Computer Science Professionals Hatchery "Measures of Success"

Legend: % 2020-2021, % 2019-2020, % 2018-2019, % 2017-2018, % 2016-2017

Y-axis: % of Target
X-axis: Progress Measure
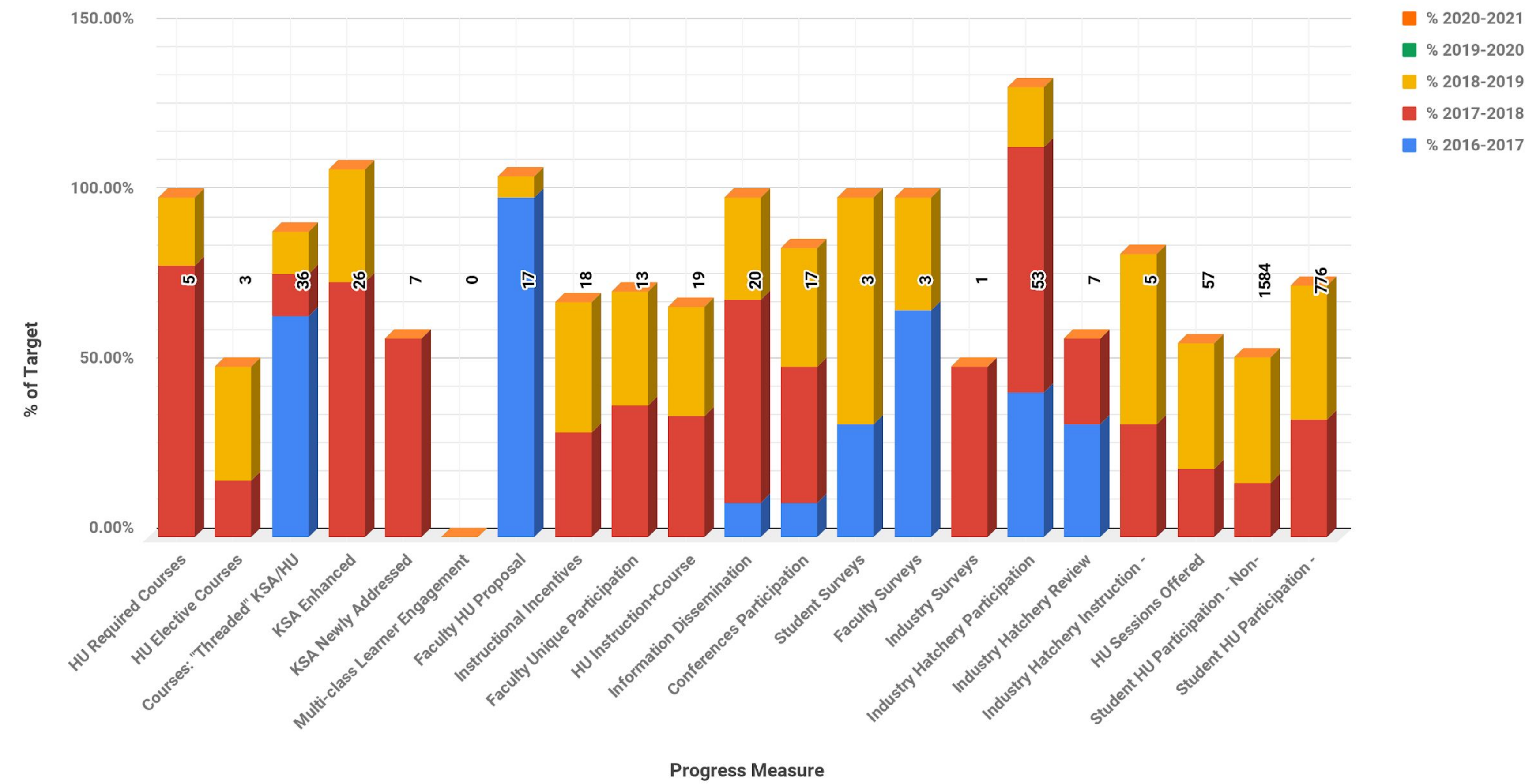
Products

Conference	Year	Location	Type	Product Title	Authors
ASEE - American Society for Engineering Education	2017	Columbus, Ohio	Paper	Talking about a Revolution: Overview of NSF RED Projects	Dr. Susan M. Lord (USD); Dr. Edward J. Berger (Purdue); Dr. Nadia N. Kellam (ASU); Dr. Ella Lee Ingram (Rose-Hulman); Dr. Donna M. Riley (VT); Dr. Diane T. Rover (ISU); Dr. Noah Salzman (BSU); Prof. James D.Sweeney (OSU)
IUSE/PFE:RED - Revolutionizing Engineering Departments	2017	Arlington, Virginia	Poster Session	Nurturing the Next Generation of Computer Science Professionals	RED Grant Team
IEEE - Frontiers in Education (FIE)	2017	Indianapolis, Indiana	Panel	Influencing Culture and Curriculum Via Revolution	Dr. Kelly Cross (University of Illinois); Dr. Marina Miletic (UNM); Tiago Forin (Rowan); Dr. Mani Mina (Iowa State); Dr. Amit Jain (BSU); Dr. Elsa Villa (UTEP); Dr. Lisa McNair (Virginia Tech); Dr. Ella L. Ingram (Rose-Hulman)
RESPECT - Research on Equity & Sustained Participation in Engineering, Computing, & Technology	2018	Baltimore, Maryland	Panel Discussion	Revolutionizing the Culture of Computer Science	Dr. Noah Salzman (BSU); Dr. Don Winiecki (BSU); Dr. Venkat N. Gudivada (ECU); Dr. Junhua Ding (ECU); Dr. Bojan Cukic (UNCC); Dr. Celine Latulipe (UNCC); Dr. Ann Q. Gates (UTEP); Dr. Sarah Hug (UTEP)
AERA - American Educational Research Association	2018	New York City, NY	Conference Presentation	Identifying gender differences in undergraduate Computer Science students: Women aren't so different	Dr. Carl Siebert; Kathleen Mullen; Dr. Noah Salzman
AERA - American Educational Research Association	2018	New York City, NY	Conference Presentation	The Computer Science Professionals Hatchery	Dr. Noah Salzman; Dr. Tim Andersen; Dr. Amit Jain; Dr. Don Winiecki; Dr. Dianxiang Xu; Dr. Carl Siebert
CoNECD - Collaborative Network for Engineering and Computing Diversity	2018	Crystal City, VA	Paper	The Computer Science Professionals' Hatchery at Boise State University: Incorporating Inclusion, Diversity and Social Justice into the Computer Science Curriculum	Dr. Noah Salzman; Dr. Tim Andersen; Dr. Amit Jain; Dr. Dianxiang Xu
CNSF - Coalition for National Science Funding	2018	Washington, DC	Poster Session	Nurturing the Next Generation of Computer Science Professionals	Dr. Amit Jain
ASEE - American Society for Engineering Education	2018	Salt Lake City, Utah	Paper	The Computer Science Professional's Hatchery	Dr. Amit Jain; Dr. Noah Salzman; Dr. Don Winiecki
IUSE/PFE:RED - Revolutionizing Engineering Departments	2018	Alexandria, Virginia	Presentation	Portable concept: Hatchery Unit	Dr. Tim Andersen
IUSE/PFE:RED - Revolutionizing Engineering Departments	2018	Alexandria, Virginia	Presentation	Incorporating Focused Professional Skills, and Inclusion, Diversity & Social Justice into the Computer Science Curriculum	Dr. Tim Andersen; Dr. Amit Jain; Dr. Noah Salzman; Dr. Don Winiecki
HICCS - Hawaii International Conference on System Sciences	2019	Maui, HI	Paper	The Hatchery: An Agile and Effective Curricular Innovation for Transforming Undergraduate Education	Dr. Amit Jain; Dr. Noah Salzman; Dr. Don Winiecki; Dr. Carl Siebert
RESPECT - Research on Equity & Sustained Participation in Engineering, Computing, & Technology	2019	Minneapolis, MN	Paper	Teaching Professional Morality and Ethics to undergraduate CS students through Cognitive Apprenticeships & Case Studies: Experiences in CS-HU 130 'Foundational Values'	Dr. Don Winiecki; Dr. Noah Salzman
PSA - Pacific Sociological Association	2019	Oakland, CA	Paper	Influencing Inclusion, Diversity, and Social Justice in Undergraduate Computer Science: Knowledge, Hegemonic Power, Performance, and Uncertainty of the Status of Membership Status	Michelle Fretwell; Erika Abbott; Dr. Noah Salzman; Dr. Don Winiecki
ASEE - American Society for Engineering Education	2019	Tampa, FL	Abstract	The Computer Science Professional's Hatchery	Dr. Amit Jain; Dr. Noah Salzman; Dr. Don Winiecki
ASA - American Sociological Association	2019	New York, NY	Paper	Peer Networks Built Around Common Experiences Stabilize Other Things Too: The Durability of Hegemonic Bias in Undergraduate Computer Science Education	Michelle Fretwell; Erika Abbott; Dr. Noah Salzman; Dr. Don Winiecki

Authors

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Assessing Community in an Undergraduate Computer Science Program Using Social Network Analysis

Significance of Differences by Class Year
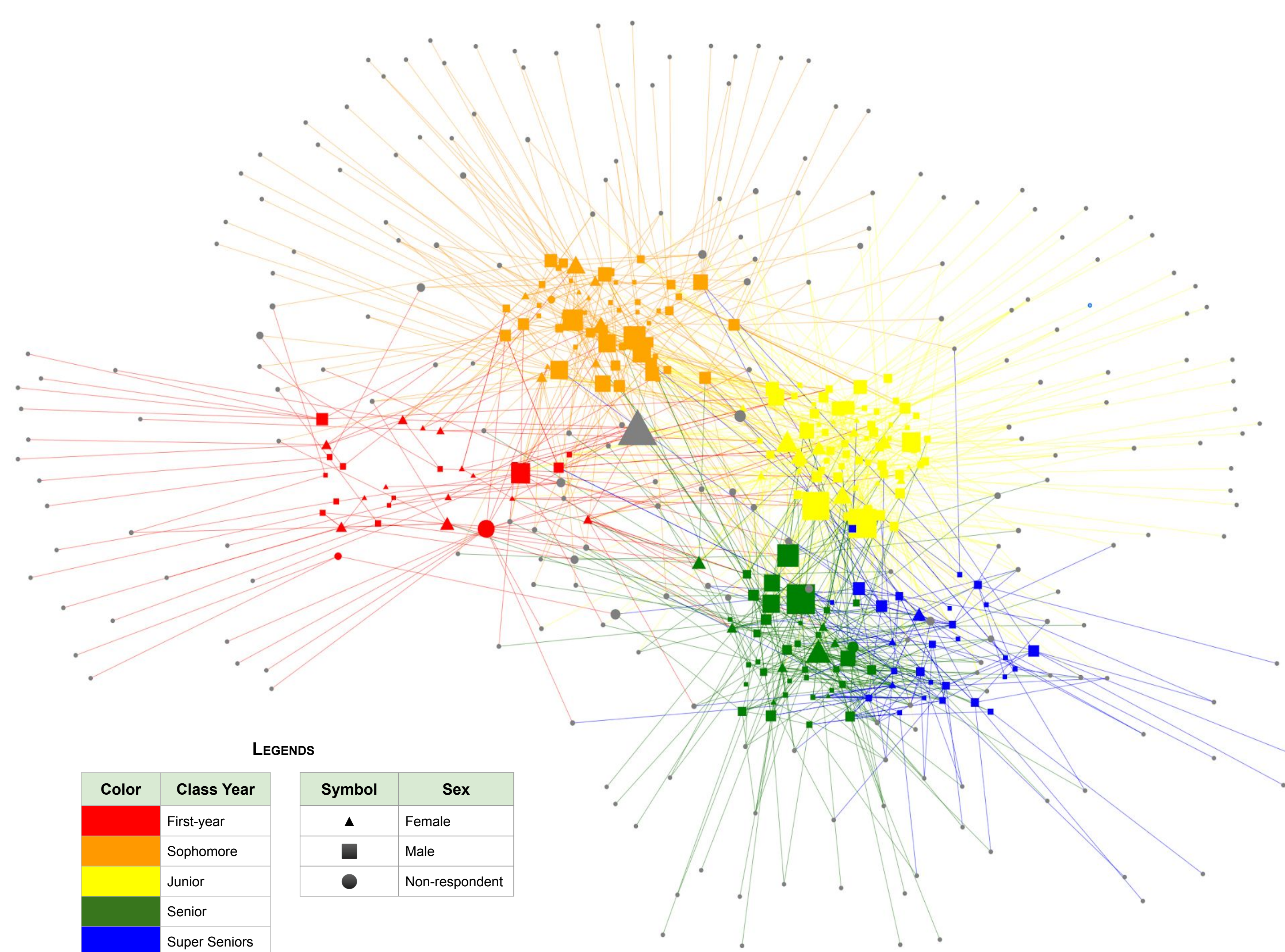
	1st Year	2nd Year	3rd Year	4th Year	5th Year or more
n	29	59	74	43	29
Mean	5.21	7.97	10.12	12.02	8.69
Standard Deviation	3.79	4.92	5.58	6.01	5.42
Median	4	8	10	12	9
Min	1	1	1	1	1
Max	16	21	27	28	20
Skew	1.17	0.56	0.69	0.56	0.26
Kurtosis	0.52	-0.3	0.25	0.43	-1.16

Differences in Degree By Class Year

	1st Year	2nd Year	3rd Year	4th Year
2nd Year	2.419 0.031*			
3rd Year	4.246 0.000*	2.186 0.041*		
4th Year	5.167 0.000*	3.455 0.002*	1.624 0.1305	
5th Year or more	2.610 0.023*	0.603 0.5467	-1.117 0.2931	-2.315 0.034*

Top number indicates pairwise z-Test value, bottom number is adjusted p-value based on Benjamini-Hochberg correction
*indicates significance (p<0.05)

Legends

Color	Class Year
	First-year
	Sophomore
	Junior
	Senior
	Super Seniors

Symbol	Sex
▲	Female
■	Male
●	Non-respondent

Differences in Degree by Gaming

	Non-Gamer	Gamer
n	303	157
Mean	4.43	8.55
Standard Deviation	4.72	5.88
Median	2	8
Min	1	1
Max	27	28
Skew	1.86	0.79
Kurtosis	3.46	0.33

Differences in Degree by Department Employment Status

	Non-Employee	Employee
n	424	36
Mean	5.29	12.33
Standard Deviation	4.8	8.41
Median	3	11.5
Min	1	1
Max	21	28
Skew	1.12	0.35
Kurtosis	0.3	-1.15

Differences in Degree by Gender

	Male	Female
n	184	47
Mean	9.11	9.49
Standard Deviation	5.56	6.23
Median	9	9
Min	1	1
Max	28	27
Skew	0.71	0.71
Kurtosis	0.37	0.05

Differences in Degree by White/Non-White

	Non-White	White
n	40	194
Mean	10.07	8.95
Standard Deviation	5.34	5.68
Median	10.5	8
Min	1	1
Max	21	28
Skew	0.02	0.83
Kurtosis	-1.05	0.62

Highlights:

- Identify institutional practices and social dynamics that produce *'super-connectors'*
- Hypothesize that connected students are more likely to persist when they encounter setbacks or adversity
- Students in higher grade levels have more densely populated networks
- Significant connectedness variation, ranging from 1 to 28 connections
- Analyses of variations in connectedness can expose factors that could help explain lower completion rates
- Teaching assistants and tutors are typically well connected and important for building connections across grade levels

Conclusions:

- No meaningful differences in the connectedness of *male versus female* students, *white versus non-white* students, or *traditional versus non-traditional* students
- Significant differences in the connectedness of several subgroups:
  - *Students' connectedness increases through the four years*
  - Students in their fifth year or more of studies tended to be less connected than traditional seniors
- Students who identified themselves or their peers as *gamers tended to have significantly more connections* than their non-gaming classmates
- Quantitatively demonstrates the *importance of teaching and learning assistants* in creating community in the CS department
  - These individuals have an outsized impact in building connections in the undergraduate CS community and further support the value of peer tutors
- *Lack of connections for students can help to diagnose the overall feeling of 'non-belongingness' in CS*
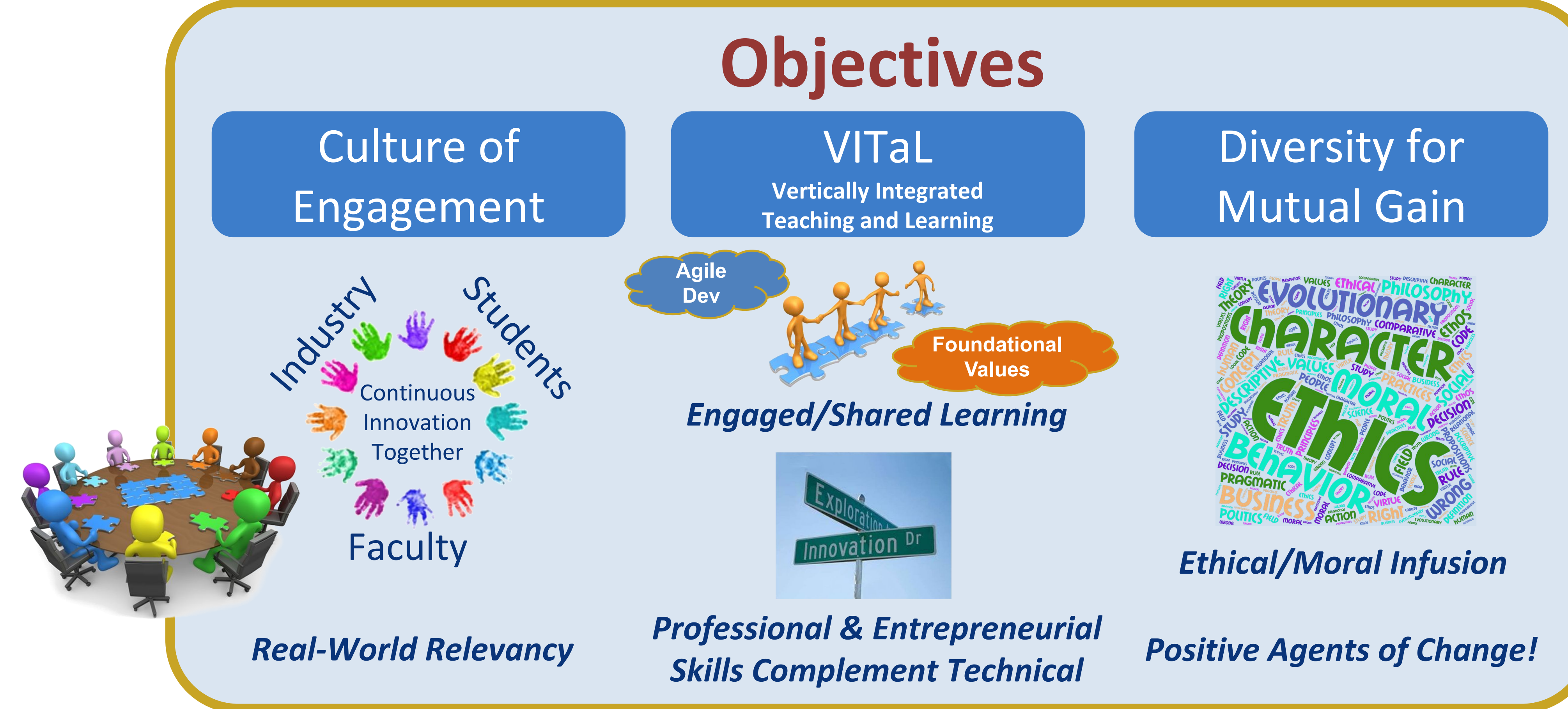
Nurturing the Next Generation of Computer Science Professionals

Amit Jain, PI and Department Chair; Co-PIs: Tim Andersen, Dianxiang Xu
Noah Salzman, Education Researcher; Don Winiecki, Social Scientist

*The **Computer Science Professionals (CSP) Hatchery** will create a revolutionary learning environment by modeling the best practices of a software company work experience, layering nurturing aspects that promote ethical questioning, value diversity, and a focus on professional skills such as increased collaboration, communication, and teamwork.*

Moral Ethical Social
Technical Professional
Entrepreneurial Business Mindset

The CS Professionals Hatchery
Software Company Environment
"Incubate Agents of Change"

Partner for Success!

- Foundational Values
- Navigating Computer Systems
- Intro to Version Control
- Agile Development
- Intro to Database System Usage
- A Brief Intro to HCI
- Technical Interviews, Jobs, and Careers
- Current Topics in Computer Science
- Secure Programming
- Software Testing

Students
Advising
Faculty/Staff
Industry

hp · clearwater · MWI Animal Health · Simplot · cradlepoint · WhiteCloud Analytics · AppDetex · paylocity · Micron · IMPACT GROUP · visitpay · metageek

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Objectives

Culture of Engagement
Industry · Students · Faculty
Continuous Innovation Together

Real-World Relevancy

VITaL
Vertically Integrated Teaching and Learning
Agile Dev · Foundational Values

Engaged/Shared Learning

Exploration · Innovation Dr

Professional & Entrepreneurial Skills Complement Technical

Diversity for Mutual Gain
EVOLUTIONARY · CHARACTER · ETHICS · MORAL · BEHAVIOR

Ethical/Moral Infusion

Positive Agents of Change!

CS Hatchery

Next Steps

- Additional HUs planned 2019-2020
- Continue faculty HU instructional rotation
- Continue *"threading"* HU content in courses
- Evaluate *"KSA content"* in CS courses
- *"Capstone integration"* feasibility evaluation
- Examine students' social/emotional levels
- Research, Validation, and Publication
- Final assessment of program impact

Progress

- Approved 11 HU courses: 5 required, 6 elective
  - 5 delivered in 2017-2018; 3 in 2018-2019
  - 57 sections, 1584 students (Fa'17-Sp'19)
- "Entrepreneurial Emphasis" approved for Fall 2019
- 14 faculty have taught a HU (4 grant members)
- 4 Industry partners have taught a HU
- Faculty & industry partners - 2nd round interviews
- Student baseline and social network analysis
- 5 papers co-authored with other Universities
- Products to date: 15 conference presentations/papers, 1 book, and 3 websites

Challenges

- Ingrained biases and comfort zones
- Building industry, student, faculty, and advising *buy-in and participation*
- *Logistics:* scheduling, integration and threading, advising, and communication
- New course development
- Modifying existing courses to reinforce Hatchery and KSA concepts – *"Threading"*
- Maintaining survey response rate and willingness to provide feedback on beliefs and experiences
- Using survey and interview data to identify and address ongoing challenges

"...every bit of computer science touches and affects society. We have to be careful what our tools do to people!..."

"...That's just the way the world is! If [under-represented groups] can't handle that, I can't help them..."

Knowledge, Skills, & Abilities

Through several meetings with industry representatives, we iteratively developed the KSA categories and desired outcomes shown below.

KSA Category	Desired Outcomes
Business	*Understanding how a company makes money and executes strategy*
Collaboration & Teams	*Working with people and groups to achieve a goal*
Entrepreneurship	*Organizes, manages, and assumes risks of a business or enterprise*
Professional	*A person engaged and qualified in the computing profession*
Research & Development	*Seeks innovation and improvement of products and processes*
Technical	*Practical knowledge and skills associated with the computing field*

Hatchery* Change Process

*Hatchery Units (HUs) are one credit courses focused on skills relevant to computer science professionals and designed to rapidly adapt to the changing needs of industry. HUs are also a vehicle to diffuse social justice and equity through the curriculum.

❶ Proposal: Concept Development
❷ Review: Project & Follow-up
❸ Curriculum Integration
❹ HU Preparation
❺ HU 1st Offering
❻ HU Integration

Proposal
- Submission
- Project Review & Follow-up
- Industry Knowledge, Skills and Abilities (KSA) Evaluation
- *Concept Decision:*
  - Approve Development
  - Proposal Refinement
  - Defer Proposal

Development
- Syllabus
- Industry Participation
- Course Materials
- 1st Course Offering
- *Pilot Decision:*
  - Course Approval
  - Course Refinement
  - Defer Course Integration

Integration
- Course Refinement
- *Integration Opportunities:*
  - HU Content Threading
  - Capstone Integration

VITaL Engaged/Shared Learning

Foundational Values (Diversity & Social Justice) Threaded Freshman to Senior Courses

Hatchery Curriculum Map

CS-HU 130 Foundational Values
CS 121 Computer Science I
CS-HU 153 Navigating Computer Systems
CS 230 Ethical Issues in Computing
CS 122 Computer Science II
CS-HU 250 Intro to Version Control
CS-HU 269 A Brief Intro to Human Computer Interactions
CS-HU 271 Agile Development
CS-HU 310 Intro to Database System Usage
CS-HU 274 Software Testing
CS 321 Data Structures
CS 253 Intro to Systems Programming
CS-HU 375 Secure Programming
CS-HU 398 Current Topics in CS
CS-HU 390 Technical Interviews, Jobs, and Careers

Legend
Prereq ⟶ Coreq ⤏
Core CS · Required HUs · Elective HUs