMPE (Society for the Advancement of Material and Process Engineering)
- Access to the Composite Lab in Mechanical Engineering at Cal Poly San Luis Obispo
- Opportunities to develop original designs and compete at conferences nationally, with undergraduate and Ph.D. graduate students
- SAMPE students at Cuesta join an internationally recognized engineering society as well as the NCUR conference

Contact
eelghand@cuesta.edu

Photo above: SAMPE member and Cuesta student, Joseph Fairchild, exhibiting his bridge design for the NCUR conference (2022)
Geology 230-234: Geographic Information Systems (GIS) and Remote Sensing

- GIS Program and Certificate developed under NSF Award ATE: 1800779
- 5 new courses, each with research projects embedded
- Students apply skills obtained in GIS courses to build original, interactive maps and applications
- Opportunities to present at GIS conferences and access to paid internships with community partners

Contact fschroeder@hancockcollege.edu

Images above: Examples of final student projects associated with GIS courses.
Math 290: Introduction to Research

- CURE dedicated to math research (launched Fall 2021)
- Opportunities to group problem solve and publish solutions in the College Journal of Mathematics
- Collaborations with SLO City Department of Public Works to address local industrial problems
- Part of the PIC Math Program
- Opportunities to participate in the i3 program for Invention and Inclusive Innovation
- Students participate in conferences and have opportunities to publish their work

Contact
guillermo_alvarezpar@cuesta.edu

Images above: Math 290 student, Harvey Perkins, recognized for providing a correct solution to a problem posted in The College Mathematics Journal, April 2022, by the Mathematical Association of America
STEM Seminar

INTRODUCING:

STEM SEMINAR COURSE

Are you interested in a degree and career in STEM (Science, Technology, Engineering, or Mathematics) but are unsure which direction to go? Are you interested in research opportunities in the STEM field but are unsure where to start?

Join us for a 2 unit multi-disciplinary STEM Seminar Course!

- Tuesdays 5:00 - 6:50 p.m.
- DE and synchronous with live Zoom meetings
- Guest speakers and more in-class assignments than homework/outside work!

Students can enroll in the STEM seminar of their choice (ANTH 295, BIO 295, ENGR 295, MATH 295 or PSCI 295), but all students will attend the same course.

The STEM Seminar will include opportunities to:

- Learn from expert guest speakers in all STEM fields
- Explore academic and career opportunities in STEM
- Increase access to information about local and external research projects and internships
- Develop personal and professional skills to be successful in STEM
- Build and refine your cover letter, resume/CV, and interview skills
- Meet and interact with professors and peers that are interested in STEM
- Be a part of the STEM culture and learn best practices in the field
- Become part of a STEM Community at Cuesta College

REGISTER TODAY FOR FALL 2022!

Questions?
Please contact Biology Instructor Laurie McConnico at Laurie.mcconnico@cuesta.edu or Anthropology Instructor Ute Mifsud at utemifsud@cuesta.edu.

For more information about undergraduate research opportunities at Cuesta College, please visit our Undergraduate Research Website.

This material is based upon work supported by the National Science Foundation under Grant No. 1821781.
Early Success

- **347** students completed one or more STEM research courses
- **49** students studied abroad (with research)
- **24** students completed the 1st STEM Seminar
- **10** students participated in the Summer Undergraduate Research Program (SURP) at Cal Poly San Luis Obispo (2019 & 2022)
- **9** students presented research at conferences
- **7** students completed the PIC Math Program
- **3** new faculty innovators recruited
- **1** honorable mention in *The College Mathematics Journal*

Photos above: Cuesta College student researchers presenting at WSN, NCUR and MathFest conferences (2019-2022)
Challenges to Overcome

• Stigma against research at community college
• Recruiting (and retaining) enough faculty
• Large teaching loads
• Small/ low enrolled research courses vulnerable to cuts
• Space and resource limitations
• Credit limits for transfer students
• Busy community college students (work, family, and academics)
Collaborations Expand Opportunities

- New (and more) Projects
- Student Internships
- Facilities and Instruments
- Community Engagement
- Financial Support
Takeaways

• Students, faculty, and institutions benefit from UREs
• It’s not easy, but it is worth the effort!
Acknowledgements
All of the student researchers!

Faculty Innovators:
Eltahry Elghandour
Feride Schroeder
Guillermo Alvarez Pardo

Jeff Jones
Lise Mifsud
Silvio Favoreto Jr.

Additional Faculty Participants:
Praveen Babu
Katherine Dittmer
Robert Schwennieke

Robb Tibstra
Jane Donaldson

Grants Team:
Janet Shephard
Lexie Bell
Kristina Vantine
Belem Diaz Infante
Janine Medina
Karla Haeberle

Collaborators:
Morro Bay National Estuary Program
Cal Poly San Luis Obispo
City of San Luis Obispo
Cuesta College Foundation
PIC Math Program

External Evaluator:
Julie Shattuck

Cuesta Institutional Research:
Ryan Cartnal
Aimee La Rue

This work was supported National Science foundation Awards:
IUSE: 1821351, ATE: 1800779, PIC: DMS 1722275
Contact and More Details

• Laurie_mcconnico@cuesta.edu

• Undergraduate Research at Cuesta College:

• https://www.cuesta.edu/student/resources/careerconnections/undergraduate-research-opportunities/
Community Colleges: Bringing Research Opportunities to Students and Creating Sustainable Pathways

William R. LaCourse, Ph.D.

Professor of Chemistry
Dean of the College of Natural Mathematical Sciences
University of Maryland, Baltimore County
IUSE Award #1821274

August 9, 2022
Overview

- Transitions - “If you don't know where you are going, you'll end up someplace else.” Yogi Berra
- HHMI NEXUS – Collaborations require a common vision
- Gates t-STEM – Relationships are built on trust
- NIQB-IUSE – Communities require shared responsibility
- Sustainability – The holy grail of collaborations
“We are the sum total of our experiences. Those experiences – be they positive or negative – make us the person we are, at any given point in our lives. And, like a flowing river, those same experiences, and those yet to come, continue to influence and reshape the person we are, and the person we become. None of us are the same as we were yesterday, nor will be tomorrow.”

B.J. Neblett (author)

You are the sum total of everything you've ever seen, heard, eaten, smelled, been told, forgot - it's all there. Everything influences each of us, and because of that I try to make sure that my experiences are positive.

Maya Angelou (poet)
<table>
<thead>
<tr>
<th>Institution (Grade)</th>
<th>Lessons Learned Along the Way</th>
</tr>
</thead>
<tbody>
<tr>
<td>Falls School (K-5)</td>
<td>Engaged learning, group work, sharing, nap reflection time,…</td>
</tr>
<tr>
<td>Buckingham School (6)</td>
<td>Where did all these other students come from?</td>
</tr>
<tr>
<td>Kelly Junior High School (7-8)</td>
<td>Let’s take away all co-curricular activities and go half days.</td>
</tr>
<tr>
<td>Norwich Free Academy (9-12)</td>
<td>You can study for the SAT and take it again. Advising – what advising?</td>
</tr>
<tr>
<td>University of Connecticut</td>
<td>30,000 students, 4,000 acres, and holes in my shoes.</td>
</tr>
<tr>
<td>Connecticut College</td>
<td>Let’s throw away 30 credits. They don’t align with our program.</td>
</tr>
<tr>
<td>Board of State Academic Awards</td>
<td>Why did the other institutions make it so hard?</td>
</tr>
<tr>
<td>Northeastern University</td>
<td>Choosing the right mentor. $1200/mo apartments on $7000 stipend.</td>
</tr>
<tr>
<td>Iowa State University (postdoc)</td>
<td>Flat, open, friendly. “I've a feeling we're not in Kansas anymore.”</td>
</tr>
<tr>
<td>UMBC</td>
<td>“The future depends on what you do today.” Mahatma Gandhi</td>
</tr>
</tbody>
</table>
  - Active learning and interdisciplinary curricula
  - Emphasizes eight competencies rather than courses
  - Allows flexibility in designing curricula
  - Shift from teaching stand alone subjects to teaching integrative science competencies
- Vision & Change (2011) provided a framework for instituting curricular change.
  - Articulates core concepts and competencies
  - Encourages student-centered learning
  - Promotes institutional commitment to change
  - Engages the national community in implementing a shared vision
- PCAST Engage to Excel (2012) proposed strategies to increase STEM college graduates.
  - Improve first two years of undergraduate STEM education
    - Adoption of evidence-based teaching practices
    - Lab course with authentic research
  - Diversify pathways to STEM careers
The goal of the National Experiment in Undergraduate Science Education (NEXUS) project was to develop validated competency-based modules and assessment tools for foundational core curriculum courses in undergraduate life science education.

Four universities created a project that connects biology with physics, math and chemistry:

- Purdue University integrated biology into chemistry
- UMBC infused math modules into introductory biology courses
- University Maryland, College Park taught the physics of life
- University of Miami developed case studies to integrate scientific disciplines
INDIVIDUAL INSTITUTIONAL CHALLENGES

- Getting buy-in from stakeholder life science departments
  - Keeping open active lines of communication
  - Preventing “turf” battles
- Maintaining resource “neutrality” (e.g., TA lines)
- Handling large class size: ~450, Fall 2013
- Effectively assessing learning in large class
- Developing guided-inquiry labs for large class
- Overcoming resistance in Chemistry departments based upon tradition
- Faculty commitment is difficult due to other obligations and responsibilities.
- Case study implementation is constrained by limited class time.

OVERALL CHALLENGES

- Each institution went their own way – before, during, and after
- No incentive to maintain and sustain – what tied these institutions together?
NEXUS Results: The only significant demographic variable that affected gains in quantitative learning was whether the student had transferred to UMBC or not.

Quantitative numeracy:
Transfer students had mean increases of 1.5-5% from pre- to post-assessment; Non-transfer students had mean increases of 11-12.5%.

Interpreting data sets:
Transfer students had mean changes from -4% to +0.5%. Non-transfer students had mean increases from 8-11%.
Sustaining a Multi-institutional Collaboration to Promote Successful Transfers for STEM Students

- Anne Arundel Community College
- Community College of Baltimore County
- Howard Community College
- Montgomery College
- UMBC

Funded by a grant from the Bill & Melinda Gates Foundation
Transfer Success is “Rooted” in Alignment

Misalignment is Our Failure
Framing The Central Question

How can 2-year and 4-year institutions partner to facilitate early and sustained success for transfer students, to foster their academic and social engagement across institutions, and to help launch them into meaningful STEM careers?

More than articulation agreements!
More than course alignments!
More than a webpage!
More than pathways!
More than what we’re doing now!
Defining Our Goals

Institutional Alignment

**Curricular Alignment**
- Institutional Partnerships
- Academic & Career Advisement
- Transfer Seminars
- Academic Pathways
- Technological Innovations
- Transitional Connections
- Toolkit Development
- Evaluation & Dissemination

Two-Year Institutions

Four-Year Institutions

*Building ownership and belonging from the start!*
“Walking a mile in someone else’s shoes”

Foci and Tensions

Institutional Missions
- AS and AA degrees, preparation for jobs or transfer to multiple 4-year universities
- BS and BA degrees, preparation for jobs and graduate/professional school

Student Profiles
- All Commuters, more part-time and/or working, more non-school responsibilities
- On-Campus/more full-time, more availability for support/curricular & campus activities

Class Size
- Small – promotes interaction, fosters group study
- Large – limits interaction and study group formation

Student Expectations
- Partial Credit, tested only on material covered in class
- No-Partial Credit, tested on material not covered in class

Assessment Practices
- Short & long answer tests, minimal/no multiple choice tests/individual grading
- Challenging multiple choice tests/Scantron® grading

STEM Instructional Interactions
- No TA use – single instructor, accessible (teaching primary responsibility)
- TA use – multiple instructors, access limited (research often added responsibility)

Course Coverage
- Prerequisites/content for lower & upper level UMBC courses

Advising in STEM
- Optional, students complete non-STEM GFRs leading to STEM overload after transfer
- Required, major-specific, help students strategize course load
**GUIDING PRINCIPLES** | **WORK TEAMS**
--- | ---
Ground the process with a common goal | Absence of institutional/individual prejudice
Share responsibility & duties | Experts in respective fields of study
Assemble “dedicated” work teams | Dedicated teachers focused on student success
Establish a common language | Commitment to the process

“IMPORTANT – There is no blame, only misalignment!”
<table>
<thead>
<tr>
<th>COURSE (%DFW)</th>
<th>TYPE</th>
<th>FA 2009</th>
<th>SP 2010</th>
<th>FA 2010</th>
<th>SP 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 101</td>
<td>Fresh</td>
<td>16.7</td>
<td>20.2</td>
<td>16.1</td>
<td>20.1</td>
</tr>
<tr>
<td></td>
<td>Trans</td>
<td>52.8</td>
<td>30.2</td>
<td>43.4</td>
<td>29.2</td>
</tr>
<tr>
<td>CHEM 102</td>
<td>Fresh</td>
<td>21.9</td>
<td>24.0</td>
<td>19.0</td>
<td>18.0</td>
</tr>
<tr>
<td></td>
<td>Trans</td>
<td>46.4</td>
<td>54.2</td>
<td>37.8</td>
<td>41.1</td>
</tr>
<tr>
<td>CHEM 351</td>
<td>Fresh</td>
<td>25.7</td>
<td>31.0</td>
<td>41.3</td>
<td>45.8</td>
</tr>
<tr>
<td></td>
<td>Trans</td>
<td>53.2</td>
<td>42.7</td>
<td>54.2</td>
<td>61.7</td>
</tr>
</tbody>
</table>

**FACT:** A difference in the %DFW for freshman vs. transfers exists.

**Building trust is essential**

Sharing data without pointing fingers

No institution tells another institution what they should do
STEM CURRICULAR ALIGNMENT: Findings

- **TOPICS**
  - More similarities than differences.
  - Topics may be grouped differently between the 1st & 2nd semesters among the schools.
  - Nuclear chemistry covered at 4 of 5 schools.
  - Calculator use in math courses differs between 2- and 4-year schools

- **PEDAGOGY & RESOURCES**
  - Many more similarities than differences.
  - Main differences are related to class size
  - Technology supports are very similar

- **ASSESSMENT**
  - The CC partners mostly use free response questions; partial credit generally given for showing the work.
  - UMBC – especially in Chemistry - uses challenging multiple-choice questions exclusively with no opportunity for partial credit.
  - Extra credit sometimes offered at CC’s; never at UMBC.
STEM CURRICULAR ALIGNMENT: Outcomes

- Information for advisors & students: Complete general introductory chemistry sequence at the same institution.
- Introduce nuclear chemistry at UMBC
- Introduce some multiple-choice exam questions in community college classes
- Established a consortium with members who wish to continue meeting after the grant ends


OVERALL CHALLENGES

- Faculty commitment is difficult due to other obligations and responsibilities.
- Limited adoption within an institution
- No mechanism to maintain and sustain
NIQB: The NSF IUSE Grant

A Model of Institutional and Community Transformation for Teaching and Learning Quantitative Reasoning in the Biological Sciences

DUE-1821179 (AACC), DUE-1821249 (CCBC), DUE-1820903 (HCC), DUE-1821169 (MC), and DUE-1821274 (UMBC)
NIQB IUSE Communities

IUSE Management (PIs, Senior Personnel, CC Administration)

Curricular Alignment
- Transfer Process
- Content Alignment
- Assessment Strategies
- Disciplinary Skills
- QR Competencies

Annual Symposium

External Advisory Board

NIQB: Work Groups
- Module Development
- Module Piloting/Assessment
- Module Revision

Faculty Development
- Workshops
- Certificate program
- Module Review

Large Scale Implementation and Longitudinal Assessment
Data Sharing, Presentations, and Publications

Model for Institutional and Community Transformation
<table>
<thead>
<tr>
<th>Community</th>
<th>Purpose</th>
<th>Model</th>
<th>Model Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curricular Alignment</td>
<td>Common Language Shared Understanding</td>
<td>Awareness</td>
<td>Inter-Institutional/Inter-Disciplinary Collaboration</td>
</tr>
<tr>
<td>Module Development</td>
<td>Shared experience Development of trust Shared values</td>
<td>Experience</td>
<td>Relationship Development Among Faculty</td>
</tr>
<tr>
<td>Faculty Development</td>
<td>Common need Shared resource</td>
<td>Sustainability</td>
<td>Sustaining collaboration beyond award period via a community</td>
</tr>
</tbody>
</table>
1. Is the proposed inter-institutional model of creating scholarly communities an effective way to promote change? Specifically, does this model promote curricular awareness and result in development of QR modules that are widely adopted and successfully implemented across participating institutions? Assessment: NIQB Module Implementation Survey; External Evaluation

2. Will adding modules to corresponding biology courses at our CC collaborative institutions increase gains in quantitative skills and decrease the achievement gap between direct entry and transfer students? Assessment: Module Pre- and Post-Assessment Data/ Math-Biology Values Index and Demographic (math experiences) survey / Global Assessment at the beginning and end of biology course experience

3. To what extent can increasing the amount of QR in biology courses enhance students’ abilities to use quantitative skills to address biological problems? Does the amount of experience with quantitative biology modules in early coursework positively impact student retention and success in advanced coursework? Assessment: Course-level data, provided by each participating instructor or institution, each semester, for all consenting students/ Global Assessment at the beginning and end of biology course experience
Competency 1: Demonstrate quantitative numeracy and facility with the language of mathematics [SFFP 1]

Competency 2: Interpret data sets and communicate those interpretations using visual tools [SFFP 2]

Competency 3: Demonstrate proficiency with statistical analyses and make inferences [SFFP 3]

Competency 4: Demonstrate facility with mathematical models of biological systems and make inferences [SFFP 5]

Competency 5: Apply algorithmic approaches and principles of problem solving [SFFP 6]

Competency 6: Use quantitative language to describe biological phenomena [Ruscetti, et al. (2018)]
NIQB: Modules Developed to Date

**Biology 1 (Molecular Biology)**
- Introduction to the Scientific Process
- Cell Structure and Size
- Solute Concentration and Osmosis
- Cellular Respiration
- Enzyme Kinetics
- Cell Cycle/Mitosis

**Biology 2 (Evolution and Ecology)**
- Natural Selection
- Hardy-Weinberg
- Population Growth
- Community Ecology
- Plant Physiology/Adaptive Plasticity

**Biology 3 (Genetics)**
- Mendelian Genetics
- Gene Linkage & Recombination
- Three-Point Mapping
- Pedigree Analysis

**Biology 4 (Cell Biology)**
- Enzyme Kinetics
- Cytoskeleton
- Diabetes
- Membrane and Action Potentials
- Bad Data
- Cell Signaling
### NIQB: Mapping Competencies Across Modules

#### NIQB-USE Quantitative Module Curriculum Map

<table>
<thead>
<tr>
<th>Module</th>
<th>Cell Biology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demonstrate quantitative literacy and facility with the language of mathematics (SPPF)</td>
<td></td>
</tr>
<tr>
<td>Interpret data sets and communicate those interpretations using visual and other appropriate tools (SPPF)</td>
<td></td>
</tr>
<tr>
<td>Demonstrate proficiency with statistical analysis and make inferences (SPPF)</td>
<td></td>
</tr>
<tr>
<td>Demonstrate facility with mathematical models of biological systems and be able to make inferences about natural phenomena (SPPF)</td>
<td></td>
</tr>
<tr>
<td>Apply algorithmic approaches and principles of logic (including distinction between causal/effect and association) to problem solving (SPPF6)</td>
<td></td>
</tr>
<tr>
<td>Use quantitative language to describe biological phenomena (Koren, et al., 2008)</td>
<td></td>
</tr>
</tbody>
</table>

**Legend:**
- Green: Competency fulfilled
- Yellow: Competency partially fulfilled
- Blue: Competency not fulfilled

Note: This competency is not a focus.

**Use level of difficulty related to the quantitative content:**
- High level of difficulty related to the quantitative content, high level of difficulty related to the quantitative content, high level of difficulty related to the quantitative content.
MEMORANDUM OF UNDERSTANDING (MOU) FOR THE DATA SHARING PARTNERSHIP BETWEEN PARTICIPATING INSTITUTIONS

- Formalizing and streamlining the data-sharing process
- The MOU will facilitate future projects among our five institutions
<table>
<thead>
<tr>
<th>Data Instrument</th>
<th>Collection Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global Assessment (Intro BIOL I)</td>
<td>SP2019, FA2019, SP2020, FA2021, SP2022 (all Inst.)</td>
</tr>
<tr>
<td>Global Assessment (BIOL 4XX)</td>
<td>SP2019, FA2021, SP2022 (UMBC)</td>
</tr>
<tr>
<td>Institutional Data</td>
<td>Available via DMOs (all Inst.) Summer 2021 – present</td>
</tr>
<tr>
<td>Module Assessments (Student Feedback Items*)</td>
<td>SP2021, FA2021*, SP2022* (all Inst.)</td>
</tr>
<tr>
<td>MBVI &amp; Demographics Survey</td>
<td>FA2019, SP2020, FA2020, SP2021, FA2021, SP2022 (all Inst.)</td>
</tr>
<tr>
<td>Module Implementation Questionnaire</td>
<td>SP2020, FA2020, SP2021, FA2021, SP2022 (all Inst.)</td>
</tr>
</tbody>
</table>
What Do Students Say Are the Modules’ Most Effective Aspects?

“The graphing of real data points and the calculation of mean and standard deviation using these points, and how changing or removing points affected these numbers” (Theme: the engaging, active learning opportunity)

“The aspects that were most effective in helping me develop such skills was the collection, application, and explanation of data collected before and after changes occurred.” (Theme: the opportunity to analyze data)

“We get to incorporate what we learned into the present module. We understood the relationships described in the modules. They do not ask random questions, but all the questions lead to one another, so students learn within the process.” (Theme: the types of practice question(s) asked)
What Do Students Say Are the Modules’ Least Effective Aspects?

General Theme of Comments on "Least Effective" Aspects of Modules

Number of Unique Student Comments

- Natural Selection
- Scientific Processes
- Osmosis & Concentration
- Glucose Transfer
- Enzyme Kinetics

N/A
Confusing instruction / content
Graphs / graphing
# or type of problems / questions
Insufficient Time
Insufficient Examples
Pre test / pre work
Mathematics or calculations
Measuring / Data
Insufficient Feedback
Scientific Content
Research Question 1: Is the proposed multi-pronged, inter-institutional model of creating scholarly communities an effective way to promote change? Specifically, does this model promote curricular awareness and result in development of QR modules that are widely adapted/adopted and successfully implemented across participating institutions?

"We were a little bit worried coming into this grant that it was going to be like oh, UMBC is going to tell us all what we need to teach. And very early on they did a very good job being like no, we want to hear what you're doing and then we're all gonna kind of try to find a common ground. So I think a lot of the people that I work with are feeling a little bit calmer now there's sharing as opposed to dictating."

From focus group interview with Biology Faculty Members, November 2019.

-Kathy Dowell, External Evaluator
“I see that a lot across all the faculty that I talk to that people are just excited about this whole approach and this whole project. I think that probably is a lot of the momentum that keeps everything going.” From interview with member of the Leadership team, April 2021.

“I really think that faculty do want students to do better. They want to improve their quantitative reasoning skills. They want them to be successful. So, I really think that that's the driving force behind all of this.” From interview with member of the Leadership team, June 2021.
Research Question 2: Will adding modules to corresponding biology courses at our CC collaborative institutions increase gains in QR skills and decrease the achievement gap between direct entry and transfer students?

Research Question 3: To what extent can increasing QR in biology courses enhance students’ abilities to use quantitative skills to address biological problems? Does the amount of experience with quantitative biology modules in early coursework positively impact student retention and success in advanced coursework?

<table>
<thead>
<tr>
<th>Course</th>
<th>Module</th>
<th>Sections</th>
<th>Approximate N</th>
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<tr>
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<td>Cell Structure &amp; Size</td>
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<td><strong>155</strong></td>
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</table>
NIQB: Lessons Learned

- Higher education institutions can work together! And in the process, learn a lot about each other that will help in other ways to improve student learning and success
  - Common vision, goals, and language – find common ground
  - Understanding the mission and tensions between institutions
  - Trust, shared responsibilities and duties
  - Committed champions and dedicated professional
  - Absence of institutional and individual bias
  - Challenge assumptions and the fixed mindset

- Data sharing MOU is essential to present and future collaborations
  - Data keeps us honest – “There is no blame!”

- Challenge of time and resources - leadership must be willing to support
- Faculty need to interact – find mechanisms for faculty to work together
- Cultural differences among institutions – embrace and leverage (PD)
Lead PI: Dean Bill LaCourse

Intro Biology I: Cells & Molecules
AACC: Julie Takacs, Mark Farinha
CCBC: Jennifer Laing, Victor Madike, Susan Warner, Lakshmi Rajkumar
HCC: Shannon Dahl, Elena McCarthy and Ed Orlando
MC: Evdokia Kastanos, Padma Tangirala, Sean Cooney, Rebecca Thomas, Vedham Karpakakunjaram, Kate Monzo
UMBC: Stephen Miller, Caitlin Kowalewski

Intro Biology II: Ecology and Evolution
CCBC: Sean McNamara, Christine DeStefano
HCC: Will Gretes
MC: Gina Wesley, Kiersten Newtoff, Kelly Livernoche
UMBC: Jeff Leips

Faculty Development: Linda Hodges (UMBC), Sarah Leupen (UMBC), Amy Chase Martin (HCC), Andrea Zamora (AACC)
Jean Ashby, (CCBC), Tom Cantu (MCC), Paul Miller (MCC)

Genetics
AACC: Tammy Domanski, Lance Bowen
CCBC: Stephen Page, Natalie Minovsky
HCC: Luda Bard and Kathy Jones
MC: Michael Chase and Antonio del Castillo-Olivares
UMBC: Dave Eisenmann

Cell
CCBC: Gwen Gillinger
HCC: Hannah Pie, Patti Turner, Bhuwana Chandran
MC: Ishrat Rahman
UMBC: Michelle Starz-Gaiano

Math Team: Sybille Clayton (AACC), Lisa Feinman (CCBC), Allison Bell (HCC), Ben Nicholson (MC), Kathleen Hoffman (UMBC), Beatrice Lauman (UMBC)
Our Questions for You

1. What institutional policies, procedures, and/or practices inhibit 2-year and 4-year collaborations?

2. Do the benefits of data sharing outweigh the concerns?

3. What approaches might be used to establish and maintain a scholarly community between 2-year and 4-year faculty?
Facilitated Breakout Rooms

Laurie McConnico’s Discussion

• Have you developed UREs at your institutions and what were the major obstacles to launching those programs? If you have yet to launch a URE, but are considering, what are your concerns?

• Are there any stigmas or hesitance surrounding the offering of UREs at community colleges?

• Why is it important to gain undergraduate research experiences at both 2-year and 4-year colleges?

• When did you have your 1st research experience and how did it impact you?

• How has your home institution effectively addressed barriers to student participation and access to UREs?

William LaCourse’s Discussion:

• What institutional policies, procedures, and/or practices inhibit 2-year and 4-year collaborations?

• Do the benefits of data sharing outweigh the concerns?

• What approaches might be used to establish and maintain a scholarly community between 2-year and 4-year faculty?
Discussion Breakout Room Recap
Thank you for attending!

Slides and recording will be available in the coming weeks.

We value your feedback, please take a few minutes to complete the survey.

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