

# ONLINE ENGINEERING EDUCATION RESEARCH COLLABORATION

**QM Connect Fall 2023**



**Oregon State  
University**

# Introductions



## **Chris Hundhausen**

Professor and Assoc. Head for Online Programs  
Director, Center for Research in Eng. Ed. Online  
Oregon State University

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## **Shannon Riggs**

Associate Vice Provost  
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@shannonriggs on X (Twitter)

@osushannonriggs on Threads

# Learning Outcomes

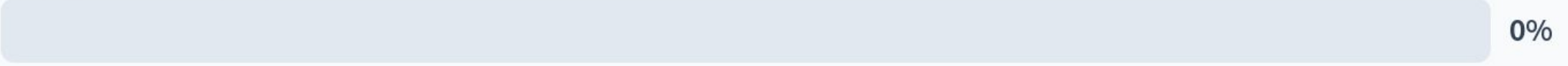
1. Attendees will be introduced to a unique research collaboration between a distance education division and an academic college.
2. Attendees will become familiar with the strategic goals and structure of the collaboration.
3. Attendees will become acquainted with a sampling of research

# What is your primary role at your institution?

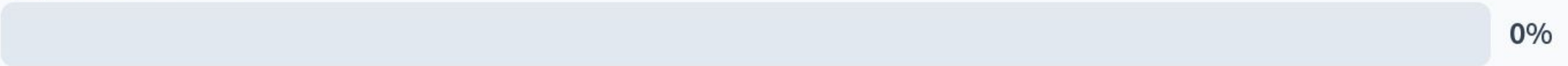
(A) Instructional Faculty



(B) Research Faculty



(C) Administrator



(D) Other



# Do you have a research unit or center at your institution that works with your online degree programs?

A. Yes



B. No



C. Not yet, but we are considering it



# Oregon State University

- Public four-year land grant
- Research 1 institution
- Corvallis, Oregon
- 32,000+ students
- 1 in 4 students is fully online

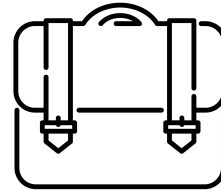
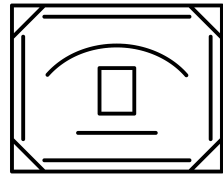


# About Ecampus

- Student success top priority
- Designed for adult learners
- Top-ranked in the nation 9 years in a row
- Partnerships with academic colleges



# Ecampus by the numbers



**Centralized**  
online learning  
division (2002)

**103**  
degree +  
certificate  
programs

**1,165**  
OSU faculty  
partners

**Over 77%**  
seeking  
bachelor's  
degree

**50 states +**  
**59**  
countries

**10,000+ GRADUATES SINCE 2002**





# Ecampus degrees and programs

**58**

**undergraduate  
programs /  
certificates**

**45**

**graduate  
programs /  
certificates**

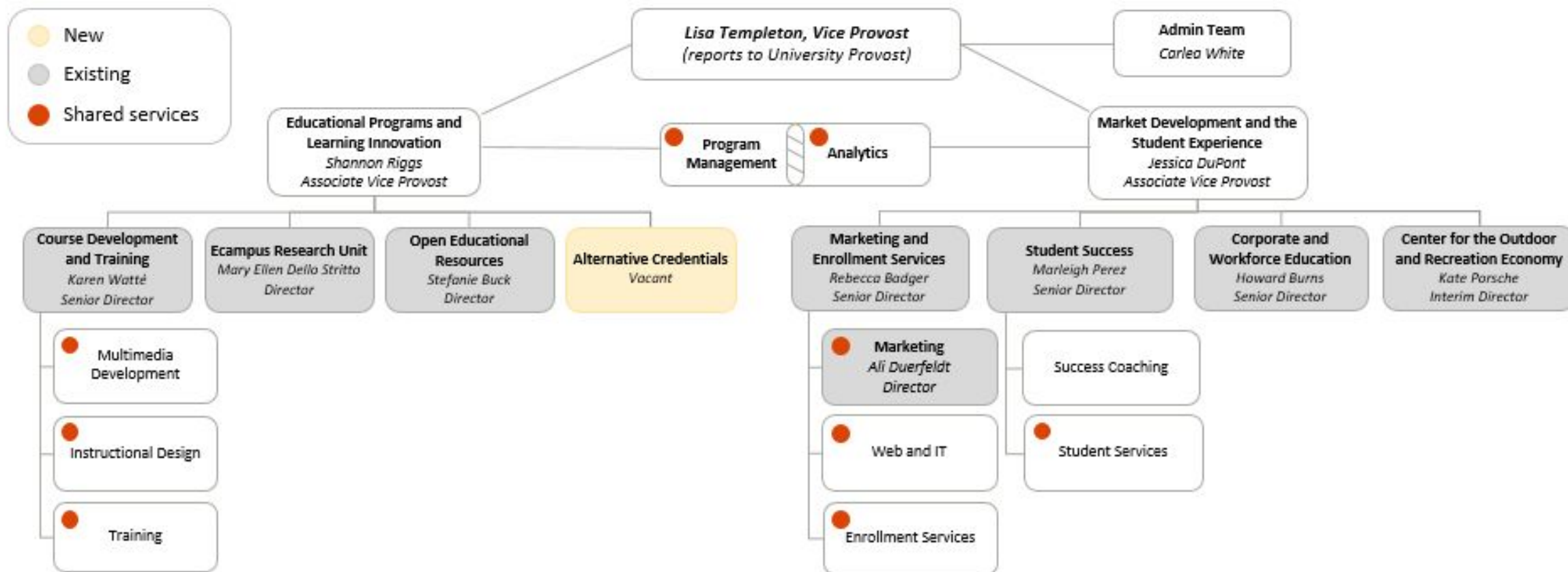
**1,800**

**credit  
courses  
available  
online in  
115+ subjects**

**11**

**academic  
colleges**

# Division of Educational Ventures



# Ecampus Research Unit

- Conducts original research in online and hybrid education (e.g., Financial Aid and Persistence Study)
- Faculty Fellows program
- Undergraduate research program
- Creates research-related tools to advance the field (e.g., Efficacy database)

*Director: Dr. Mary Ellen Dello Stritto*



## What benefits can research bring to online and hybrid programs in higher education?

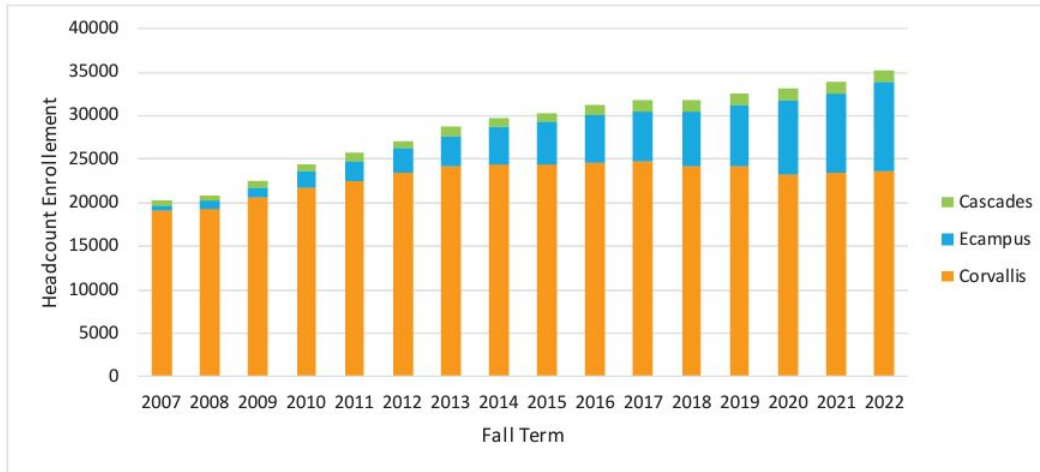
Nobody has responded yet.

Hang tight! Responses are coming in.





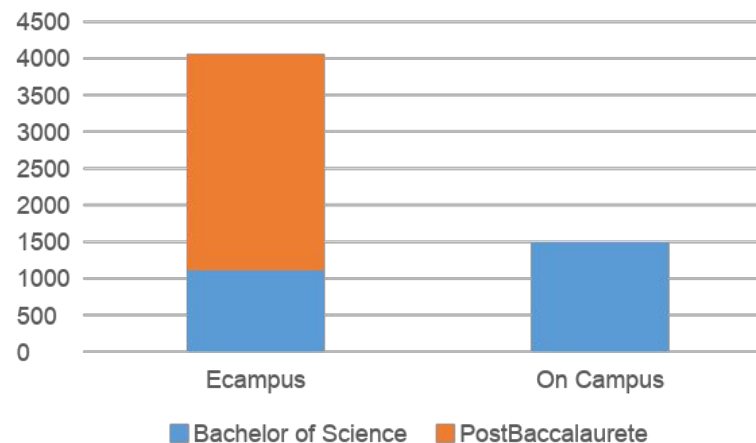
# OSU CS Programs by the Numbers



**Oregon State University Enrollment: Ecampus has Growing Share**

Degree Programs with the Highest Enrollment (Last Year's Rank)	
<b>Undergraduate</b>	
1. Computer Science (1)	4297
2. Business Administration (2)	1715
3. Psychology (4)	1469
4. General Engineering (5)	1397
5. Mechanical Engineering (3)	1265
6. Biology (6)	1008
7. Kinesiology (7)	902
8. BioHealth Sciences (9)	820
9. Zoology (13)	723
10. Environmental Sciences (11)	705

**CS is Largest Degree Program @ OSU**



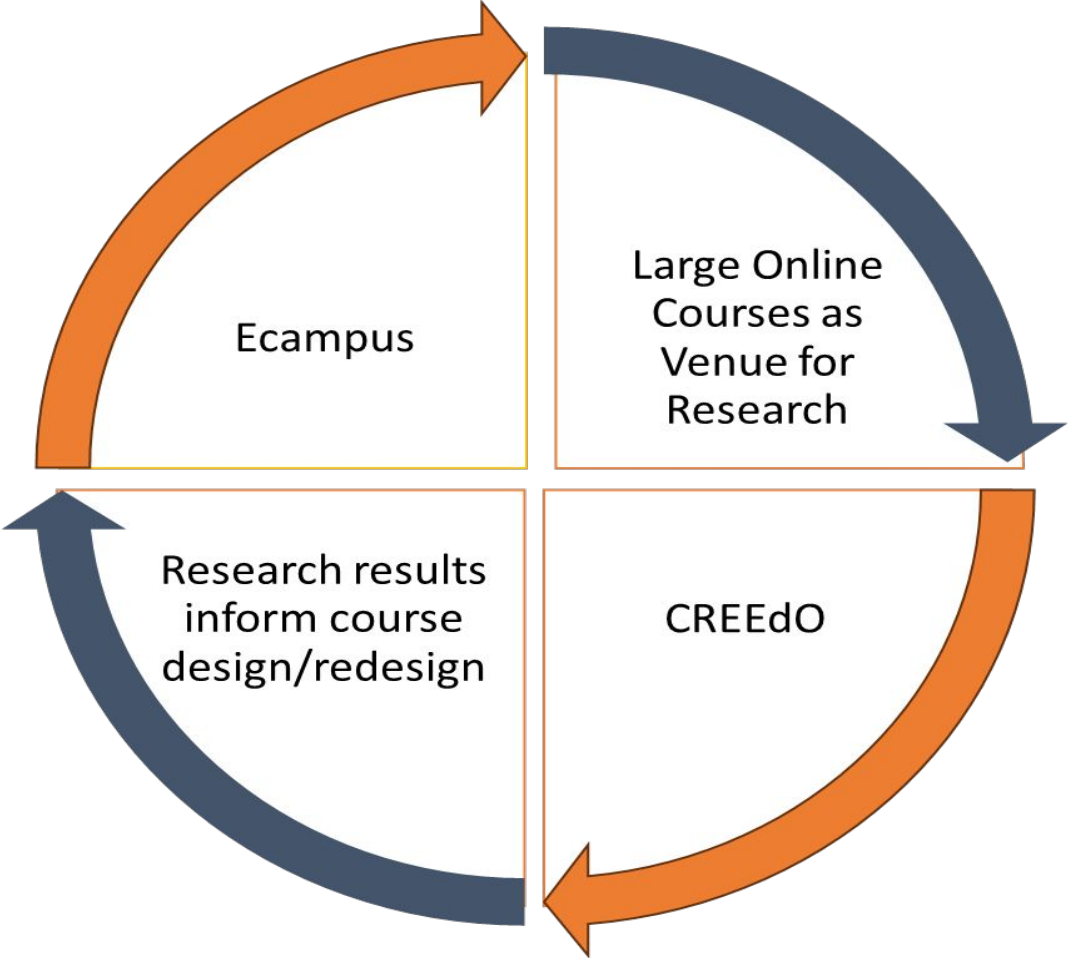
**Computer Science @ OSU: Ecampus Postbac Dominates**

# Challenges we were facing



- Engaging busy CoE faculty in online course development and teaching
- Continuously improving high-enrollment online engineering courses

# A Synergistic Partnership is Born: Ecampus and CREEdO



# Center for Research in Engineering Education Online (CREEdO)



## **College of Engineering**

- Academic home
- Leadership and administration
- Financial investment

## **Ecampus**

- Financial support
- Assistance with grant proposal review process



# CREEdO Strategic Goals

- Innovate the future of online engineering education
- Rigorously study online pedagogical and technological interventions
- Improve access to degree programs
- Improve student success
- Promote new online program development
- Provide seed funding leading to external grants
- Build a community of engineering education researchers

# Structure of Agreement

Faculty Fellowships (3/yr)

Grad Assistants

Assessments

T/TT Startup package

T/TT Salary

# Structure of Agreement, cont'd

And ... a commitment from CoE to develop **AT LEAST ONE** new fully online program



# Structure of Agreement, cont'd

**THREE** have been launched:

1. MS in Computer Science
2. BS in Mechanical Engineering
3. BS in Construction Engineering Management



# CREEdO Seed Grants

## Goals

- Enhance current and future online courses and degree programs in the OSU College of Engineering and beyond
- Pursue new lines of inquiry not already supported by grants
- Provide research foundations for new proposals to external funding programs (e.g., National Science Foundation IUSE)

# CREEdO Seed Grants

## Benefits

- Funding for 12-18 month projects
- \$25,000 for faculty support
- Support for 12-month graduate research assistant (GRA) position, including tuition and benefits
- A pool of funding available to support formal assessment

# Seed Grant Review Criteria

## Proposal quality

- Research questions, project plan, performance indicators

## Significance and impact

- At OSU and beyond
- Potential to lead to external grants

## Feasibility

- Budget, scope and timeline

## Other

- Support letter, other grant funding

# Seed Grant Review Rubric

PROPOSAL: [REDACTED]				
REVIEWER: [REDACTED]				
	CRITERION	WEIGHT	RATING	JUSTIFICATION/COMMENTS
PROPOSAL QUALITY	Research problems and questions are well described and motivated	5%	5 - Excellent	Comments specific to each criterion go here.
	Proposed solution is well described and Project work plan is clearly described and appropriate to addressing research problems/questions	10%	4 - Very Good	
	Performance indicators to assess and measure project outcomes relative to project objectives are measurable and appropriate	10%	3 - Good	
		10%	2 - Fair	
SIGNIFICANCE & IMPACT	Has potential to enhance current and/or future COE online curriculum and programs (i.e. strong relevance to COE degree programs)	20%	4 - Very Good	
	Has potential to enhance online engineering education beyond OSU	15%	4 - Very Good	
	Has potential to stimulate new proposals for external funding programs**	20%	4 - Very Good	
FEASIBILITY	Project's scope and timeline are appropriate for the duration of the project	5%	4 - Very Good	
	Project budget (faculty support, RA support, and assessment) are appropriate for project	5%	3 - Good	
OTHER REQ'TS	Has required letter of support (Yes/No_	-	Yes	
	Pursues new lines of inquiry not already pursued by other research or supported by external grants (Yes/No_	-	Yes	
<b>Weighted Average:</b>		<b>100%</b>	<b>3.70</b>	

## GENERAL COMMENTS ON PROPOSAL

This is a nice proposal with clear research questions and potential for high impact.



# CREEdO Project Examples

Since 2022, CREEdO has funded five projects and has been involved in conducting another study in collaboration with the eCampus Research Unit





# Assessing Efficacy of VR Site Visits to Enhance Remote Learning for CCE Students

Joseph Louis, Assoc. Professor, School of Civil & Construct. Eng.

## Motivation

- Perceived disparity of learning experiences between remote and in-person construction engineering students

## Research Questions

- Can virtual reality site visits measurably improve student learning outcomes and learning experiences?

## Methods

- Problem identification and solving in virtual construction sites
- Affective assessments measuring student understanding, belonging, and engagement

## Key Results

- Unity-based software application created to rapidly develop construction scenes completed
- Survey development is underway, and will be deployed in Spring 2024







# Increasing engagement and access in STEM: Development of virtual laboratories that elicit engineering epistemic practices

Jeffrey A. Nason, Professor and Head, School of Chemical, Biological and Environmental Engineering, OSU

Milo D. Koretsky, Professor, Chemical and Biological Engineering / Education, Tufts University

Milo D. Koretsky, Professor, Chemical and Biological Engineering / Education, Tufts University

## Research Questions

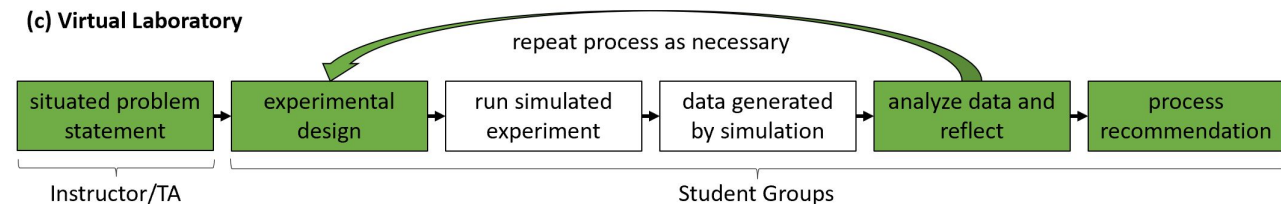
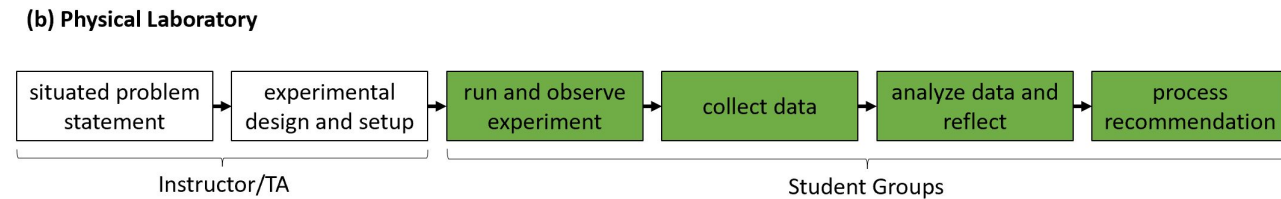
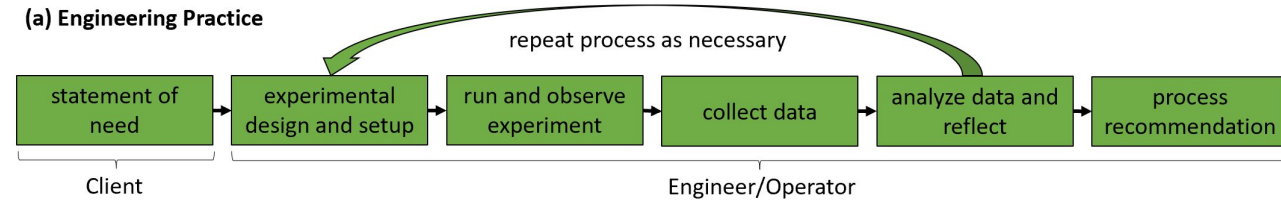
- Which types of engineering epistemic practices manifest during physical and virtual laboratories?
- When both lab modes are engaged, what is the impact of laboratory order?

## Methods

- Developed virtual and physical versions of the Jar Test for Drinking Water Treatment
- Video recording, transcription and discourse analysis of 4 student teams

## Key Results

- Physical laboratories more efficiently scaffolded material epistemic practices
- Virtual laboratories more efficiently scaffolded conceptual epistemic practices
- Physical and virtual laboratories can be complementary





# Developing a Scale to Measure Social and Cognitive Engagement in Online STEM Courses

Shane Brown, Associate School Head for Graduate Affairs, School of Civil and Construction Engineering

## Research Questions

- What key factors contribute to student engagement in online STEM courses?
- How can these factors be reliably measured?

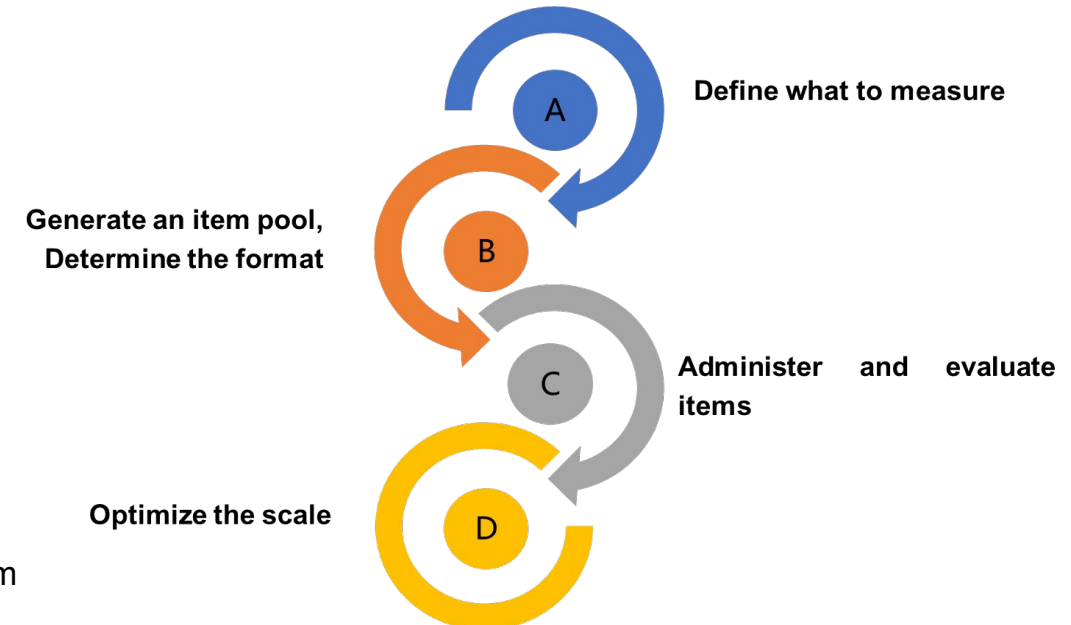
## Methods

- Conducted 33 interviews with students in online STEM courses.
- Conducted Exploratory and Confirmatory Factor analyses (EFA and CFA)

## Key Results

- Based on the interviews and thematic analysis, eight key constructs were identified: *Interactivity And Connectivity, Instructor Availability, Connecting Knowledge, Self-directedness, Course Difficulty, Academic Proactivity, Course Organization, and Resources.*
- Based on the identified constructs and existing literature, a survey was formulated and implemented over three iterations.
- The survey questions were adjusted to refine the scale based on feedback from multiple implementations.
- The EFA results provide a robust structure for understanding the dimensions of student cognitive and social engagement.
- The CFA results provide evidence of scale reliability.
- Researchers can utilize this scale to understand Social and cognitive engagement, and educators can use this instrument's results to improve their online courses.

## I. SCALE DEVELOPMENT STEPS





# A Transformative Study on the Effectiveness of Extended Reality in Enhancing Engineering Education.

PI: Raffaele De Amicis, Ph.D., Associate Professor, School of Electrical Engineering and Computer Science.

Co-PI: Dr. Yelda Turkan, Assistant Professor, School of Civil & Construction Engineering;

Co-PI: Dr. Onan Demirel, Associate Professor, School of Mechanical Engineering

Graduate Assistant: Jordan Henstrom, School of Electrical Engineering and Computer Science

## Research Questions

- What effect does Extended Reality have on Cognitive Load when used in educational settings?
- What effect does Extended Reality have on user experience when used in educational settings?

## Methods

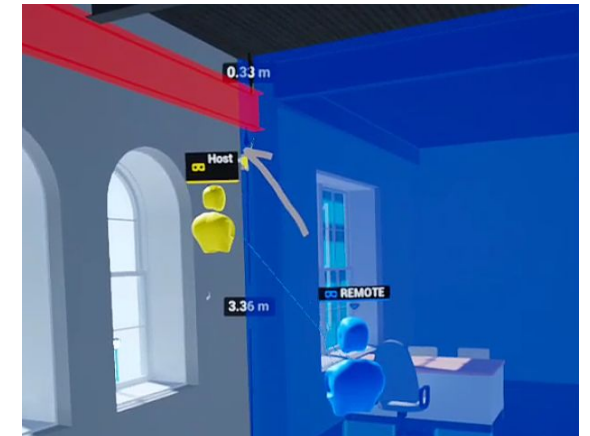
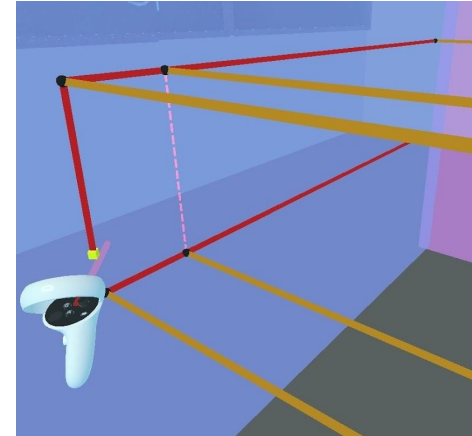
- Integrated VR based educational applications into two separate engineering courses (CCE 203, ENGR 248)
- Regular meetings with course instructors to ensure effective use of the technology without effecting learning outcomes
- Formal assessment of VR applications and dissemination of results
- Data collection conducted in Fall and Winter of 2023

## Dissemination

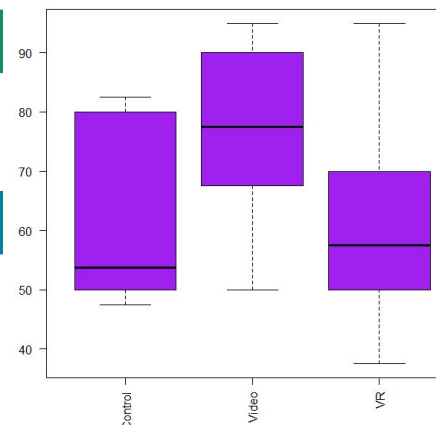
- ADM 2023 International Conference in Florence Italy
- ACM SIGGRAPH Web3D International Conference in San Sebastian, Spain
- Received Best Paper award for publication

## Key Results

- The use of VR for technical drawing does not incur a significantly higher cognitive load than traditional instructional methods.
- The use of VR for virtual building inspections does not incur a higher cognitive load than traditional instructional methods and improves some aspects of the user experience of students.
- VR technology has matured to a point where educational virtual environments can be effectively and efficiently created for a variety of STEM domains.



Summary of System Usability Scores



## Cognitive Load - Effort

Within Subjects Effects

	Sum of Squares	df	Mean Square	F	p	$\eta^2$
Medium	113	1	113.2	5.64	0.023	0.075
Residual	682	34	20.1			

Note. Type 3 Sums of Squares

## Post Hoc Tests

Post Hoc Comparisons - Medium

Comparison		Mean Difference	SE	df	t	Ptukeay
Navisworks	- VR	2.54	1.07	34.0	2.37	0.023

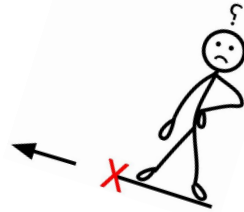
# GenderMag to “DeBias” Online Courses

Margaret Burnett, Anita Sarma, Lara Letaw (EECS)



## For: Online courseware inclusivity

- Locate & fix online courseware’s inclusivity bugs



## Methods

- Developed AID: a GenderMag tool to locate inclusivity bugs
- Evaluated with 7 faculty

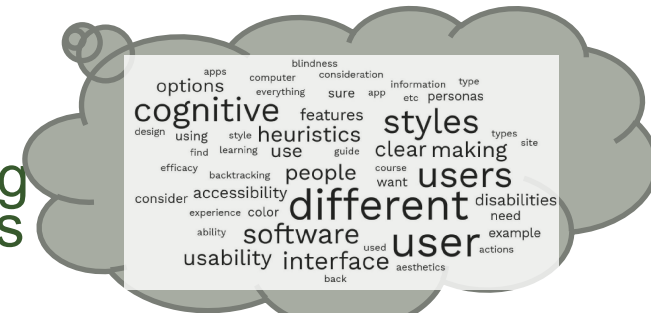


## For: Online faculty & student inclusivity

- Put (bits of) GenderMag into courses

## Methods

- Developed online faculty training + teaching resources
- Evaluated w faculty, designers, students



## Results & Recommendations

- Faculty: AID & GenderMag content useful, feasible, actionable 👍
- Students: higher intent to stay in major, better climate 🥰
- Recommend: ➡ Use GenderMag + AID for online course inclusivity. [gendermag.org](http://gendermag.org)





# Exploring the Influence of Class Size on Online Community

Chris Hundhausen, Professor, School of Elec. Eng. & Comp. Sci.

Mary Ellen Dello-Stritto, Director, Ecampus Research Unit

## Research Question

- How does the course size influence student engagement, sense of community, and success?

## Design & Methods

- Between-subjects quasi-experiment in successive offerings of online CS course
- Indy var: *section size* (*small* = <50 and *large* = 250-350)
- Dep vars: *grades, retention, attitudes* (e.g., classroom community, peer learning)

## Preliminary Results

- Both students and instructors complained about a lack of “critical mass” in smaller classes
- Students interpreted “community” as receiving academic support, not as building camaraderie

The screenshot shows a discussion thread on a course forum. At the top, an anonymous user asks a question about getting values from objects in a class and putting them into a list without using append. Below the question, there are two answers. The first answer, from an instructor, explains that you don't need to create a separate list of ages. The second answer, from a student, states they believe they used list comprehension. Below the answers, another anonymous user asks for clarification on how to get a list made when they don't know what the user will enter. The instructor responds by explaining that the user will pass a list of Person objects and that the function can iterate through them. Finally, another anonymous user asks why they need to know what the user will enter.

Anonymous 355 views  
Last year in Assignments - Assignment 6

Are there any hints for getting the value from the objects in a class and putting them into a list without using append? I have the class, I have attributes, and I'm fairly sure I could calculate the standard deviation, but I can't get the ages into a form that I can do anything with them.

...

2 Answers

T [REDACTED] INSTRUCTOR  
Last year

✓ You don't need to create a separate list of the ages to be able to do anything with them. You can just do whatever you need to with the ages as you iterate through the list of Person objects.

...

S [REDACTED]  
Last year

I believe I used list comprehension to accomplish this.

...

Anonymous 1y  
The Readme said "Here's a simple example of how your class and function could be used:"

Could be... not will be, right? So we can't just use "person\_list" along with the give list of names to populate our own list, right? That's what's tripping me up. How to get a list made when I don't know what the user will enter.

...

T [REDACTED] INSTRUCTOR 1y  
You know that the user will pass a list of Person objects to your function. Your function can then iterate through the list of Person objects and ask each one for its age. Does that help?

...

Anonymous 1y  
Oh, I think I see. I was thinking the user was going to just pass in the objects. I didn't realize the user was passing in a list of objects.

...

T [REDACTED] INSTRUCTOR 1y  
Why do you think you need to know what the user will enter (besides knowing that it's a list of Person objects)?

...

# On The Horizon for CREEdO

- 2023-24 [CREEdO seed grant call for proposals](#) is live
- Collaboration on \$161 million [National Science Foundation Regional Innovation Engine](#) proposal focused on semiconductors, with significant online engineering education component
- Three new National Science Foundation proposals to [IUSE](#) and [SaTC](#) competitions focus on innovative pedagogies for online software engineering and cybersecurity education
- Cluster hire of faculty focused on online engineering education research



If you were a member of the CREEdO proposal review team, which research topics/questions would you like to see studied?

Nobody has responded yet.

Hang tight! Responses are coming in.



# Thank you!



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**Q&A**

