Lessons from Students Experiences Outside of the Classroom

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Outline

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- Speakers
- Employers Expectations & Learners
- Learning Opportunities Outside of Classroom in Computing
- Challenges in Students Learning outside of classroom
- Examples of bring lessons learned back into the classroom
- Activity: Reimagine Students Experiences of the Classroom in your discipline

Speakers

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Department of Computer & Information Science & Engineering

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CS Identity Project: Engaging Learning Lab

Key Focus

- Computing Professional Identities
- Professional Development in Undergraduate Computing Programs in US
- Gaps between Academia and Industry in Computing

Research Questions

- How do CS undergraduate students form computing professional identities?
- How does the preparation process of CS undergraduate students who secure an internship differ from those who do not intern?
- What are the barriers that CS students face to secure a computing job?

Methods

- Multi-Institutional Mixed Methods Studies: Qualitative and Quantitative Approaches
- Survey, Interviews, Documents (Resumes), and Ethnographies in Computing Clubs
- 900+ surveyed students, 50+ interviews, observations at three clubs for 1.5 years

Who’s in the audience

Go to menti.com and use code **54 05 61**

1. What is your department?
2. What is your role/title on campus?
3. What one word describes you as an undergraduate?

Attendee Poll
menti.com
use code 54 05 61

Expectations of Employers & Learners

Employer Expectations & Need for Internships for CS Students

Internships have become an integral part of employers' recruitment process

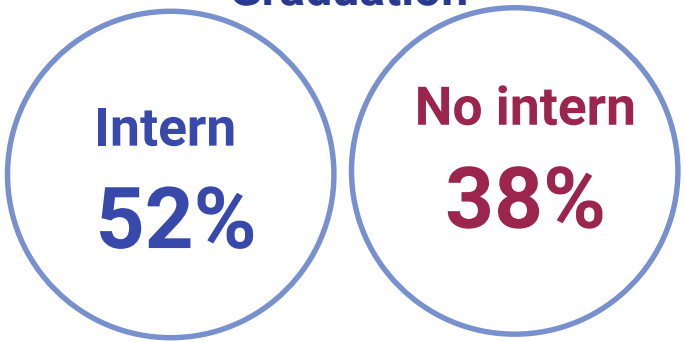
46%

Employers consider prior experience when hiring new grads

Pursuing Internships

- Increases chances of Full-time Employment
- Higher Starting Salary

Receiving Job Offers Before Graduation



Source: National Association of Colleges and Employers. 2014. The Class of 2014 Student Survey Report.

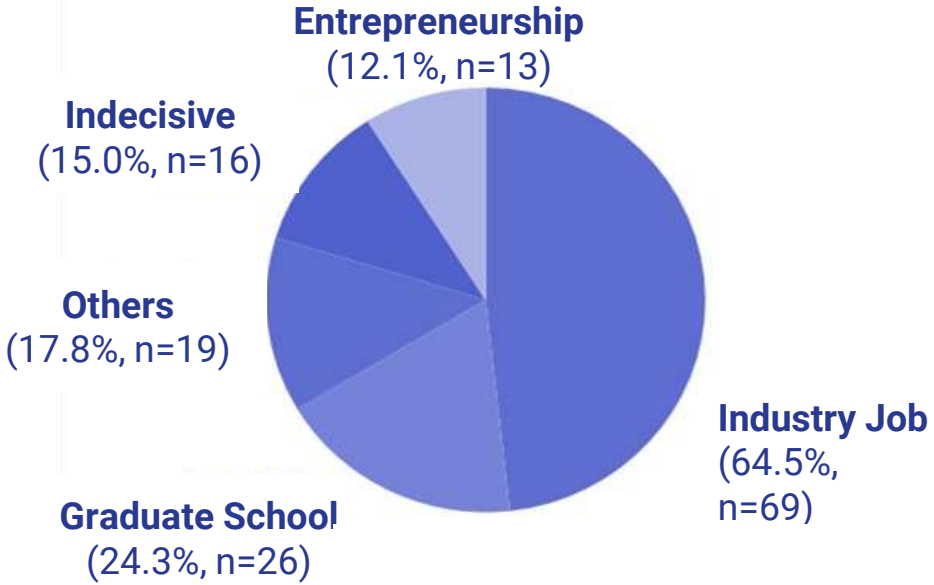
Typical Hiring Process for CS Internships in USA

Apply	Screening	Interview
• Applying at Career Fairs • Online for Paid/Unpaid/Co-op Internships in Computing Disciplines	• Resume by Application Tracking System, • Referrals, or • Recruiters or a • Technical/Aptitude Test	• 0-4 remote or in-person Technical *Requires: Coding + Data Structures + System Design* • Behavioral interviews.

Expectations: Technical Skills + Professional Skills + Technical Interview Preparation & Practices + Working outside the curriculum

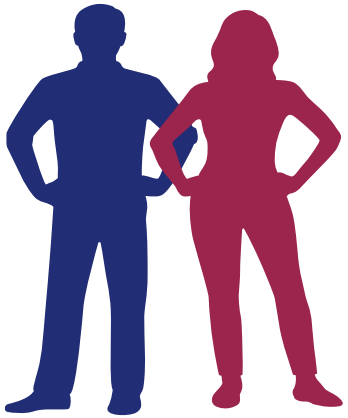
Learners Goals and Expectations

Professional Goals

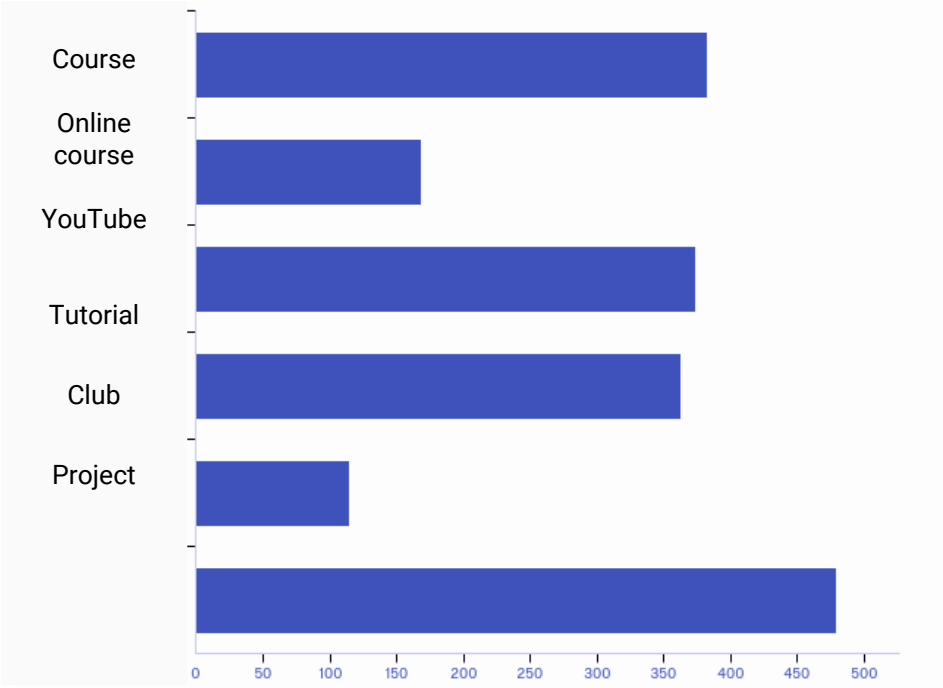


Understanding Professional Identities and Goals of Computer Science Undergraduate Students. ACM SIGCSE '18.
Amanpreet Kapoor and Christina Gardner-McCune.

Learning Preferences

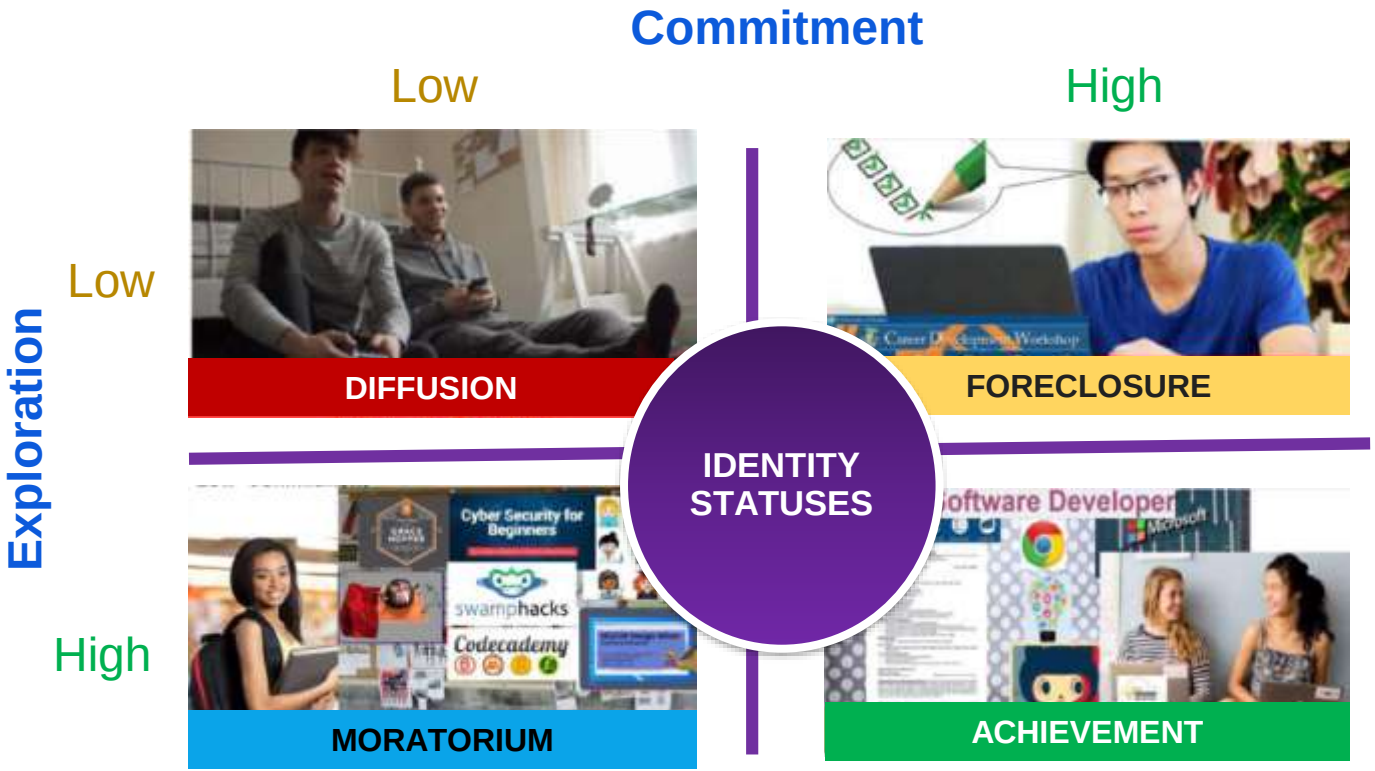


599 UF CS/CE Students : Learning a Computing Skill



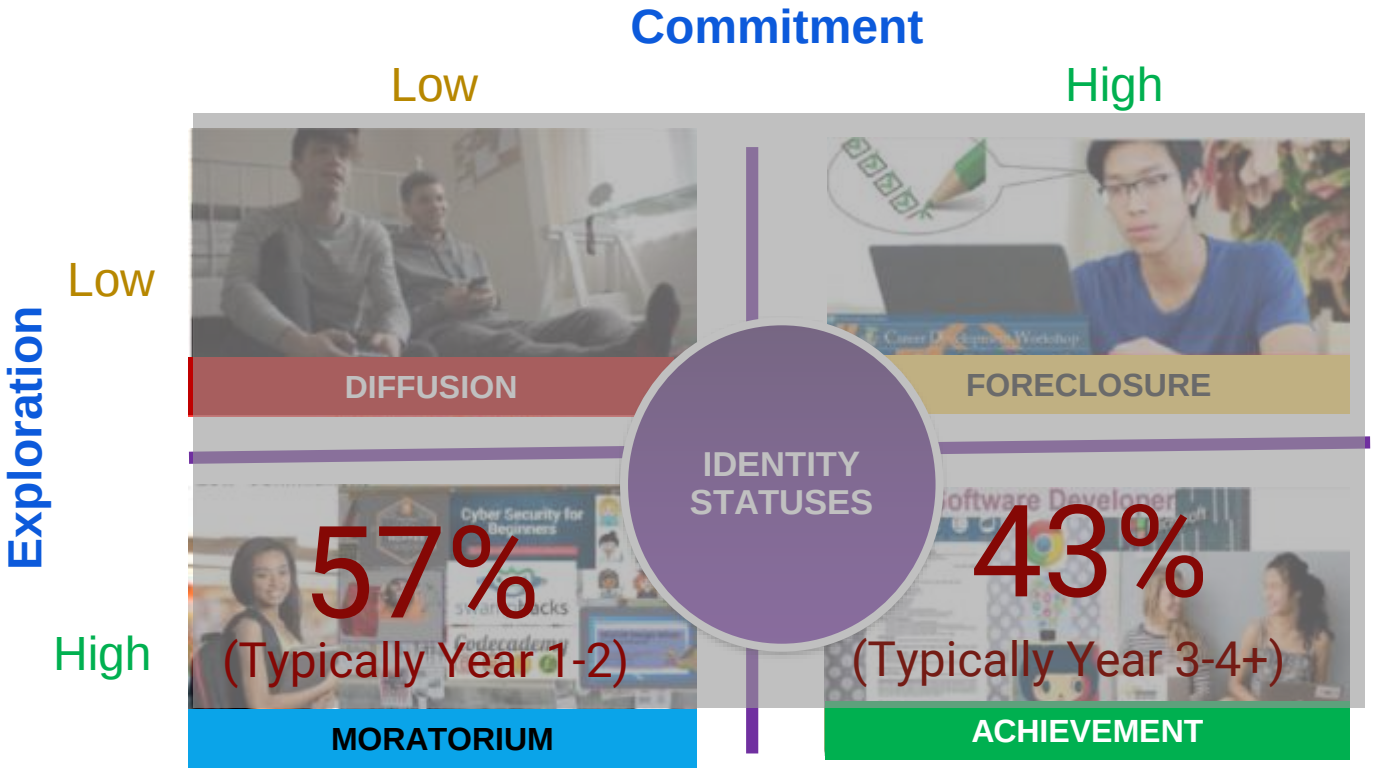
CS Identity Development Interview Project: Understanding the role of CS communities of practice on the development of CS undergraduate students' professional identity.
SIGCSE Special Project Grant. Christina Gardner-McCune and Amanpreet Kapoor.

Formation of Professional Identity

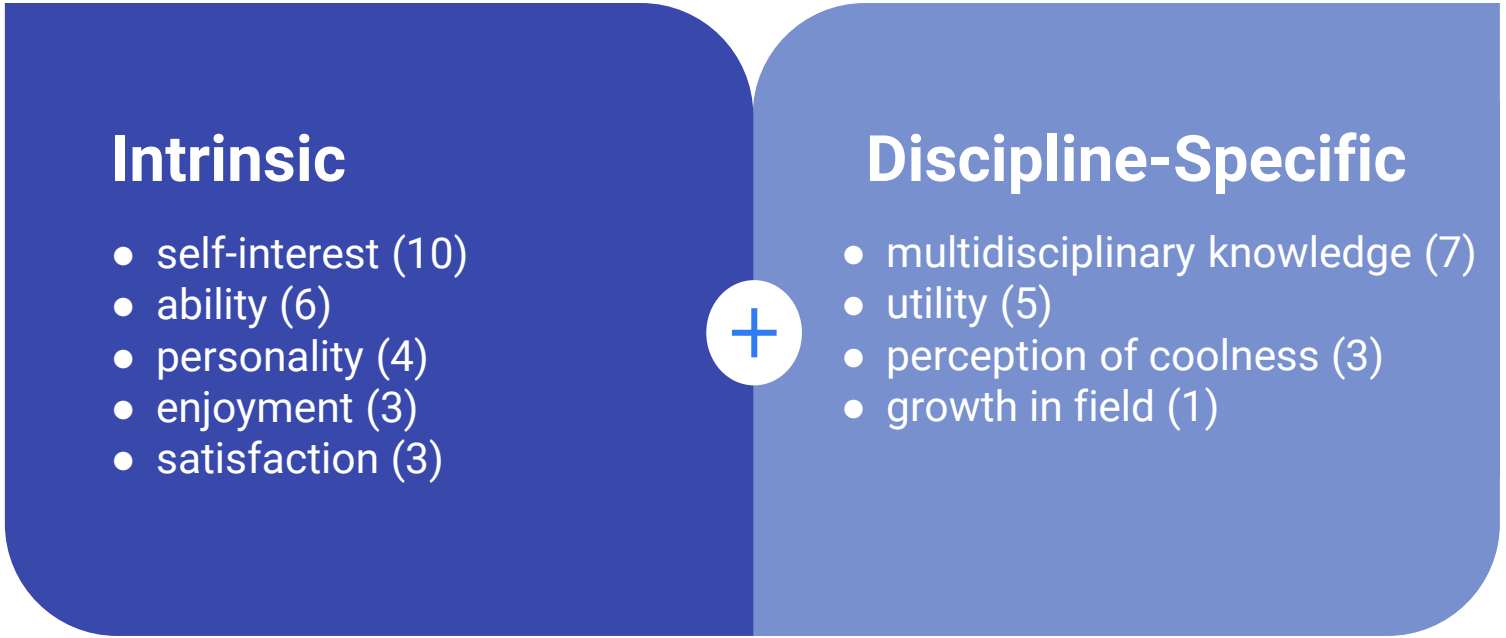


Marcia (1966). Development and validation of ego-identity status.

Formation of Computing Professional Identity



Reasons for Student Exploration & Commitment to a Computing Profession



Our Current Educational Model

Skillsets

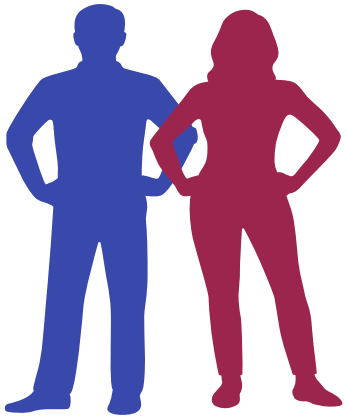
Attitudes

Goals

Expectations

Beliefs

Motivations



Large Classrooms

Understanding How Computer Science Undergraduate Students are Developing their Professional Identities. ACM SIGCSE '18.
Amanpreet Kapoor and Christina Gardner-McCune.

Our Current Educational Model

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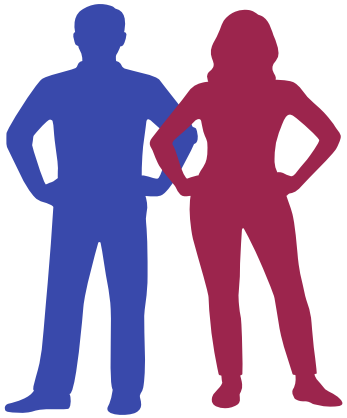

Understanding How Computer Science Undergraduate Students are Developing their Professional Identities. ACM SIGCSE '18.
Amanpreet Kapoor and Christina Gardner-McCune.

Equitable & Inclusive Learning Experiences

for empowering our students & supporting learning

What activities did you participate in on-campus during undergraduate?

Learning Opportunities Outside of Classroom in Computing

acm

sec
software engineering club

uf wicse

Clubs/Student Organizations

I feel that clubs are probably the place where I get the most practice just **talking to peers** and being friendly and approachable and sociable with other people. Uh, you know, other, other people who are both **my age** but want, have **similar goals** as me. They want to be professionals and w**e're all together and learning how to act like it**.

So, you do a project and present at the club. **Those are good because you get to show what you learned** and encourage other people to participate.

Events @ Clubs/Student Organizations

01	Technical Development	• Technical Workshops • Alumni Events • Job Shadowing Events • Hacking Events
02	Professional Development	• Company Info Sessions • Job Application Workshops • Professional Development Workshops • Formal Mentoring
03	Community Building	• General Body Meetings • Social Events

Affordances @ Clubs/Student Organizations

Software Engineering Club

Club Focus

Technical Development (High) &
Professional Development (Low)

Collaborative Project

Building an event posting React App in self-selected teams over a semester

Professional Development

How to secure internships and technical interview preparation

Exclusive professional development events such as American Express cookout for club attendees

Technical Skill Development

Teaching authentic tools such as Web APIs, React, Git, Nodejs, etc.

Software Engineering Club

Challenges

- Participation of women
- Tailoring projects targeting students at different levels of competence

Events:

- General Body Meetings
- Company Info Sessions
- **Technical Workshops**
- Job Application Workshops
- Alumni Events
- Social Events
- Professional Development Workshops
- Formal Mentoring
- Job Shadowing Events
- Hacking Events

Affordances:

- Exploratory Environment
- Build Professional Skills
- **Opportunity to work on team**
- **Build a working project**
- **Gain technical skills demanded by industry professions**
- Socialization and Networking
- Mentoring Opportunities
- Understand Oneself
- Become Aware of Professional Expectations
- Work with like-minded peers
- Motivation through recognition

Software Engineering Club

I think most of it [testing or Scrum **skills**] came before I had the Citi internship. The **Citi internship** kind of **reinforced** it and **showed me the application** of it being used in the day to day life. But I kind of have those kind of things before as well.

[In] the **software engineering club**, I worked on one of their applications that they're building and they had **regular Scrum**, so every day at 9:00 pm everyone gets on a call. And everyone talks about what they did and any problems that they face and what they're going to be doing. So I think my Scrum, becoming good at Scrum came a lot from that from being exposed to that.

Women in Computer Science & Engineering Club (UF WiCSE)

Club Focus

Professional Development (High), Community Building (High), and Technical Development (Low)

Community Building

Create a supportive community for women in computing

Mentorship events like "Big Gator, Little Gator"; Speed Dating; etc.

Professional Development

Resume and Portfolio Building

Exclusive hiring events

Office hours

Speakers from Industry

Technical Skill Development

Job shadowing program with InfoTech, Gainesville

WiCSE Club

Challenges

- More technical competence development opportunities
- Recruit more women

Events:

- General Body Meetings
- **Company Info Sessions**
- Technical Workshops
- Job Application Workshops
- Alumni Events
- **Social Events**
- **Professional Development Workshops**
- Formal Mentoring
- **Job Shadowing Events**
- Hacking Events

Affordances:

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Classroom vs Independent learning vs Clubs Skill Development

Yeah, I feel like almost everything that I've learned in these clubs are invaluable for what I've been seeing in the job atmosphere. **I think it's definitely possible and a little bit more manageable to be able to learn technical skills on your own separately**. But to be able to command a room or to be able **to communicate professionally with adults is a different skill** that you can't necessarily read from a book.

WiCSE Leader and Member

So, I gained a lot of skills from there and I noticed that even **companies valued [professional] skills a lot more than**, not a lot more, but to the same extent if not more as compared to strictly technical skills. And I think I was **able to use that a lot during interviews** and being able to talk to company reps about my experiences with them and show how it's **built my character** throughout the years.

Clubs role in Building Confidence and personality

By joining in a CS student organization, it really **helped me knowing [my professional goals]**. So I would say if I didn't get into a student organization, first of all, I wouldn't have all those **opportunities**. And then if I didn't have those opportunities, I don't feel confident enough to be in the CS field. Maybe by just taking the classes, even though even if I have like really **high GPA**, I still don't, I still **wasn't** like **confident** enough. So, **joining a student organization I start like being more confident** and of what I want to be in the future, if that makes sense.

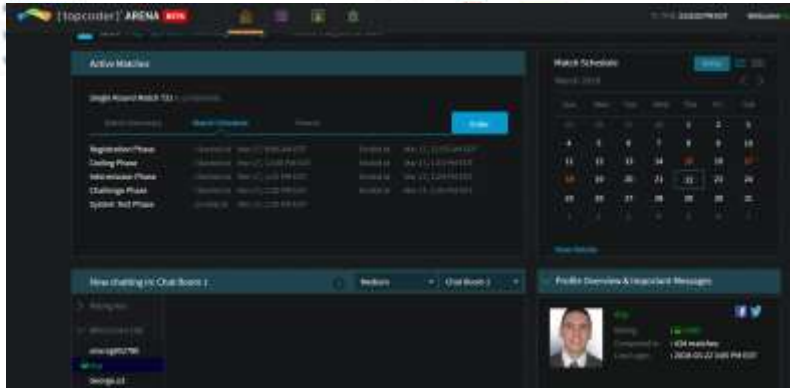
Besides just study, what, what's more unique about myself, what can **make me stand out in the CS field**? So, if you are just taking classes, like I just feel like, okay, I'm taking this class and you are taking the same class. So there's nothing [separating] me from other people even if my GPA is higher. But **by joining student organization**, like there are something unique about myself, like **unique** about me is that I communicate with people. Like I have a good **personality**. Like, I know how to communicate with the professional people that way. And then I think those, those features or those things, **makes me stand out**, um, during **interview** or even in the future, like **working**.

WiCSE Leader & Member

Competitions & Coding Challenge Events

Challenges

- Fast paced
- High stakes
- High-Difficulty
- Requires lots of training & practice
- Not beginner friendly



Affordances

+ Pathways for employment
+ Improves technical skills
+ Work with like-minded people
+ Opportunity to work on a team or individually

Hackathons

Challenges

- Fast paced / learning on the fly
- Intimidating for beginners/shy students
- May require travel costs

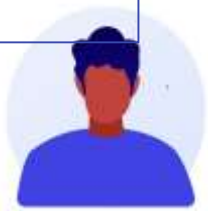
Affordances

+ Employers' expectation
+ Learn new technologies on the go
+ Build working products solving real problems
+ Work in a team
+ Jump-start or finish a personal project
+ Mentorship
+ Opportunity to fail in a low-stakes
+ Scaffolded skill building

I looked at **going into hackathons to explore projects** that I can build **over the weekend** [...]. And so eventually, what I ended up doing is throughout the past two years, **I've experienced a whole range of technologies**. But I haven't completely decided what specifically I want to focus on after graduating. So **I've attended eight or nine hackathons now.**

And at each hackathon, I try to **experiment with the new technology**. So I've done **web app projects**, I've done mobile app development projects with I've used web frameworks like **React Native**, and I've used **Android Studio,** and the **iOS** version of it, and then I've done hardware kind of hacks, and I've just tried to... I've used **API's to do machine learning and big data analysis** and of all that as well at different hackathons. And I've also done a **VR project.** [...]

So in the start when I didn't like web technologies, but now looking at how React and React Native work and how you can modularize all these concepts. And then when I started being more exposed to it, I think my interest for it started increasing as well. [...] So I think **going from not being interested to something to being something that I see a lot of value in**, I think that's where my interest has kind of changed.



Personal Projects

Challenges

- Requires personal agency & time management
- Getting started
- Defining a reasonable scope
- Willingness to seeking help & receive feedback
- Completing the project

Affordances

+ Employers' expectation
+ Understand one's likes and dislikes
+ Self-paced
+ Technical skill development
+ Explore topics or tools not covered in the curriculum
+ Distinguish yourself from the crowd
+ Show incremental growth
+ Opportunity to collaborate

Conferences

Challenges

- Traveling costs
- Getting scholarships is highly competitive
- Conflicts with coursework & classes
- Can be too large

Affordances

+ Networking
+ Meet like minded people
+ Gain/Practice professional skills
+ Dedicated time with recruiters

Events

+ Workshops
+ Networking
+ Career Fair
+ On-site interviews

Career Fairs

Challenges

- Prior company research, Resume, Portfolio
- Often very large & long lines
- Students may not receive feedback on their applications
- Suggestion - apply online
- Class conflicts

Affordances

+ Networking
+ Explore types of jobs
+ Understand professional expectations

"Since freshman year, I have been very career-focused. I have **attended career showcase & CDW** [Career Development Workshop] every semester. Furthermore, before my first internship, I **attended workshops** and **visited the Career Resources Center** several times before I felt prepared (resume & interview-wise) for employment."

P368, Senior Female, interned

Internships

Challenges

- Can be unpaid
- Can be hard to get into
- Students can have bad experiences

Affordances

+ Gain authentic experiences[1,2]
+ Build technical skills[1,2]
+ Understand industry expectations
+ Develop professional skills[1,2]
+ Secure future employment[3]

Source

1. Amanpreet Kapoor, Christina Gardner-McCune. 2019. Understanding CS Undergraduate Students' Professional Development through the Lens of Internship Experiences. SIGCSE '19
2. Joann J. Ordille. Internships Enhance Student Research and Educational Experiences. https://cra.org/crn/2008/11/internships_enhance_student_research_and_ educational_experiences/
3. National Association of Colleges and Employers. 2014. The Class of 2014 Student Survey Report. Bethlehem. Retrieved August 31, 2018 from www.naceweb.org

Impact of Industry Internships

It has given me experience as well as encourage me to stay with computer science.

- Male, Senior

It allowed me to see what it was like working in a professional environment and how working in a company would be.

– No gender specified, Sophomore

It helped me understand how the industry works actually. I did realize that I might not want to do the work I was doing in my internship but look at something else.

- Female, Senior

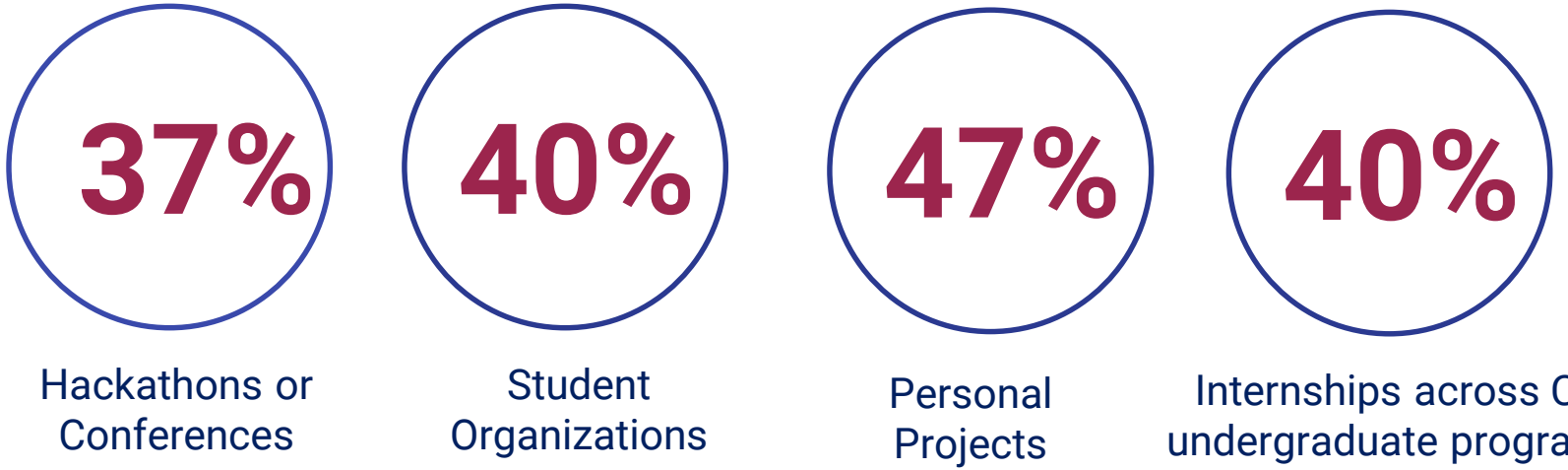
Themes for Impact of Internships on on Career Goals (N=34)	%
strengthened students' commitment to CS	41.1%
encouraged exploration of CS careers and industries	35.3%
promoted personal/professional growth	17.6%
developed awareness of professional expectations	14.7%

Source

Amanpreet Kapoor, Christina Gardner-McCune. 2019. Understanding CS Undergraduate Students' Professional Development through the Lens of Internship Experiences. SIGCSE '19

Learning Outside the Classroom

Participation in



Challenges in Learning Opportunities Outside of Classroom

Recruitment-process

Psychological

Socio-economic

What **barriers** do CS undergraduate students, who do not intern, **encounter** in **securing** an industry **internship**?

Why haven’t you interned yet?

Psychological constraints
E.g. low self-efficacy and lack of agency

“**Not enough experience** or intriguing personal projects; **Lack of experience**, work-wise and coding-wise.”

- P376, Senior Male

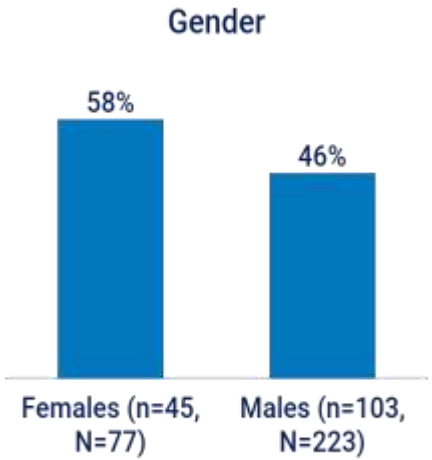
“I am **not very far in the computer science major** yet and I have not gone seeking out internships.”

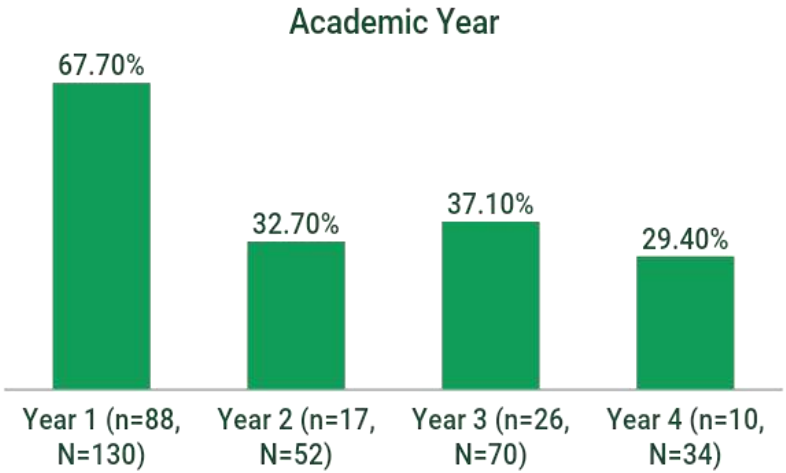
-P287, Sophomore Female

Barriers to Securing Industry Internships in Computing | ACE 2020 | Amanpreet Kapoor & Christina Gardner-McCune

Why haven’t you interned yet?

Psychological constraints
E.g. low self-efficacy and lack of agency





Why haven’t you interned yet?

Socio-economic constraints
e.g. work and family responsibilities

“I **haven't applied**, I had a job to support my living and school expenses and leaving for an internship would have been too much strain on me. I **support myself**, so I couldn't lean on my parent's **financials**.”

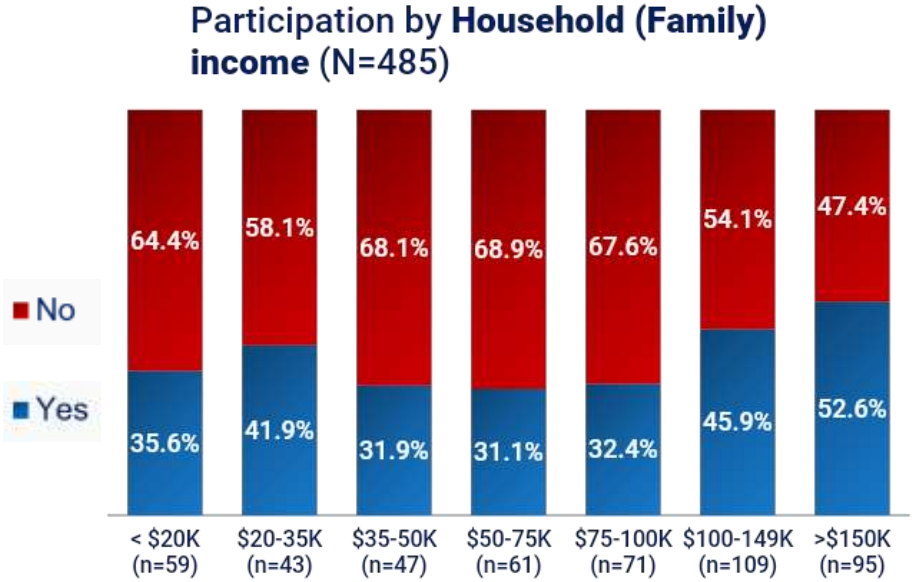
-P183, Senior Male

“I haven't had the time since I have a **job and classes**, and I don't think I'm far enough into the major to be able to take on an internship.”

- P654, Sophomore Female

Why haven't you interned yet?

Socio-economic constraints
e.g. work and family responsibilities



z	**p-value**	η^2
-2.76	**0.006**	0.016

Why haven’t you interned yet?

Recruitment-process constraints

e.g. involvement in projects & extra-curricular activities, managing time with coursework

“The internship process is difficult. I **applied and interviewed with multiple companies but I didn't do great on the technical interview side** because I didn't take Data Structures course yet, although I taught myself some Data Structures it didn't help that much due to my lack of deep understanding.”

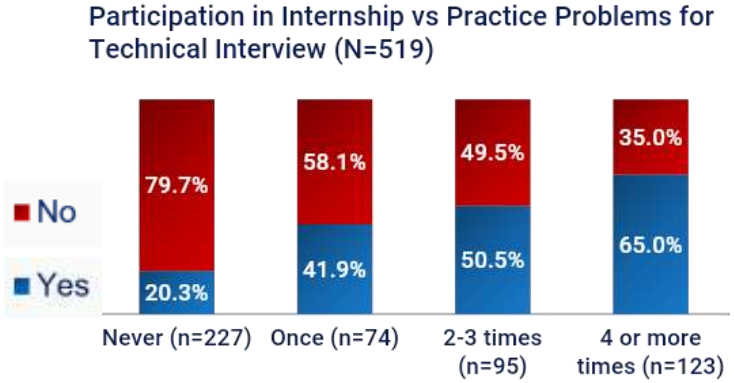
-P673, Junior Male

“Recruiters that I have talked to have said to work on side projects. Companies that I have applied online to have all rejected my application.”

- P250, Sophomore Male

Why haven't you interned yet?

Recruitment-process constraints
e.g. involvement in projects & extra-curricular activities, managing time with coursework



z	p-value	η^2
-8.75	**<0.001**	0.14

Engagement: Median Weekly Hours on Career Preparation

Intern_yes = 2-3 hours
Intern_no = 1 hour

z	p-value	η^2
-4.4	**<0.001**	0.04

Barriers to Securing Industry Internships in Computing | ACE 2020 | Amanpreet Kapoor & Christina Gardner-McCune

CS students fail to secure an internship not only due to less technical proficiency, but also due to :

Psychological constraints
E.g. low self-efficacy and lack of agency

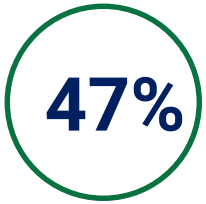
Socio-economic constraints
e.g. work and family responsibilities

Recruitment-process constraints
e.g. involvement in projects & extra-curricular activities, managing time with coursework

Barriers to Securing Industry Internships in Computing | ACE 2020 | Amanpreet Kapoor & Christina Gardner-McCune

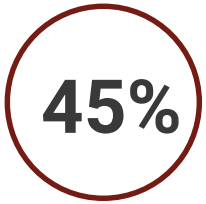
Gaps between Industry and Academia (Interns)

How well has the CS curriculum at the university prepared you for industry?



Effective

Pretty well I'd say. It has taught me to teach myself how to code in new languages at least.
- Male, Senior



Needs Improvement

Only somewhat. It's been mostly personal investment in different technologies. [University] only provides the "paper" that allows you to get in the door. The rest is on you.
- Male, Sophomore

Our Role as Academics

Create pathways for smooth **transition** of students from **college to industry** ensuring that the CS graduates are **technically and professionally** competent.

Source

Joint Task Force on Computing Curricula, Association for Computing Machinery (ACM) and IEEE Computer Society. 2013. Computer Science Curricula 2013: Curriculum Guidelines for Undergraduate Degree Programs in Computer Science. Association for Computing Machinery, New York, NY, USA.

Infusing Industry Software Development Practices into an Intro Software Engineer Course

Target Audience: Juniors & Seniors
Only half have had internships

Problem:

- Code review
- Testing
- Evaluating students with multiple technical entry points
- Communication of work
- Peer Feedback

Major Features of the FIR Project:

- Workflow (Revision)
  - Code review
  - Testing
- Adopt a Style Guide
- Revise Design Document for individuals
- Peer Evaluation

UF | UNIVERSITY of FLORIDA

Examples of Integrations

In Course Integrations

- Guest Speakers
- Promote student orgs
- Promote recruitment
- Industry Projects
- Connection to industry roles & responsibilities
- No Class on Career Fair!!!
- Connections to other courses

Extra Credit

- Resume
- Reflection on Career Fair & Interviewss

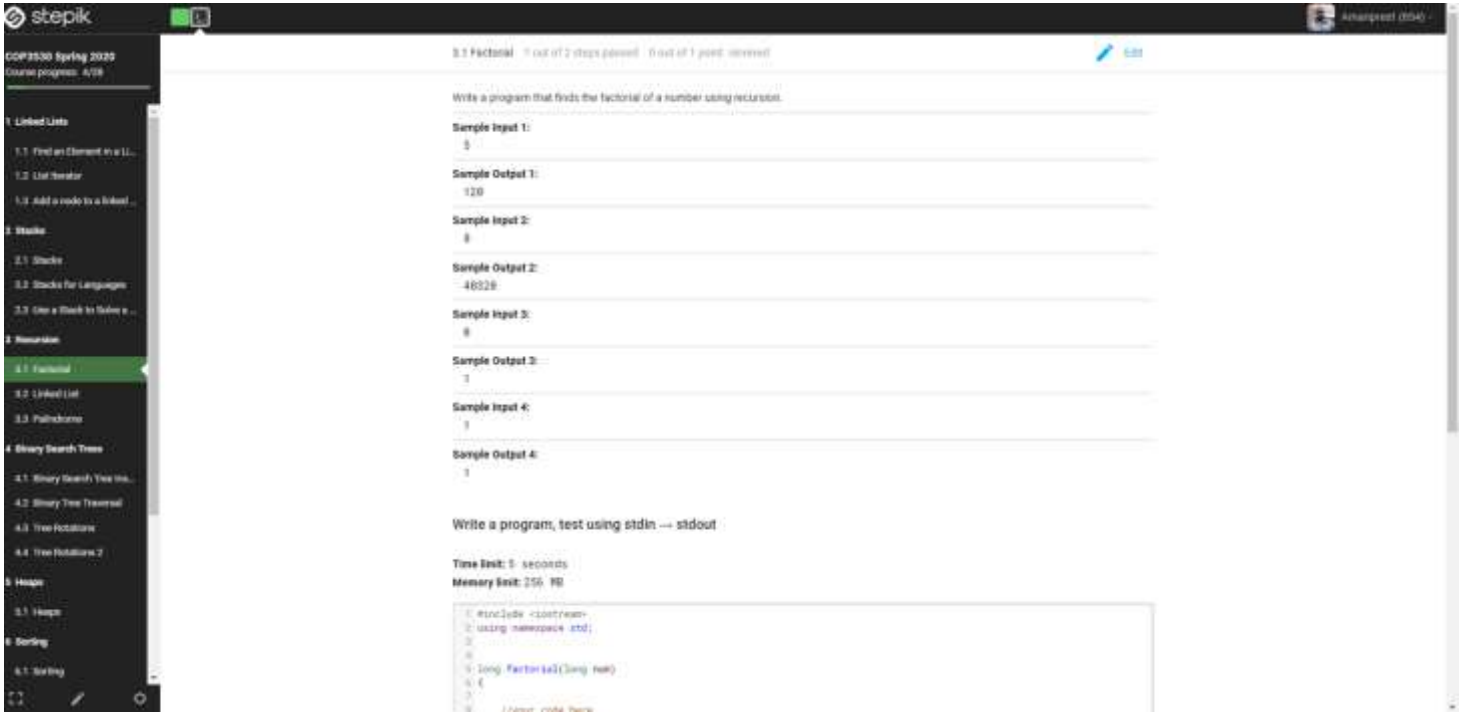
Resources

- Extension ideas for course projects
- Career Connection Center
- Other tools & resources

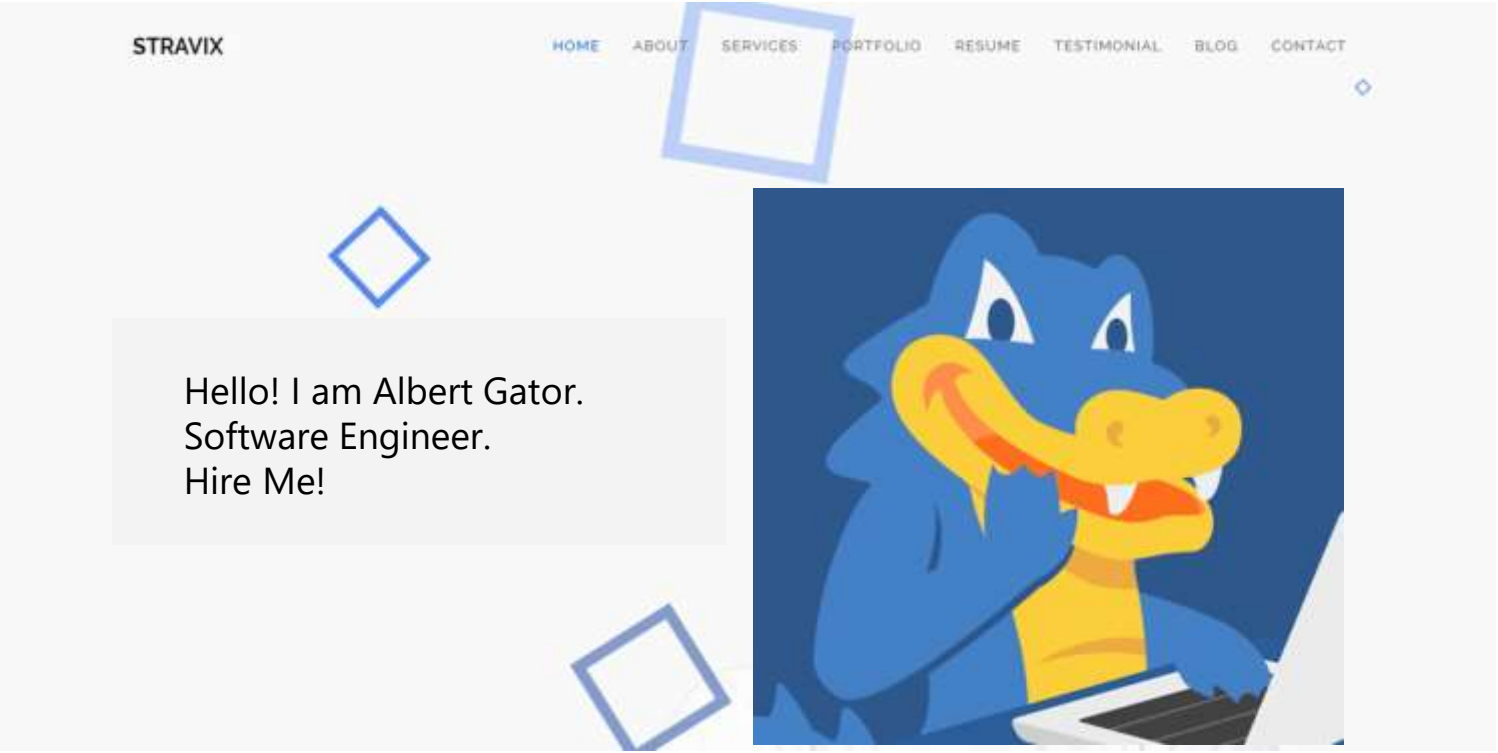
Professional Development

- Personal - I talk to industry & students
- Bring lessons learned back to
  - classroom
  - Student org workshops
  - Faculty meetings

Examples: Stepik E-learning Platform



Examples from the classroom: Portfolios



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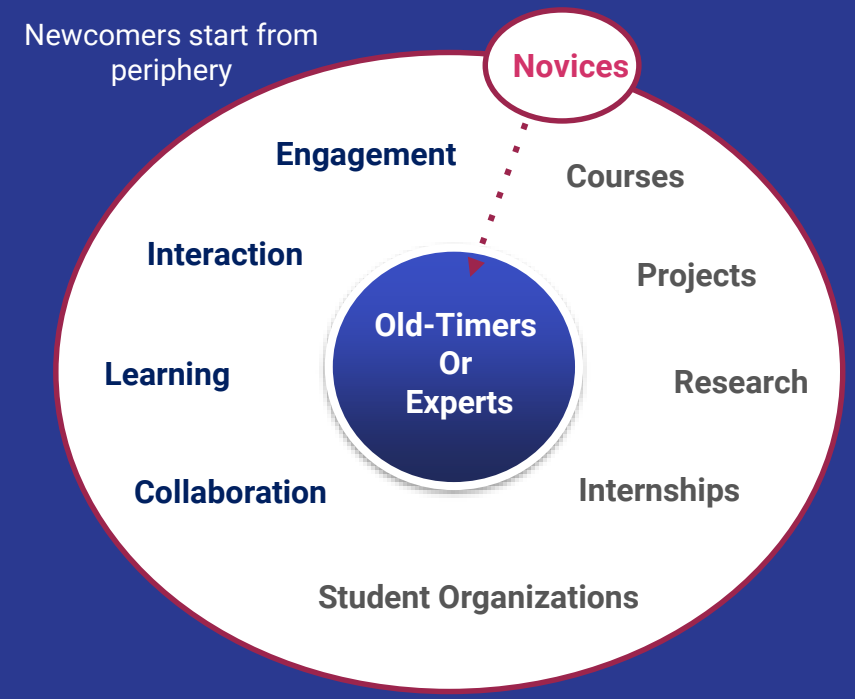
Activity: Reimagine Students Experiences of the Classroom



Reimagine Students Experiences in your Roles

Expectations & Goals

- Expectations of Employers
- Hiring Process
- Professional Goals of Students
- Technical & Professional Needs of Students

Outside of Classroom Opportunities & Activities in your Degree

- Student orgs
- Competitions
- Projects

Challenges & Barriers to Securing Internships & Technical Skill Development

- Psychological
- Socio-economic
- Recruitment process

Lessons Learned for Your Course

- Address challenges & barriers
- Lower the barrier to entry
- Bring awareness of professional expectations

Equitable & Inclusive Informal Learning Experiences

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Slides

http://bit.do/engageCCC