

Computing Undergraduate Students' Participation in Internships

Experiences, Preparation, and Barriers

Committee:

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- Dr. Kristy Elizabeth Boyer (CISE)
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Agenda

- **Part I: Overview**

- Introduction
- Theoretical Grounding

- **Part II: Internship Participation**

- ✓ Study 1: Why are internships important?
- ✓ Study 2: Who is participating in internships and how?
- Developing Personas: Fitting in altogether

- **Part III: Intervention & Evaluation**

- ✓ Study 3: How can we improve our curriculum so that more students intern?
- Study 4: How effective is our pedagogical intervention in preparing students for securing internships?

- **Part IV: Contributions & Conclusions**

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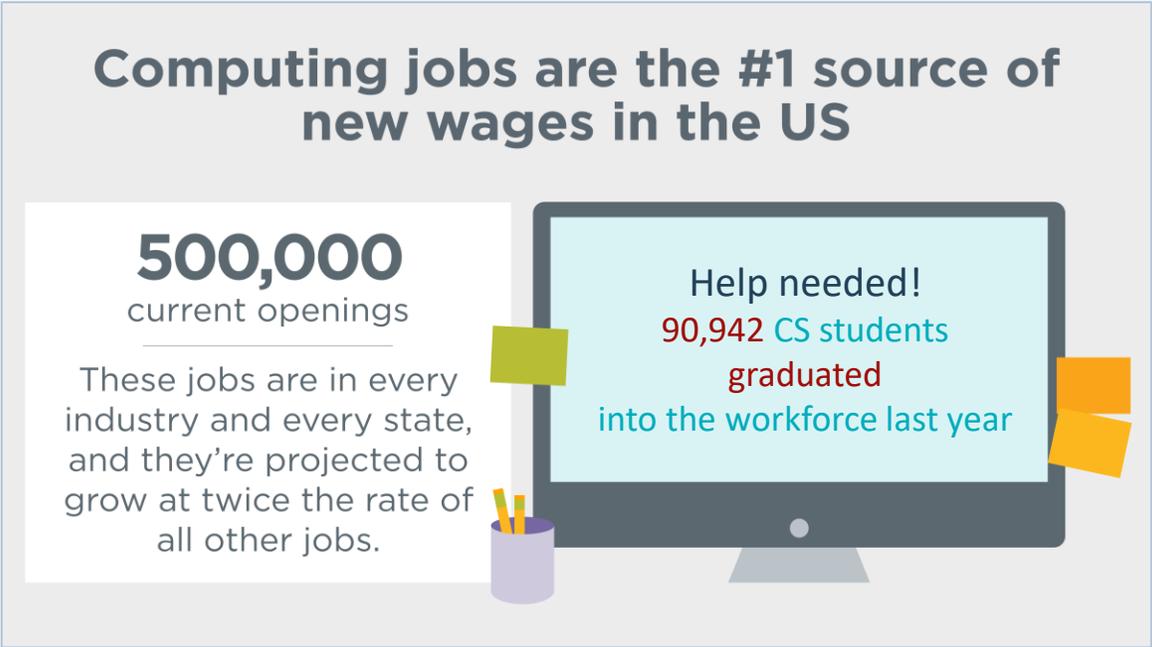
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Motivation

Gap between CS Graduates in the USA vs available jobs in computing



Source: https://code.org/images/cs-stats/Slide6_Computing_Jobs.png



Jobs in Computer and Mathematical occupations 2022-2032;
Software related jobs will grow 22%

Source: Occupational employment projections to 2032. U.S. Bureau of Labor Statistics

Motivation

Underprepared Computing Graduates

Underemployed CS Recent Graduates



Employers report CS graduates **lack**

- Technical abilities, e.g., Testing Code
- Personal skills, e.g., Communication
- Professional skills, e.g., Teamwork

Source:

The Labor Market for Recent College Graduates
<https://www.newyorkfed.org/research/college-labor-market#--:explore=outcomes-by-major>

Sources:

Brechner. Things they would not teach me of in college (OOPSLA 2003);
Radermacher & Walia. Gaps between industry expectations and the abilities of graduates (SIGCSE 2013, ICSE 2014);

Motivation

Internships



Integral part of employers' recruitment process

46%

Employers consider prior experience when hiring new grads

-   Apply classroom knowledge to real-world problems and projects collaboratively
-   Work with modern technologies and gain hands-on experience

RESEARCH QUESTIONS

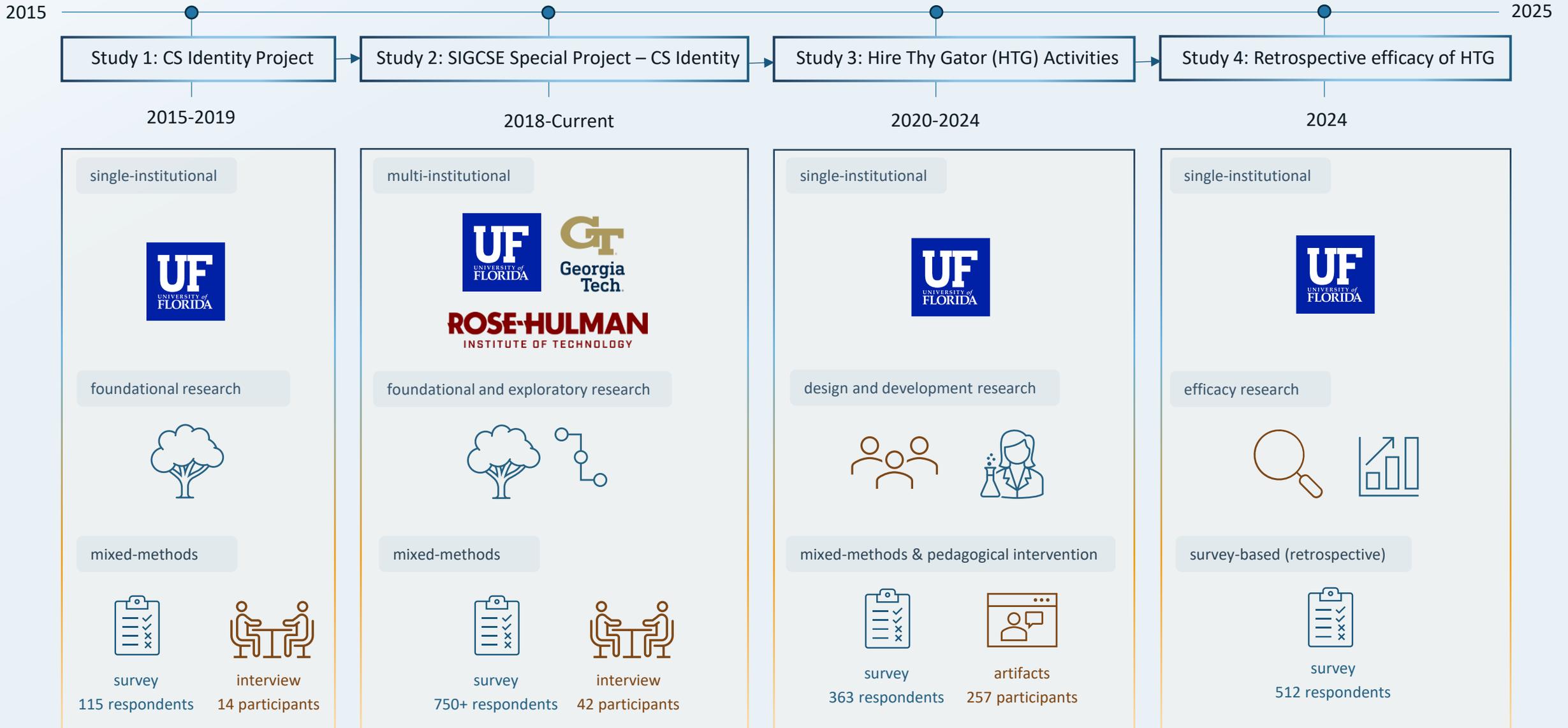
Central Question

How do computing undergraduate students prepare and participate in internships? What barriers prohibit them from participating in internships?

Sub-Questions

- Internship experiences and impact
- Internship participation
- Barriers to participation
- Preparation for securing internships
- Interventions that can help students secure internships

Studies



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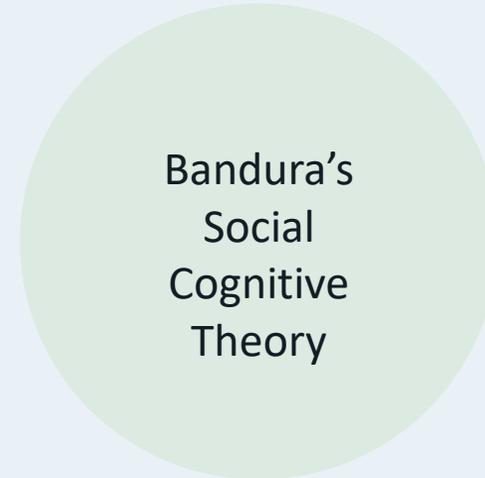
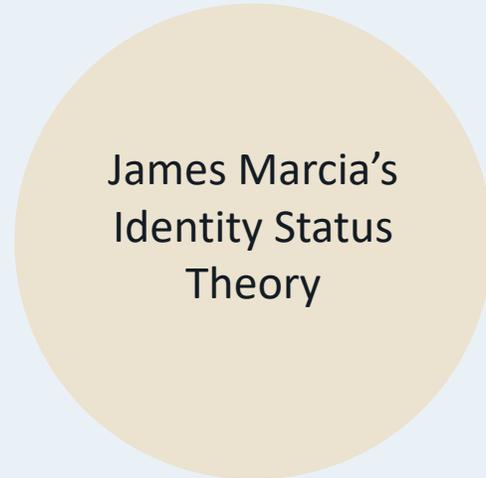
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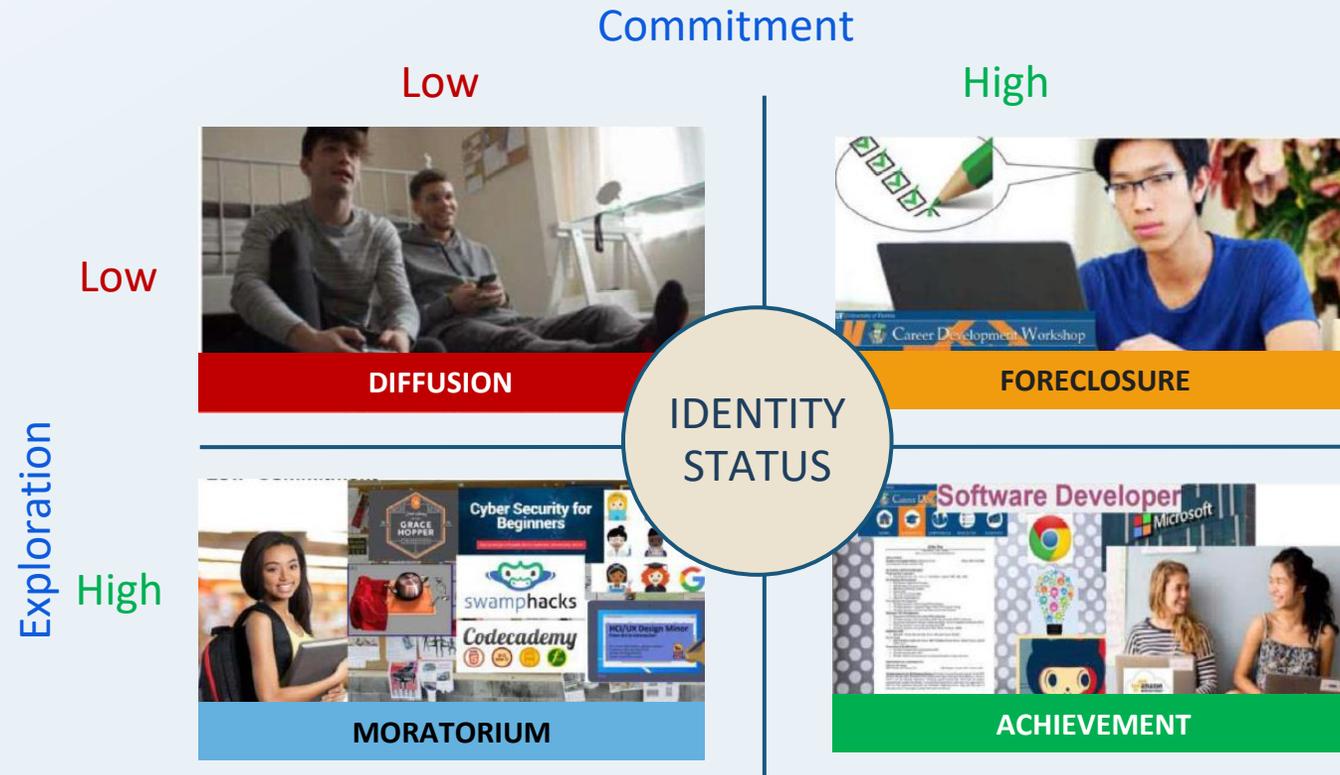
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Theoretical Grounding



Theoretical Grounding

James Marcia's Identity Status Theory



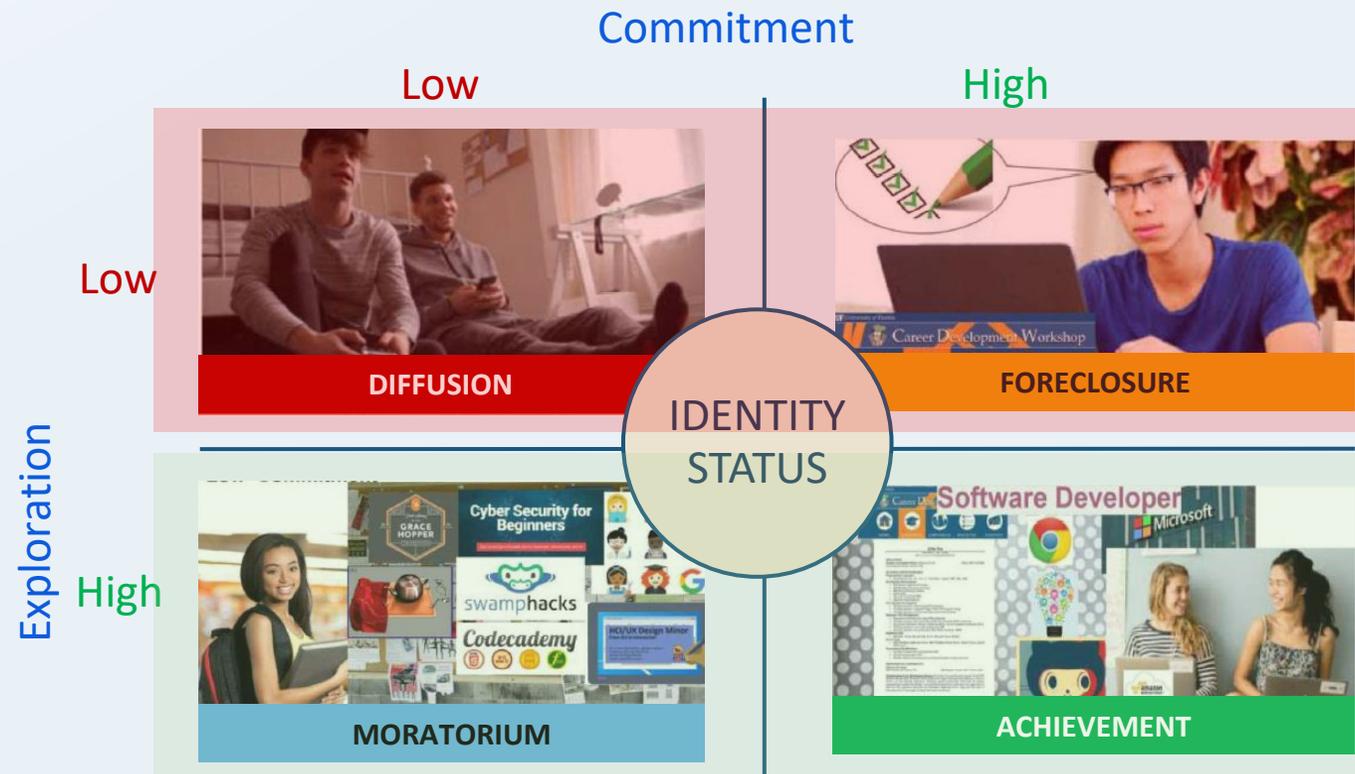
Identity changes over time based on a person's **active** or **passive** exploration and **commitment** to a profession.

Source

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

Theoretical Grounding

James Marcia's Identity Status Theory



Source

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

Use of this theory:

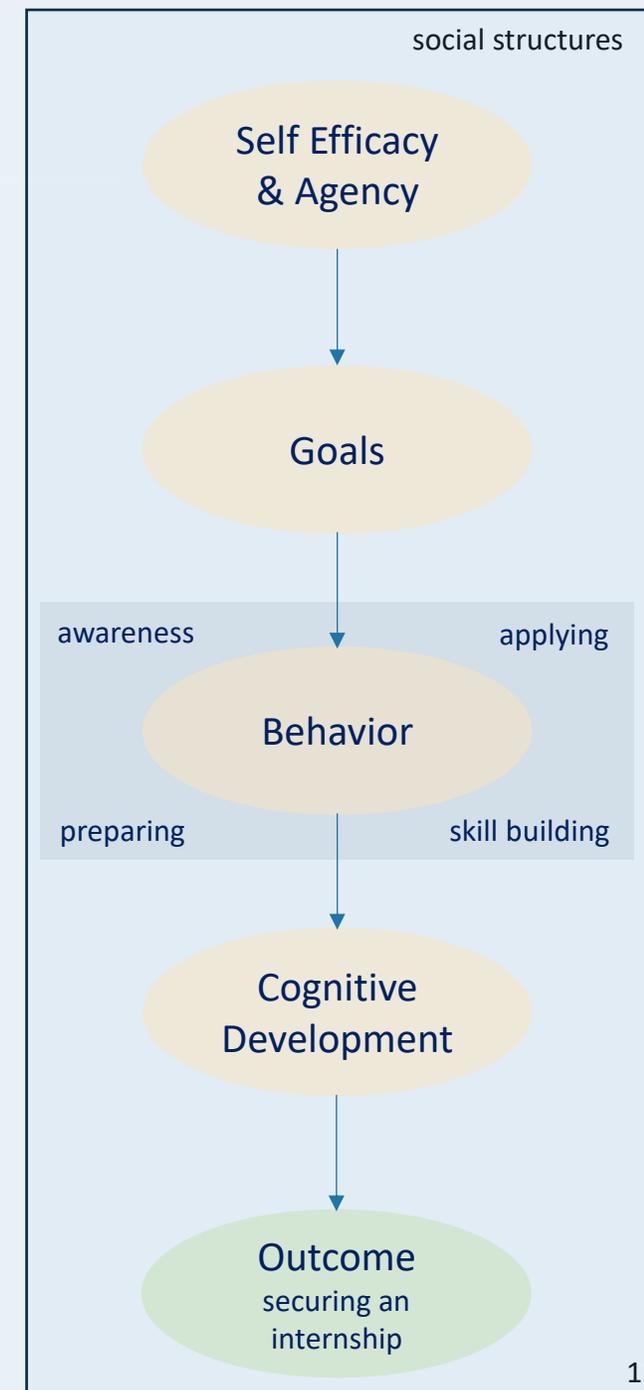
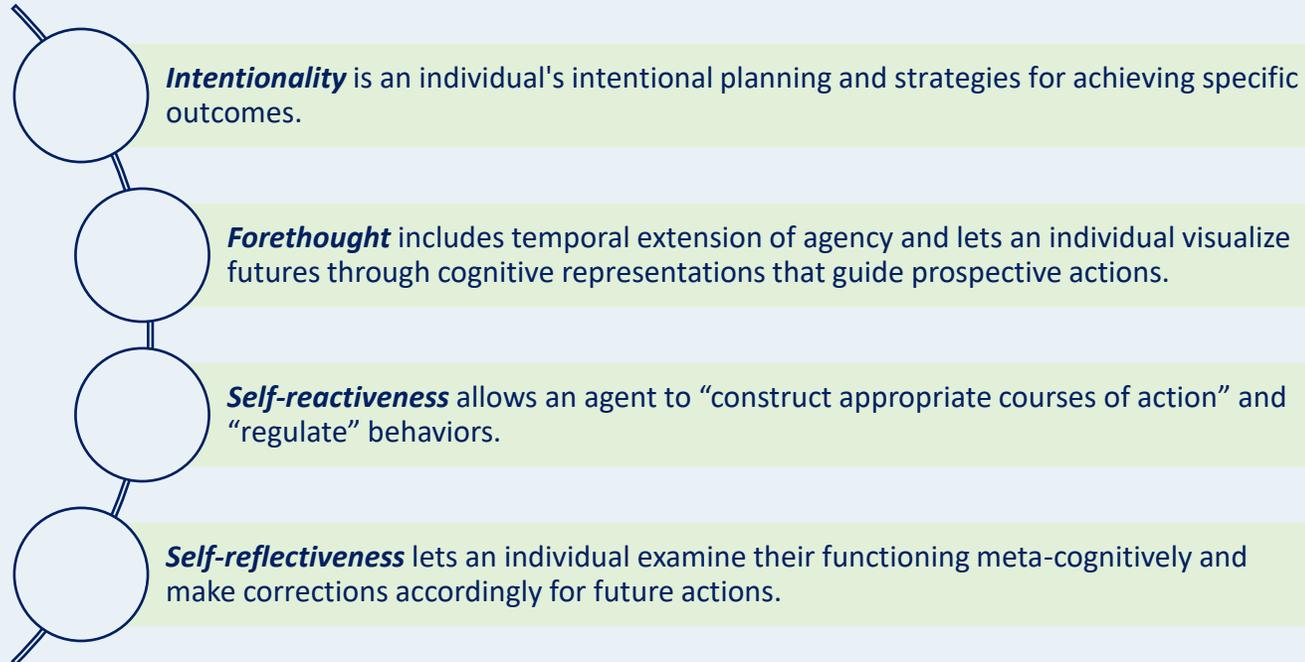
- **Guide Research Design**
 - Relationship between identity formation and participation in internships.
 - **Extended Objective Measure of Ego Identity Status (EOM-EIS, Bennion & Adams, 1986) instrument** in Study 2.
- **Explain Phenomenon**
 - Students in **Moratorium and Achievement** statuses are **more likely to participate in internships** compared to Diffusion and Foreclosure.

Theoretical Grounding

Bandura's Social Cognitive Theory (SCT)

Self-efficacy: belief that one has about their capacity for specific achievements, given domain-specific obstacles.

Agency: an individual's actual ability to deal with a complex task.



Theoretical Grounding

Bandura's Social Cognitive Theory (SCT)

Self-efficacy: belief that one has about their capacity for specific achievements, given domain-specific obstacles.

Agency: an individual's actual ability to deal with a complex task.



Use of this theory:

- **Guide Intervention Design**
 - Study 3: Specific elements of the Intervention cater dimensions of agency.
 - Example: **Surveys after mock interviews promote self-reflectiveness** or **Panel** shows them how others strategize preparation and demonstrate **intentionality**.
- **Explain Phenomenon**
 - Study 2: Students who **exhibit agency** and have avenues that support agentic **properties are more likely to participate in internships**.

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- **Contributions & Conclusions**

Study 1: Why are internships important?

2015

2024

Study 1: CS Identity Project

2015-2019

single-institutional



foundational research



mixed-methods



survey

115 respondents



interview

14 participants

Context and Outcomes for the CS Identity Project

Context and Outcomes for the CS Identity Project

- Goal of the study: **assess CS students' professional identity formation**
- Data analysis and outcomes:
 - **Papers**
 - ✓ *Understanding Professional Identities and Goals of Computer Science Undergraduate Student* (SIGCSE 2018)
 - ✓ *Considerations for Switching: Exploring Factors behind CS Students' Desire to Leave a CS Major* (ITiCSE 2018)
 - ✓ ***Understanding CS Undergraduate Students' Professional Development through the Lens of Internship Experiences*** (SIGCSE 2019)
 - ✓ *Understanding CS Undergraduate Students' Professional Identity through the lens of their Professional Development* (ITiCSE 2019)
 - **Posters**
 - ✓ *Understanding How Computer Science Undergraduate Students are Developing their Professional Identities* (SIGCSE 2018)
 - ✓ ***Deconstructing Successful and Unsuccessful Computer Science Undergraduate Interns*** (SIGCSE 2019) 🏆
 - ✓ *Understanding Aspiring UX Professionals' Professional Development* (UXPA 2018)

Study 1: Why are internships important?

2015

2024

Study 1: CS Identity Project

2015-2019

single-institutional



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Study 1: Findings

Core Finding

RQ1. How do professional internships impact CS undergraduate students?



Strengthen students' **commitment** to CS



Encourage **exploration** of CS careers and industries



Promote **personal/professional growth**



Develop **awareness** of professional **expectations**

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Study 2: Who is participating in internships and how?

2020

2024

Study 2: SIGCSE Sp. Project – CS Identity

Study 2: Internship Recruitment Process

2018-Current

multi-institutional



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mixed-methods



survey

750+ respondents



interview

42 participants

Internship Recruitment Process

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
- Working outside the curriculum

Study 2: Who is participating in internships and how?

2020

2024

Study 2: SIGCSE Sp. Project – CS Identity

Study 2: Context and Outcomes

2018-Current

multi-institutional



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mixed-methods



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Context and Outcomes

- Goal of the study: **assess participation in internships**
- Study 2 was designed during Fall 2018 and data was collected in 2019
- Cross-sectional mixed methods study at **three universities** based on a Concurrent Triangulation Design
- Data analysis and outcomes:
 - **Papers**
 - ✓ *Exploring the Participation of CS Undergraduate Students in Industry Internships* (SIGCSE 2020)
 - ✓ *Barriers to Securing Industry Internships in Computing* (ACE 2020)
 - ✓ *Modeling Determinants of Undergraduate Computing Students' Participation in Internships* (SIGCSE 2023, undergraduate students Megan Wolf and Charlie Hobson were first and third authors)

Contributions from
Survey Data Analysis

Quantitative Model for Participation

Qualitative Model for Barriers

Study 2: Who is participating in internships and how?

2020

2024

Study 2: SIGCSE Sp. Project – CS Identity

Who is participating?

2018-Current

multi-institutional



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survey

750+ respondents



interview

42 participants

Who is participating?

- **40%** of CS undergraduate students **intern before graduation (N=536)**.
- **59%** of the **graduating** CS undergraduate **students (Year 4-5-6) intern**.
- CS students with **higher academic standing, more external involvement, and higher socioeconomic status** are **more likely to intern**.
- CS students in **identity diffusion status** are **less likely to intern**.
- **No statistically significant differences** across **gender, racial/ethnic identity, GPA, and part-time employment**



Similar to Hoekstra, 2021

Results different than Hoekstra, 2021

New results

Paper 1 (who participates and preparation practices)

Paper 3 (factors influencing participation)

Study 2: Who is participating in internships and how?

2020

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Study 2: SIGCSE Sp. Project – CS Identity

Why are students not participating?

2018-Current

multi-institutional



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mixed-methods



survey

750+ respondents



interview

42 participants

Why are students not participating?

CS students fail to participate in an internship due to :



Psychological constraints

E.g. low self-efficacy



Social constraints

e.g. family responsibilities



Financial constraints

e.g. work responsibilities



Recruitment-process constraints

e.g. technical proficiency, involvement in projects & extra-curricular activities

Paper 2 (barriers to participation)

Study 2: Who is participating in internships and how?

2020

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Study 2: SIGCSE Sp. Project – CS Identity

How are students preparing to participate?

2018-Current

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survey

750+ respondents



interview

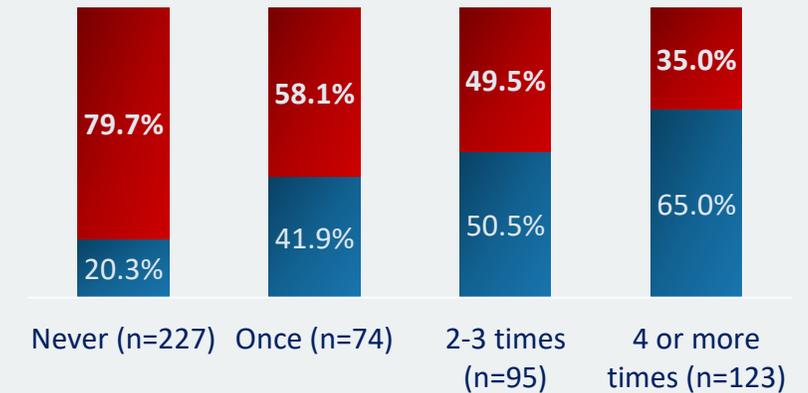
42 participants

How are students preparing to participate?

✓ **Interns** were more **engaged in application process and interview prep** than students who did not participate in internships.

✗ **Unsuccessful interns** relied more on **coursework/GPA** for internships.

Participation in Internship vs Practice Problems for Technical Interview (N=519)



Internship Participation

■ Yes ■ No

z	p-value	η^2
-8.75	<0.001	0.14

Paper 1 (who participates and preparation practices)

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Developing Personas: Fitting in altogether

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Study 2: SIGCSE Sp. Project – CS Identity

Study 2: Motivation

2018-Current

multi-institutional



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mixed-methods



survey 750+ respondents interview 42 participants

Motivation

RQ. How are computing undergraduate students who successfully secure internships different from those who have not interned?



Goal: identify and disseminate how students can secure internships to stakeholders involved in the career development



Developing Personas: Fitting in altogether

2020

2024

Study 2: SIGCSE Sp. Project – CS Identity

Study 2: Prior Work

2018-Current

multi-institutional



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survey

750+ respondents



interview

42 participants

Prior Work

Personas are archetypes of users based on actual data that narrate realistic types of users based on clusters of *goals*, *attitudes*, and *behaviors*.

Pedagogical tool in Classroom

(e.g., Mohan and Chenoweth, 2011)

Conceptual tool to guide research

(e.g., Letaw et al., 2021)

Personas in Computing Education Research

Design tool to collect data

(e.g., Chinn and VanDeGrift, 2007)

Analytical tool for visualizing data

(e.g., Giannakos et al., 2014)

Developing Personas: Fitting in altogether

2020 ————— 2024

Study 2: SIGCSE Sp. Project – CS Identity

Study 2: Data Corpus

2018-Current

multi-institutional



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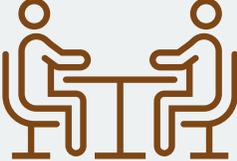


survey
750+ respondents

interview
42 participants

Data Corpus

Primary Data



Interview data from Study 2
42 participants

Secondary Data



Survey Data



Resume

Developing Personas: Fitting in altogether

2020

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Study 2: SIGCSE Sp. Project – CS Identity

Study 2: Participants

2018-Current

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survey

750+ respondents



interview

42 participants

Participants

Purposeful sample (Suri, 2011) from the survey based on:

- (1) Internship status
- (2) Gender identity
- (3) Racial identity
- (4) Year in program
- (5) University affiliation

Developing Personas: Fitting in altogether

2020 ————— 2024

Study 2: SIGCSE Sp. Project – CS Identity

Study 2: Participants

2018-Current

multi-institutional



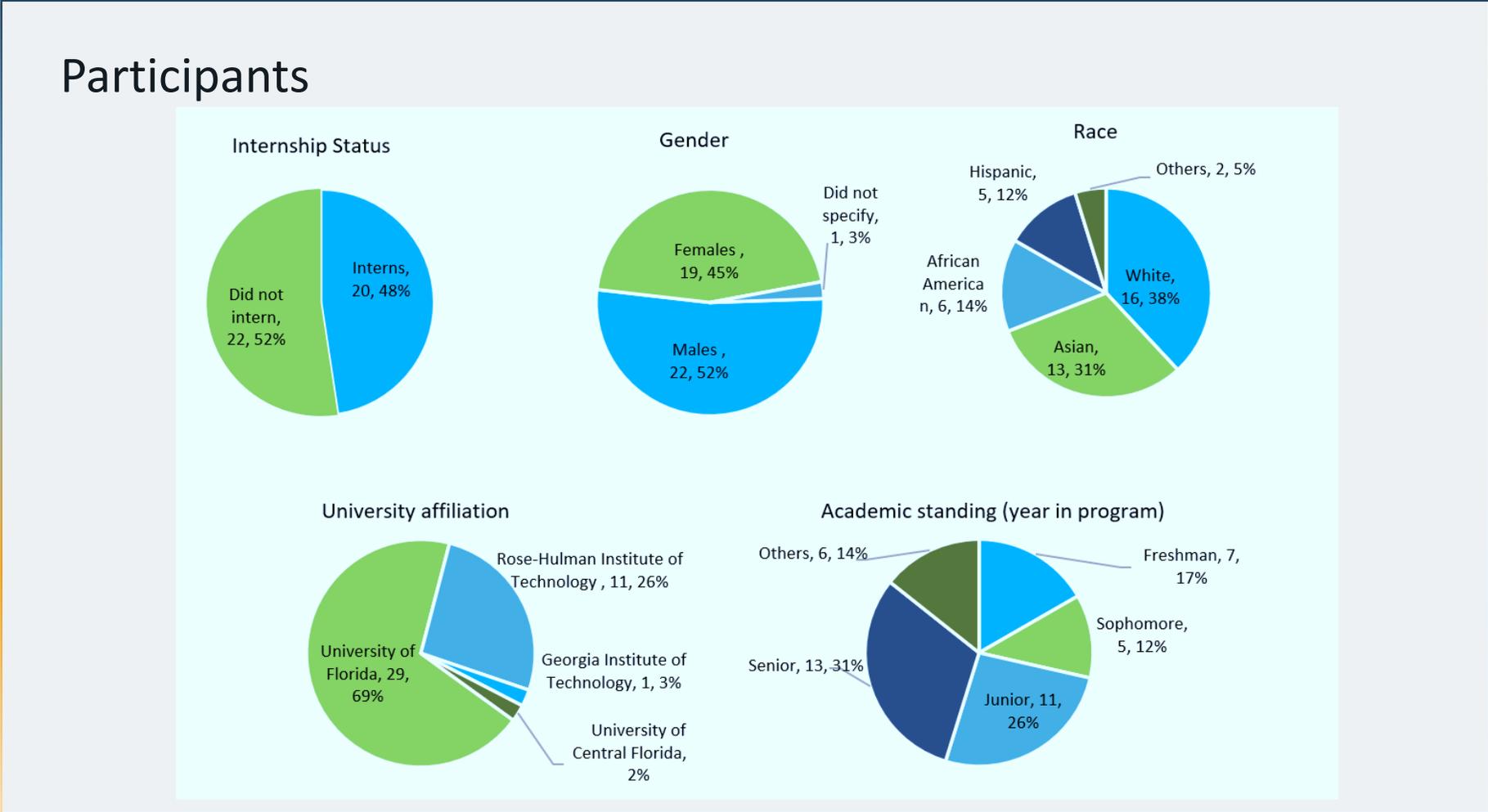
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mixed-methods



survey 750+ respondents interview 42 participants



Developing Personas: Fitting in altogether

2020

2024

Study 2: SIGCSE Sp. Project – CS Identity

Study 2: Data collection

2018-Current

multi-institutional



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survey

750+ respondents



interview

42 participants

Data collection

Semi-structured interview questions (Study 2, 2019)

- based on our findings from Study 1
- developed with my advisor
- tailored based on student responses in the survey
- average interviewing time was 55 minutes (Range: 21-74 minutes, SD: 10)
- compensation via gift cards

Developing Personas: Fitting in altogether

2020

2024

Study 2: SIGCSE Sp. Project – CS Identity

Study 2: Data collection

2018-Current

multi-institutional



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survey

750+ respondents



interview

42 participants

Data collection

Semi-structured interview script

Section	Example Questions
Grand Question	Why did you decide to pursue a Computer Science or Computer Engineering degree?
Career goals and choices	You mentioned you want to become a _____, can you tell me how you got interested in _____?
Preparation for Career	How are you preparing yourself to become a _____ and work in _____?
Professional Experience (e.g. Internships)	<p>Interned: You indicated on the survey, you participated in internships in _____ year, tell me the story of how you got your first internship?</p> <p>Not an intern (Applied but failed): Through prior research we found that only 40% of juniors/seniors pursue internships, why do you think you haven't secured an internship so far?</p> <p>Not an intern (Not applied due to lack of confidence, skills, etc.): Through prior research we found that only 40% of juniors/seniors pursue internships, why haven't you applied for an internship so far?</p>
Professional Development (e.g. Personal Projects, Clubs, etc.)	You have participated in _____ clubs/hackathons/projects. Out of all these, which was most beneficial for your professional growth as a _____?
Degree Program Experience	How has your CS coursework shaped your professional interest and identity?
Hypothetical	What mistakes did you make during the degree program, which you would advise your junior/brother/sister not to make, if they were to enroll into a similar program in future?

Developing Personas: Fitting in altogether

2020

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Study 2: SIGCSE Sp. Project – CS Identity

Study 2: Data analysis

2018-Current

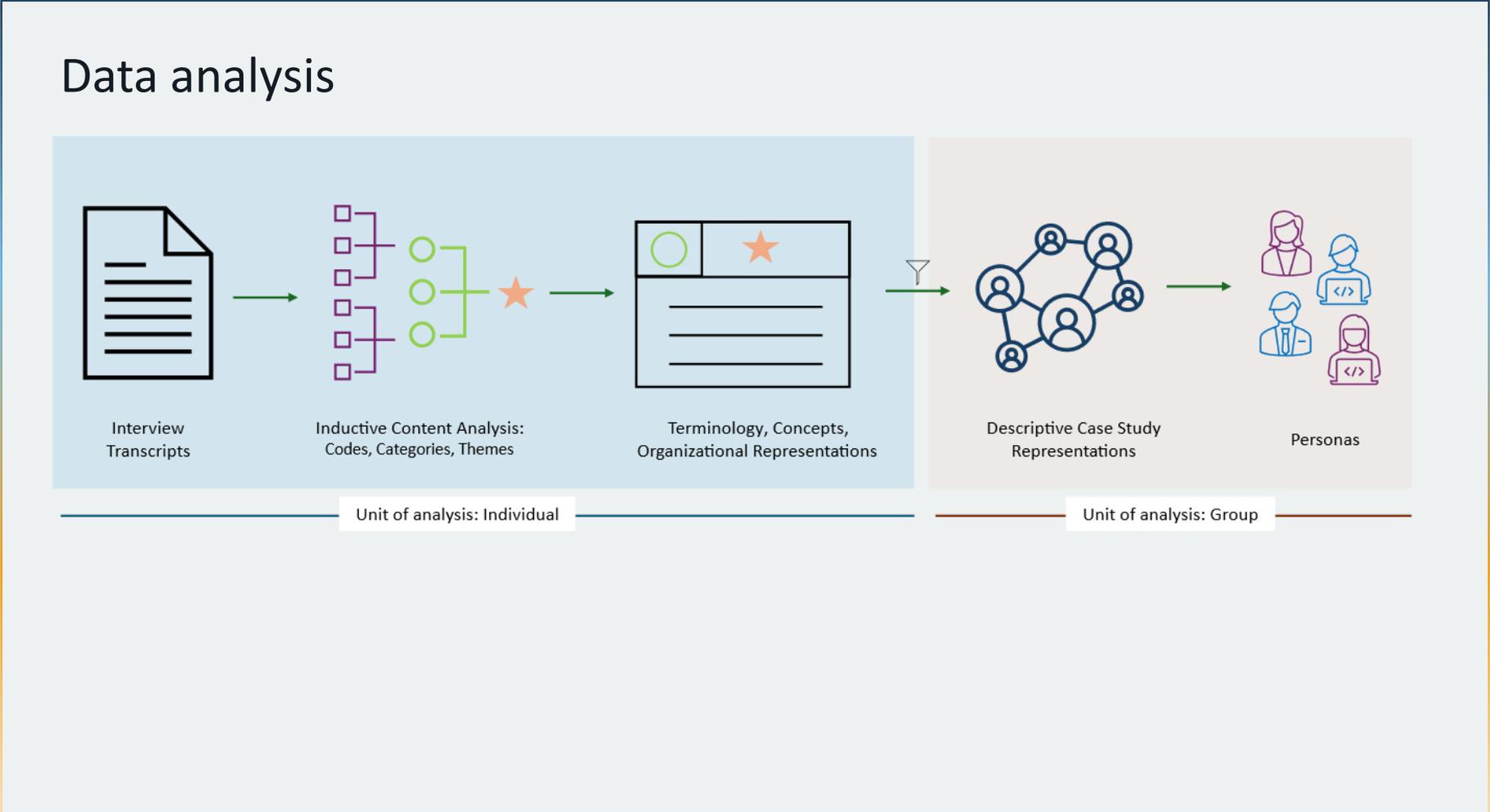
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mixed-methods

survey 750+ respondents interview 42 participants



Developing Personas: Fitting in altogether

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Study 2: SIGCSE Sp. Project – CS Identity

Study 2: Data analysis

2018-Current

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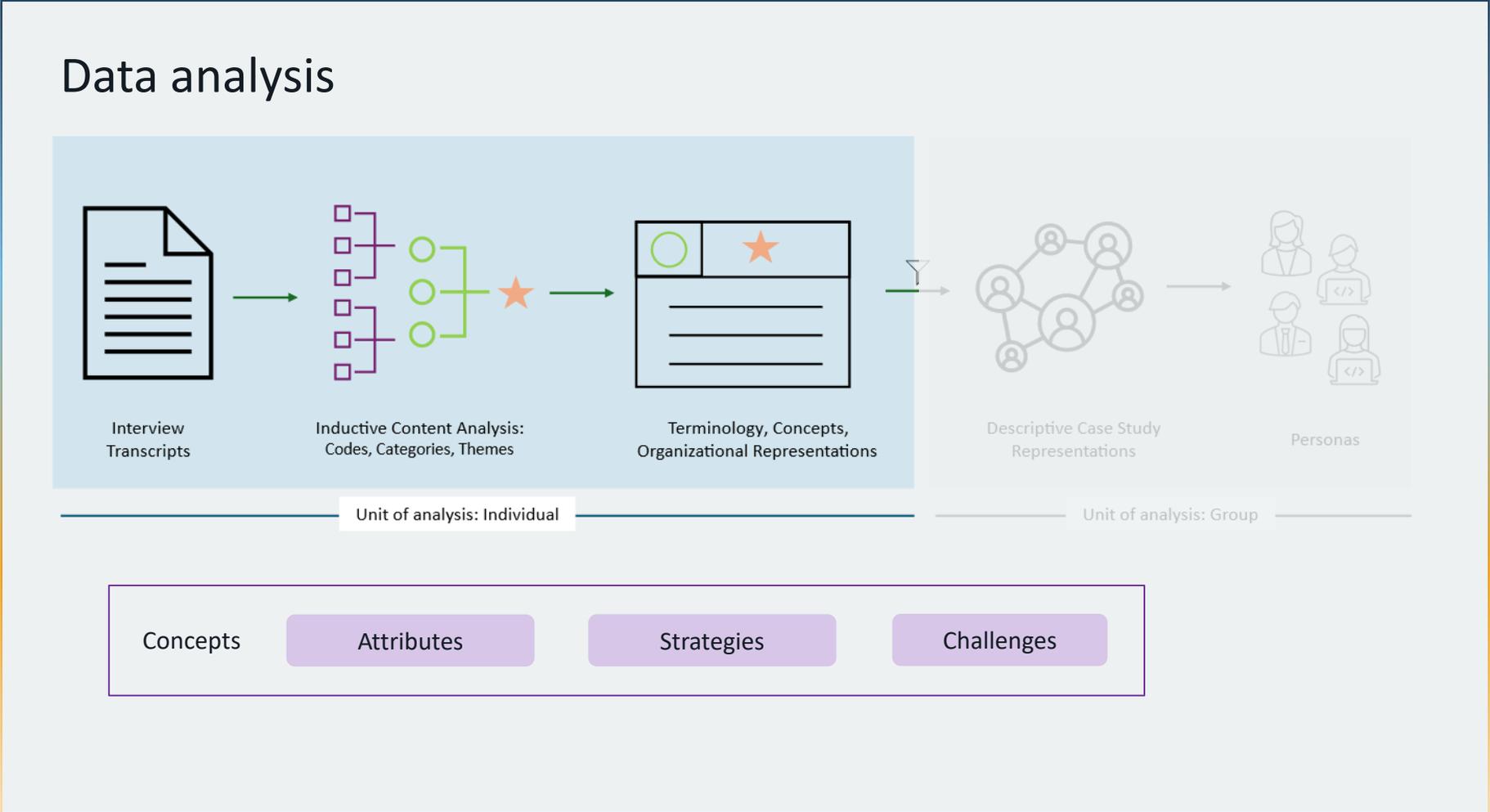


mixed-methods



survey
750+ respondents

interview
42 participants



Developing Personas: Fitting in altogether

2020 ————— 2024

Study 2: SIGCSE Sp. Project – CS Identity

Study 2: Findings

2018-Current

multi-institutional



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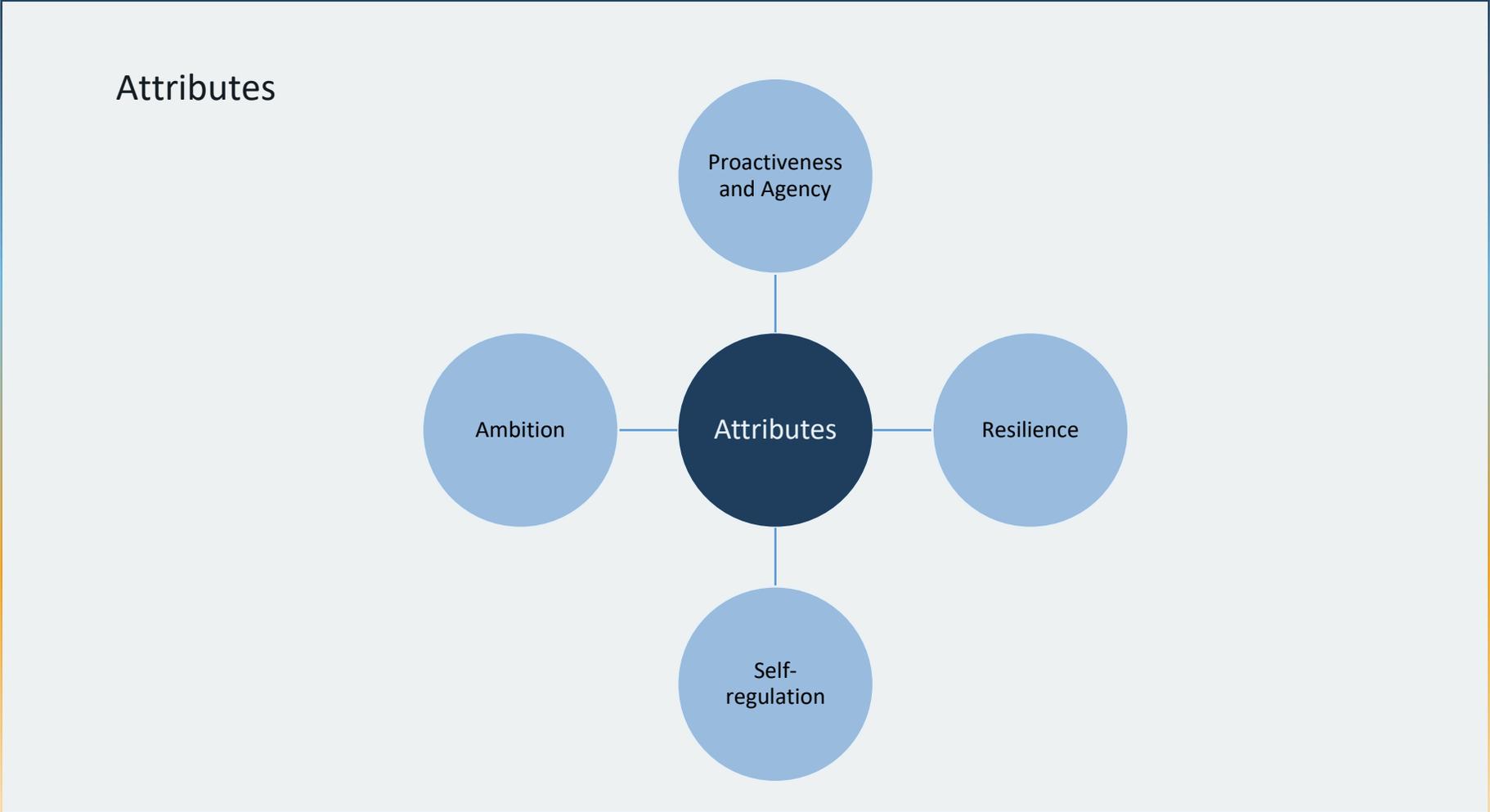
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survey 750+ respondents interview 42 participants



Developing Personas: Fitting in altogether

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Study 2: SIGCSE Sp. Project – CS Identity

Study 2: Findings

2018-Current

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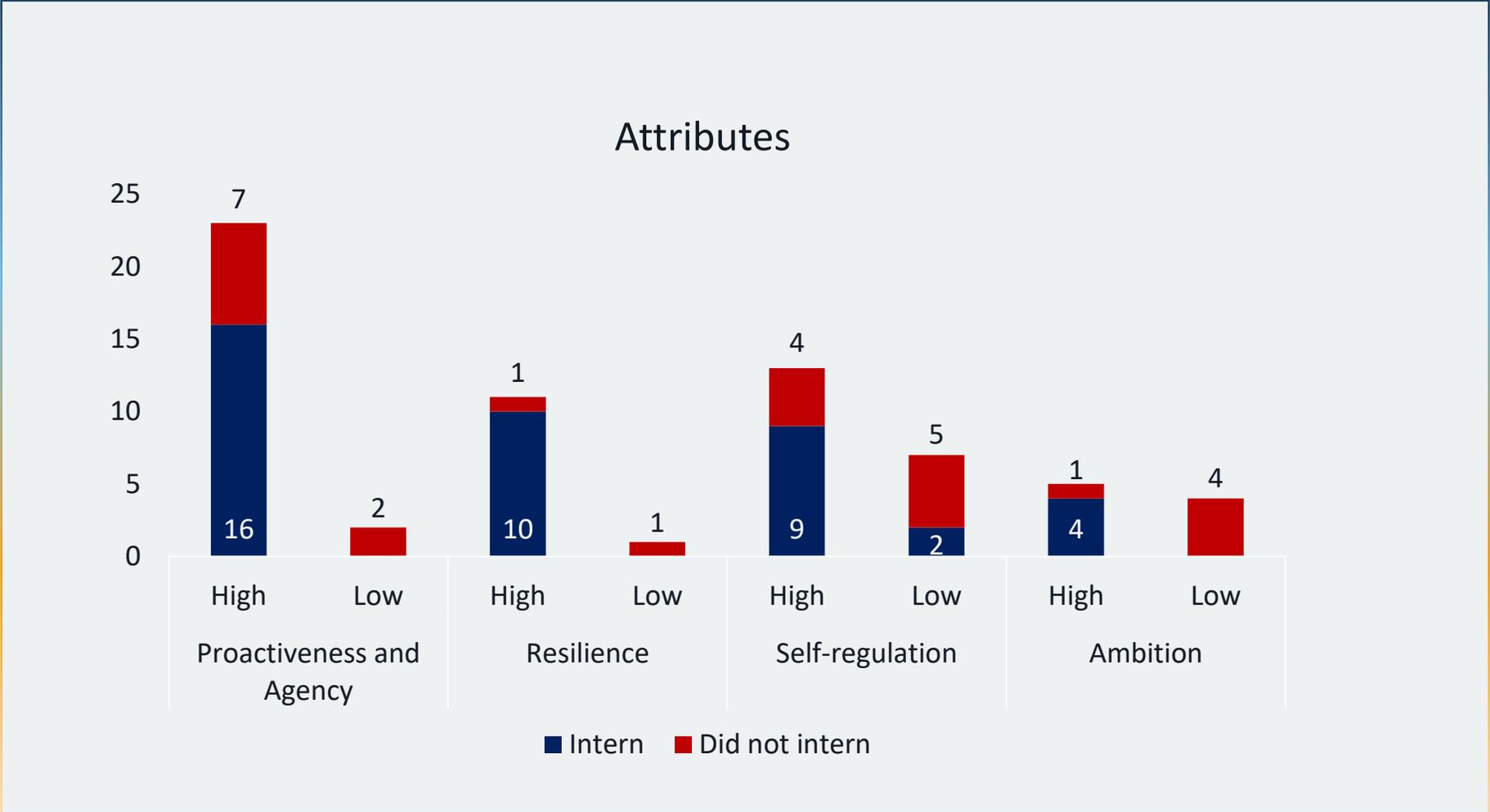


mixed-methods



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Developing Personas: Fitting in altogether

2020 ————— 2024

Study 2: SIGCSE Sp. Project – CS Identity

Study 2: Findings

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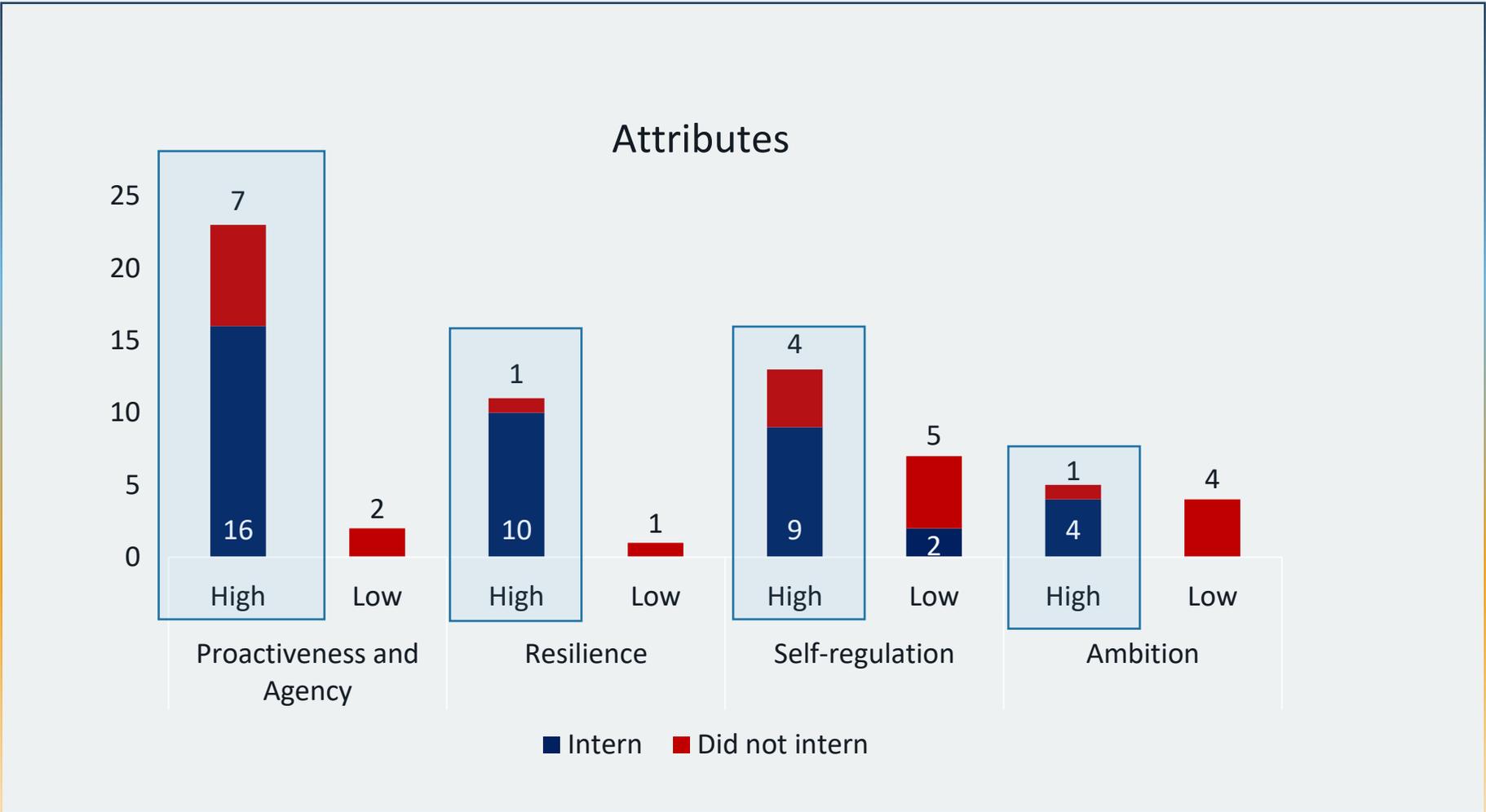
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Developing Personas: Fitting in altogether

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Study 2: SIGCSE Sp. Project – CS Identity

Study 2: Findings

2018-Current

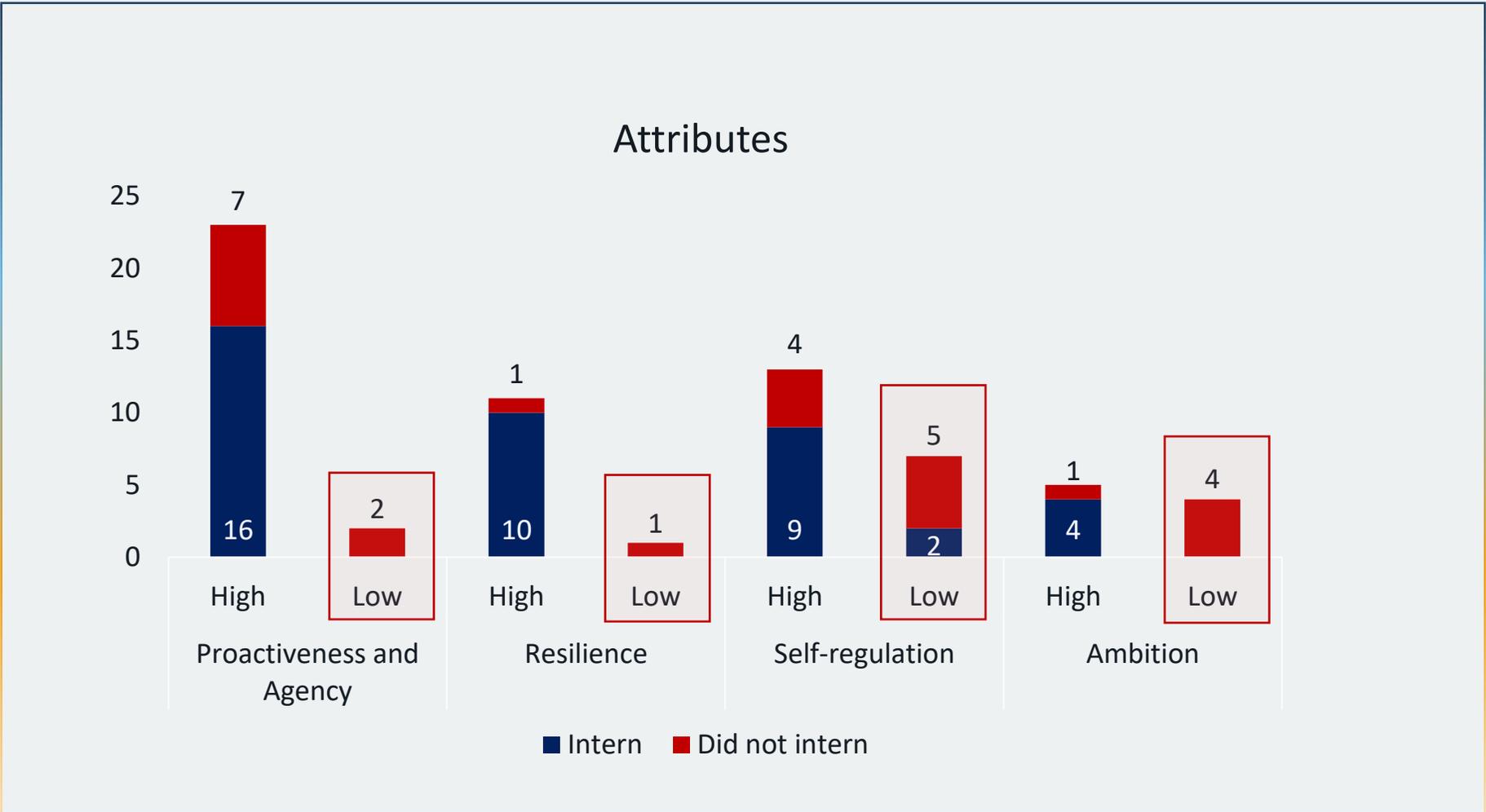
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Study 2: SIGCSE Sp. Project – CS Identity

Study 2: Findings

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survey 750+ respondents interview 42 participants

High Proactiveness and Agency

-  **High Intentionality:** Took initiative in their growth
-  **Skill Building:** Learned independently & collaboratively
-  **Internship Applications:** Applied & prepared for opportunities
-  **Active Engagement:** Joined clubs, hackathons, mentoring & research

I feel what has been **unique about me particularly is my proactivity**. I feel that being proactive has really set me forward, and so I say that I haven't seen the same proactivity in other students. [Proactivity is] **being willing to email, to reach out, talk to recruiters, go to CDW [career development workshop], practice for interviewing, going to interviews, so companies come to events or host events, going to those, it's talking to professors.**

  P900
 Male, Senior Year
 2 Internships
 2 at Big 5 Tech

Developing Personas: Fitting in altogether

2020

2024

Study 2: SIGCSE Sp. Project – CS Identity

Study 2: Findings

2018-Current

multi-institutional



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survey 750+ respondents interview 42 participants

High Resilience

-  **Resilient Mindset** – Persisted through rejections & setbacks
-  **Determined Effort** – Kept applying despite multiple failures
-  **Long-Term Commitment** – Stayed motivated over years
-  **Growth-Oriented** – Learned from failures & improved

SpaceX isn't the best about getting back to you, but they did give me some feedback, though. For them, it was just other candidates had more experience at that time. **I wasn't deterred**, just every interview, whether or not you get turned down, is good experience, because it teaches you how to interview better the next time. **Each time you get interviewed, you learn what to say and what not to say, and you become more confident**, because a lot of the time the first time people get interviews, they're very shy, or they don't quite know how to respond correctly, with the certain amount of confidence, because it's very important not to have too much confidence, but it's also important to have a little bit. Just the right amount.

  P679

 Male, Super-Senior Year

 internship as a test engineer at a defense contractor

 shared that he “applied from sophomore year to my senior year”

Developing Personas: Fitting in altogether

2020

2024

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Study 2: Findings

2018-Current

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survey

750+ respondents



interview

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Summary of Attributes



Participants who interned

- ✓ **High Proactiveness** – Took initiative in career growth
- ✓ **Strong Sense of Agency** – Actively shaped their future
- ✓ **Resilience** – Bounced back from setbacks
- ✓ **Self-Regulation** – Managed time & goals effectively
- ✓ **Ambitious Career Aspirations** – Pursued long-term success



Participants who did not intern

- ✗ **Lower Agency** – Less control over career preparation and goals
- ✗ **Reduced Proactiveness** – Fewer efforts toward opportunities
- ✗ **Weaker Self-Regulation** – Struggled with discipline & planning
- ✗ **Complacency Risk** – Limited motivation for skill development

Developing Personas: Fitting in altogether

2020 ————— 2024

Study 2: SIGCSE Sp. Project – CS Identity

Study 2: Findings

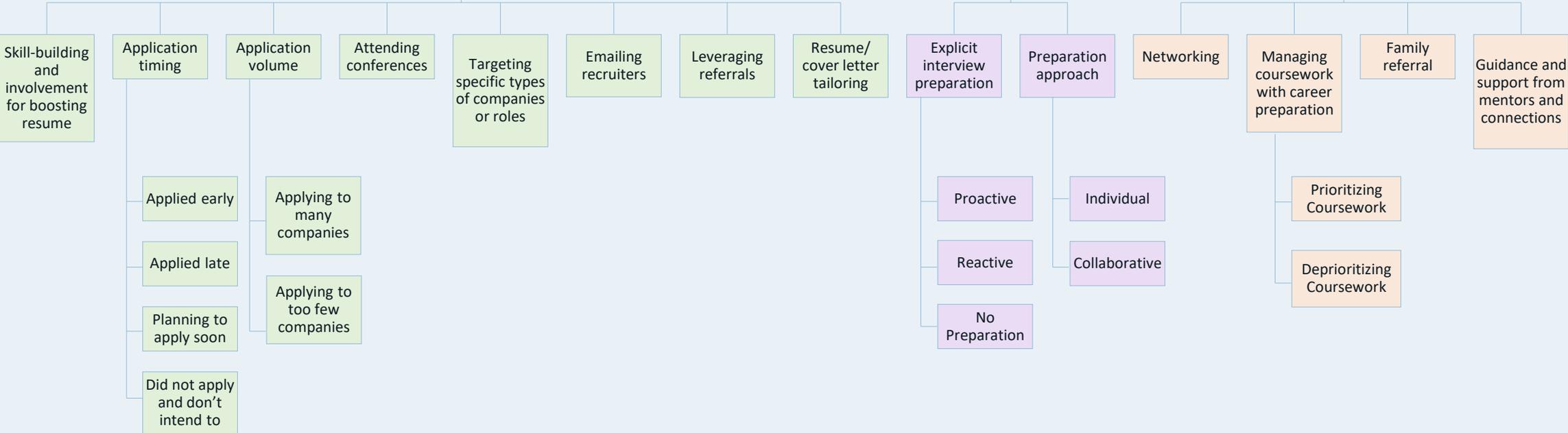
2018-Current

Strategies

Strategies specific to the application phase (getting an interview)

Strategies specific to clearing interviews

Generic strategies



Developing Personas: Fitting in altogether



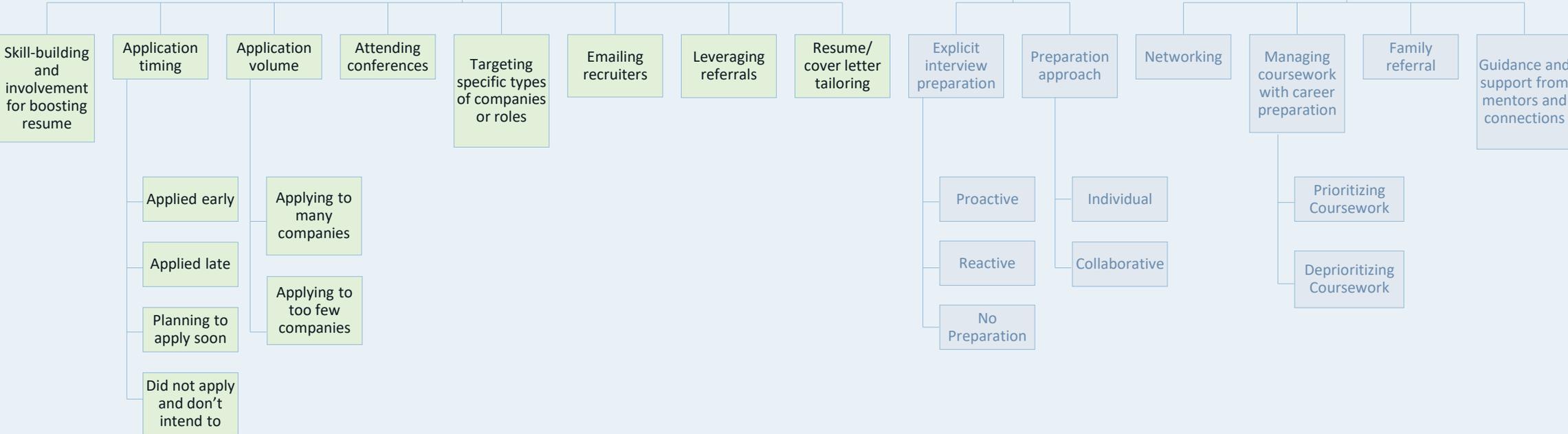
2018-Current

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Strategies specific to clearing interviews

Generic strategies



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Study 2: Findings

2018-Current

multi-institutional



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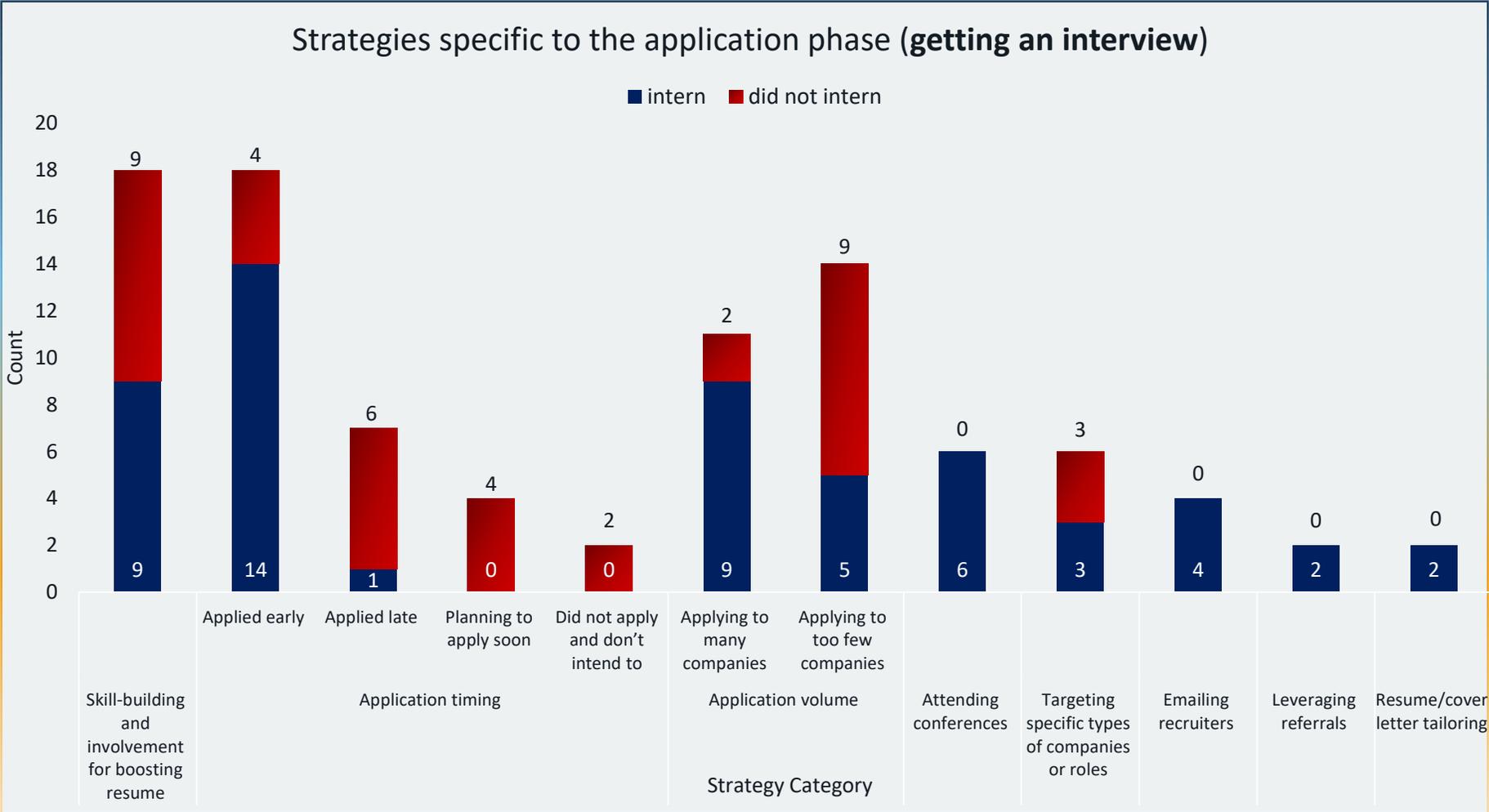


mixed-methods



survey
750+ respondents

interview
42 participants



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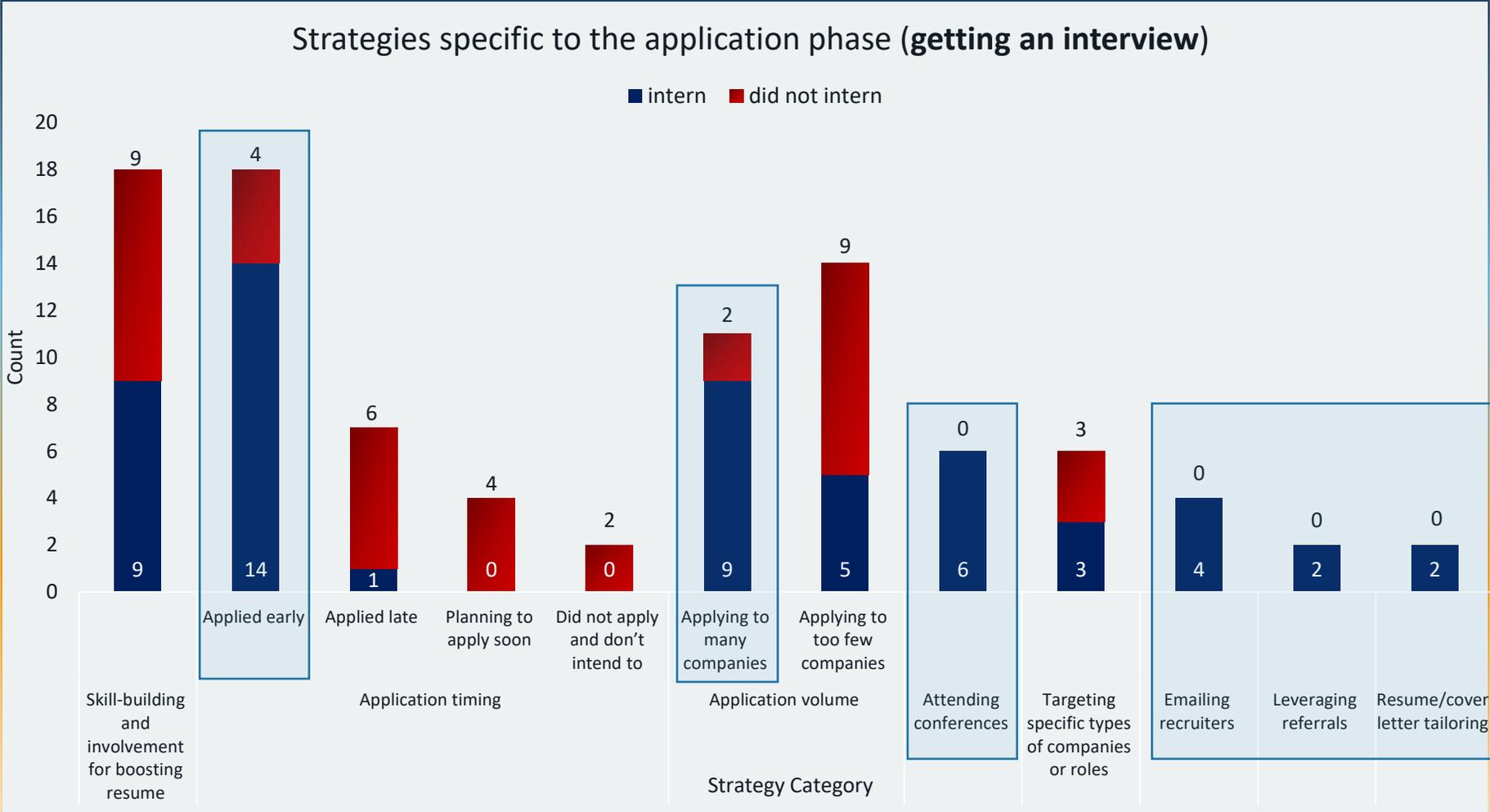


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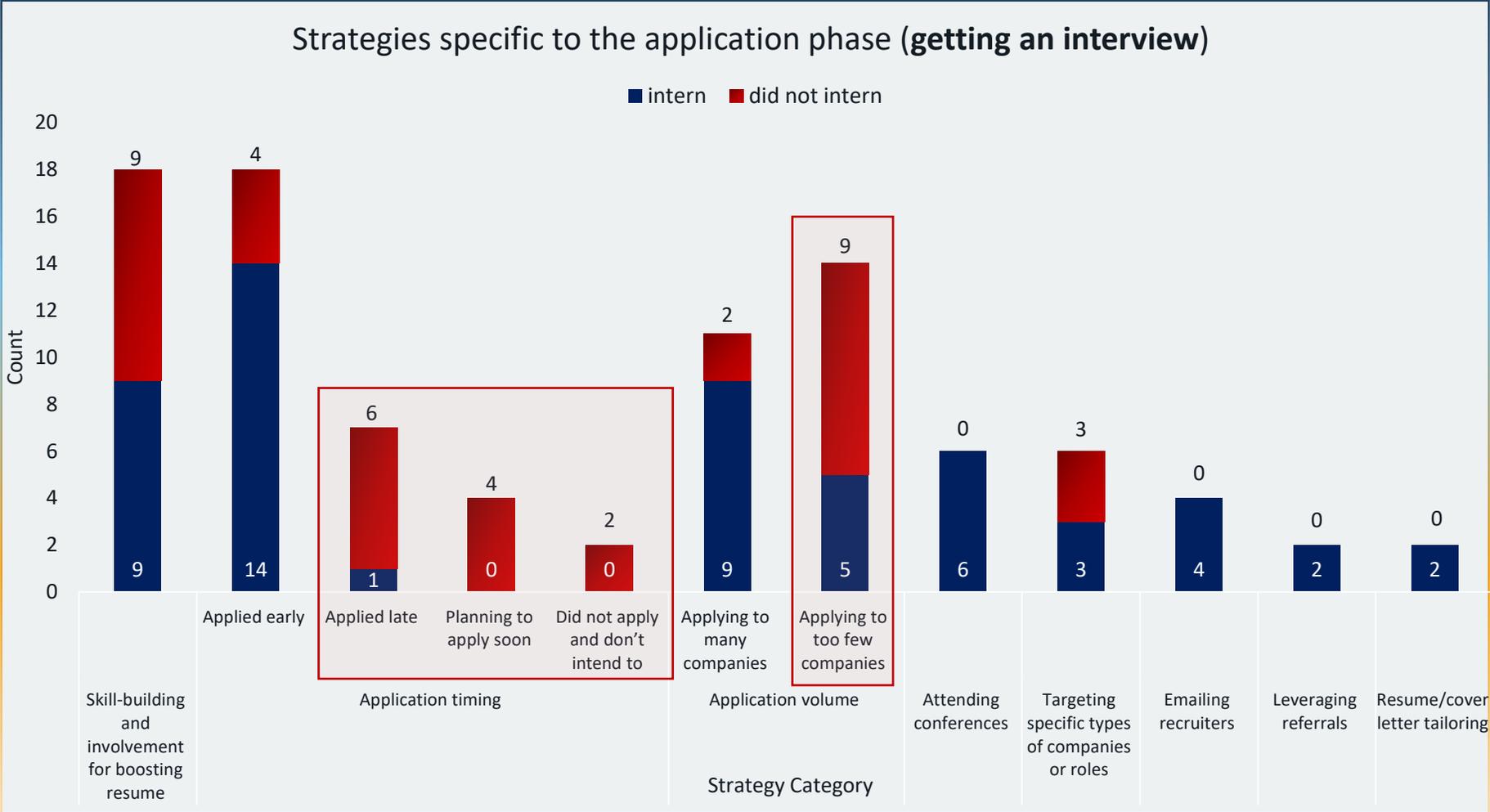
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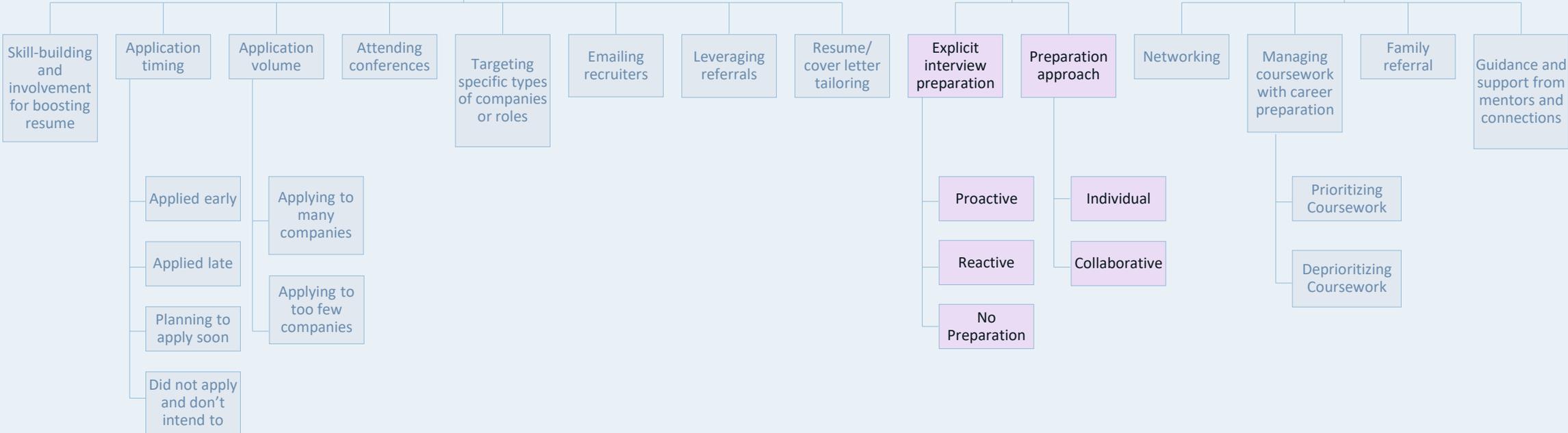
2018-Current

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Strategies specific to clearing interviews

Generic strategies



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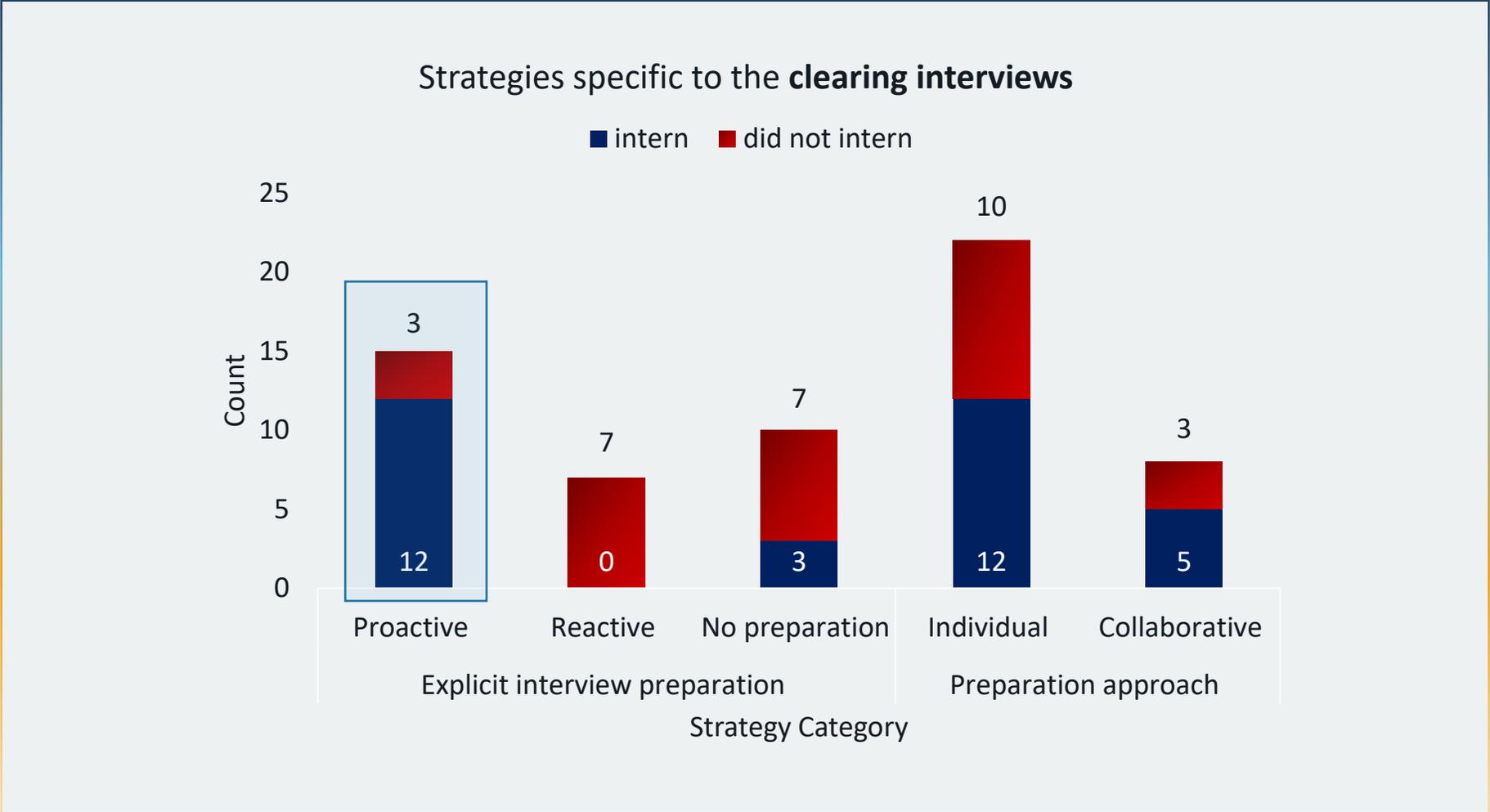
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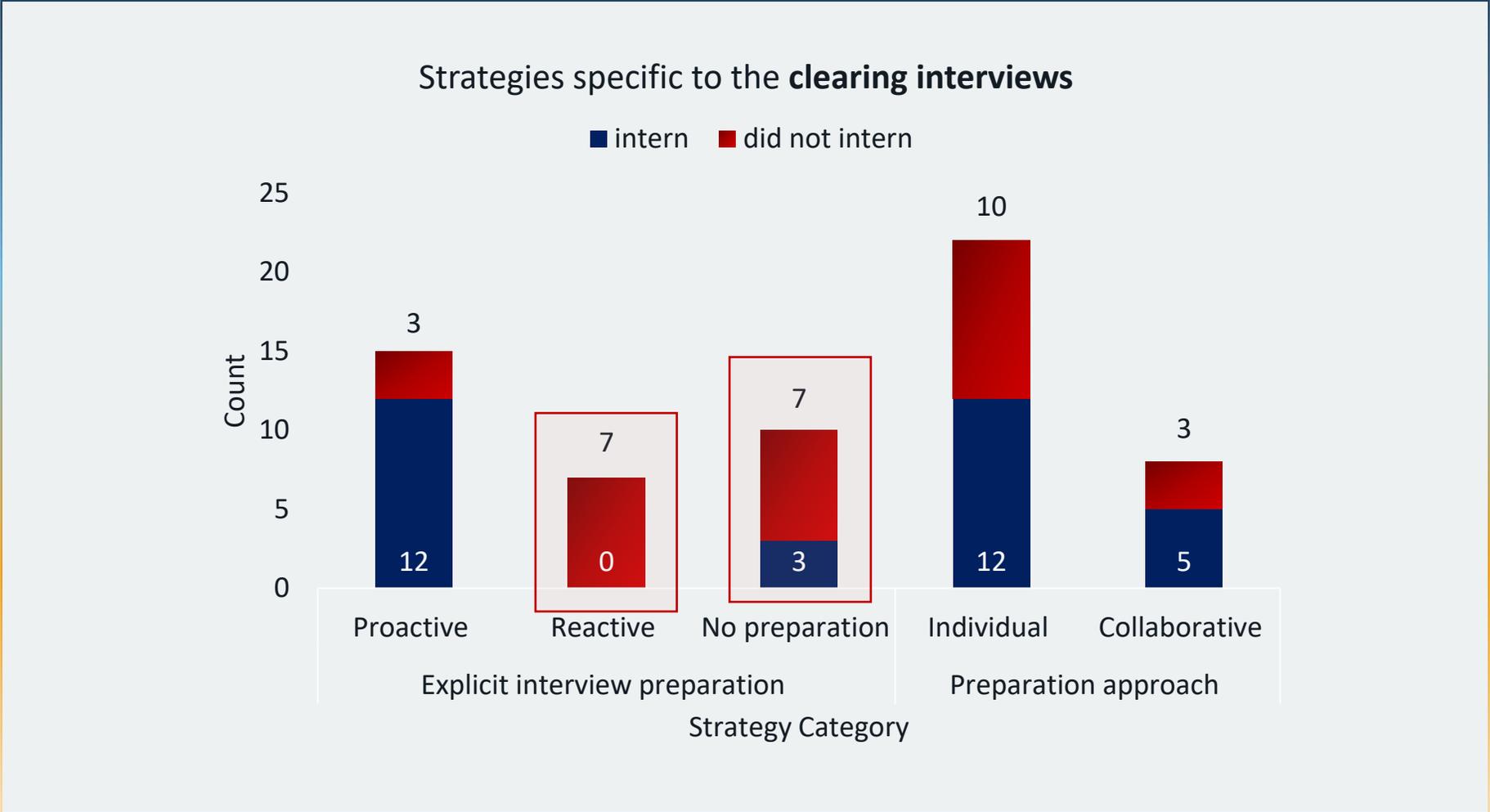


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Proactive Interview Prep

I did probably **60 [Leetcode] questions [before interview]**, which is very on the lower end. I know a lot of people who do 300+ to get these jobs. And I did a mixed bag. So, I did **five dynamic programming questions, five tree problems, five graph problems, so forth, just to like have a general grasp of how to handle these problems.** [...] And I **did a lot of mock interviews.** So, me and my friends, I'd mock interview one of them, they'd mock interview me. Then we'd handle the next guy. So, it was **probably 15, 20 mock interviews** throughout the semester.

P794
Male, Junior Year
3 Internships
2 at Big 5 Tech

Reactive Interview Prep

Before the Arizona [interview] last Friday or last Thursday, I **spent a few days, two hours each, looking at the top 50 Java questions.** And then, if I ran out, I just go to the next website with those top 50 interview questions.

P341
Female, Senior Year
Did Not Intern

No preparation

I haven't really ventured into taking, I know I have some friends who do like leetcode and stuff like that, but I **haven't really touched anything like that. It's mainly just classes right now.**

P690
Male, Senior Year
Did Not Intern
No Interview Prep – Only got resume

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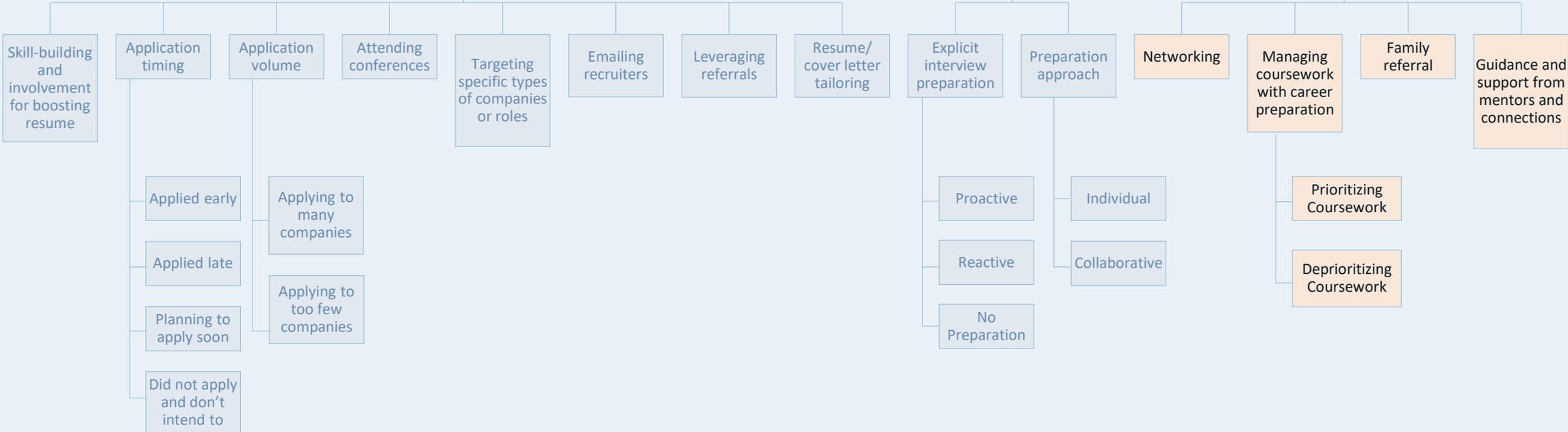
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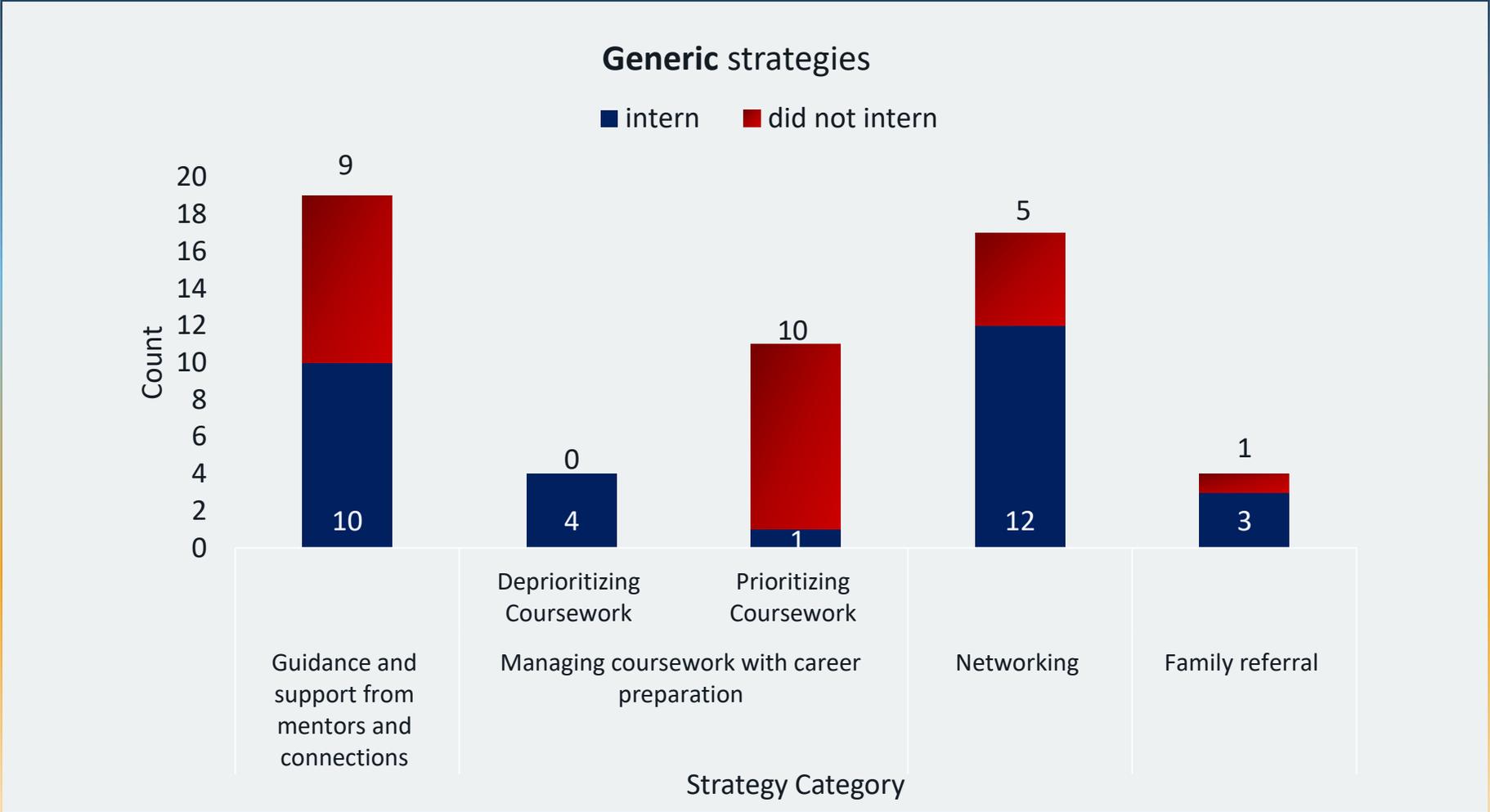
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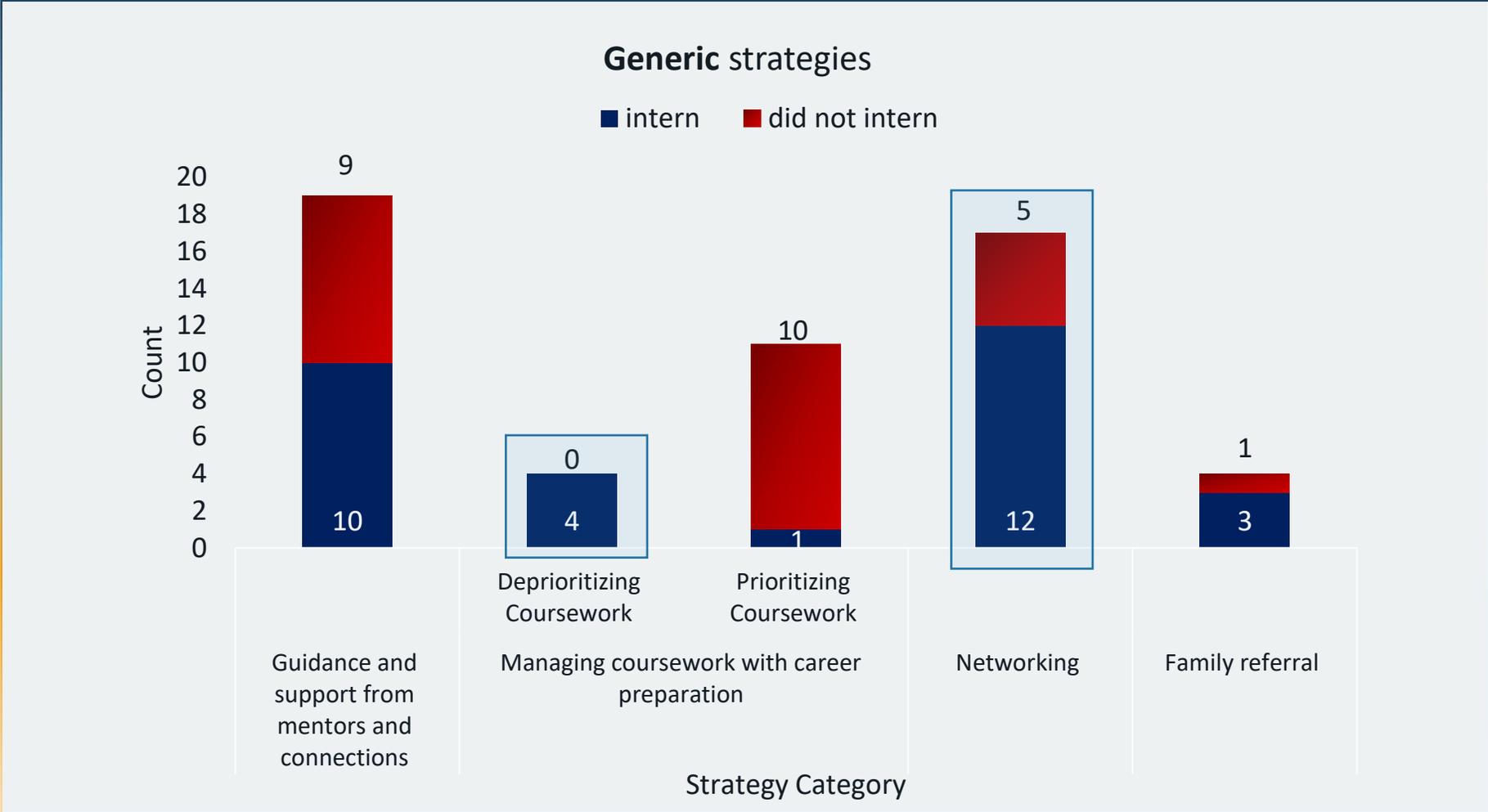
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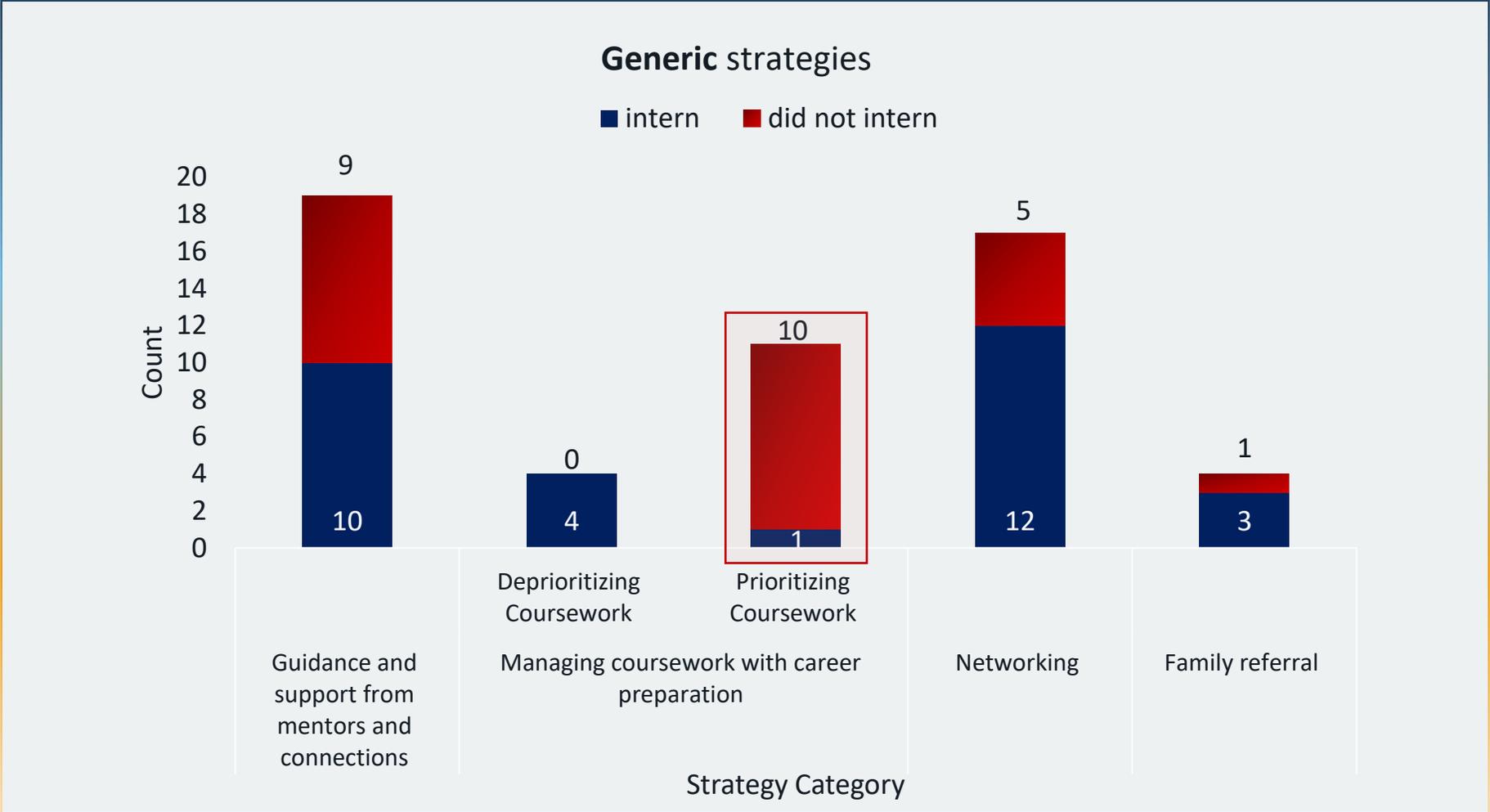
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survey

750+ respondents



interview

42 participants

Deprioritizing Coursework

We [group of three peers practicing technical interviews] realized that since we had interviews already at all these major companies, we realized that we had to **step our game up** in terms of getting the job now. So, we **didn't give as much priority** as we should have **to class coursework**, and we kind of prioritized other things more than we did class work. So before doing my interview prep, I had a 4.0 GPA, after taking my interview prep, I can't say I have a 4.0 GPA anymore.

P440 | Male, Junior Year
 2 Internships | 1 at Big 5 Tech

If I have proof that I'm going to interview and I have to fly out because they're flying me out, **let me miss class**. Let me miss a quiz, **because your quiz isn't more important than my career**.

P665 | Male, Senior Year
 1 Internship

Prioritizing Coursework

I have **not attended any of them [career fairs]**. No. They usually **conflicted with my class schedule**.

P690 | Male, Sophomore Year
 Did Not Intern

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survey

750+ respondents



interview

42 participants

Summary of Strategies

✔ Participants who interned

- Applied Early** – Started in freshman/sophomore years
- Applied Broadly** – Sent applications to many companies
- Strategic Approach** – Attended conferences, networked, & emailed recruiters
- Balanced Priorities** – Managed coursework & internship prep
- Proactive Preparation** – Prepared for interviews before applying

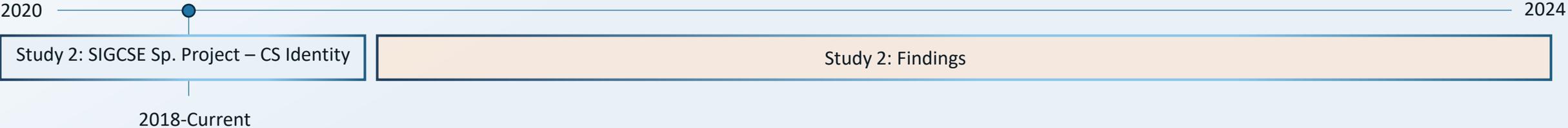
⚠ Participants who did not intern

- Applied Later** – Started applying in later years or still developing skills
- Fewer Applications** – Sent applications to fewer companies
- Prioritized Coursework** – Focused more on academics than job search
- Reactive Preparation** – Prepared for interviews only after getting one
- No Prep** – Some did not prepare for interviews at all

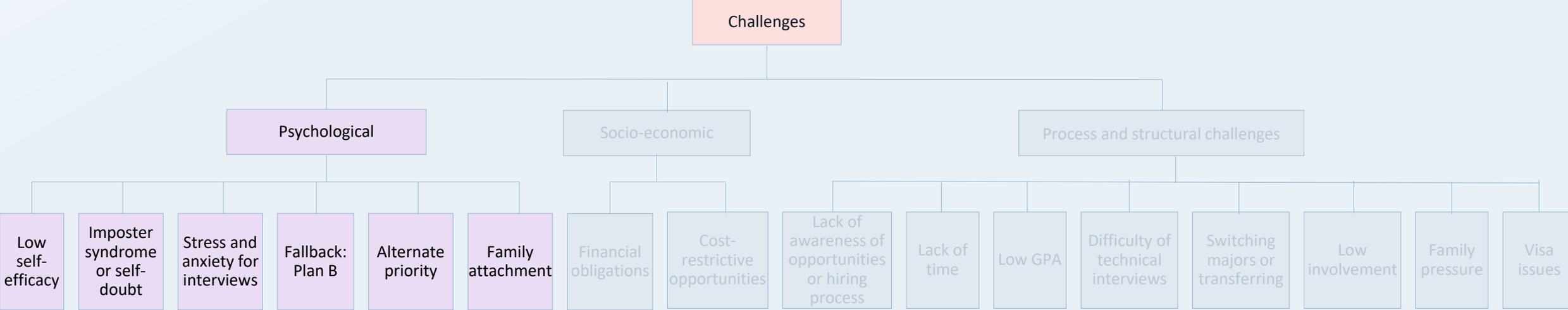
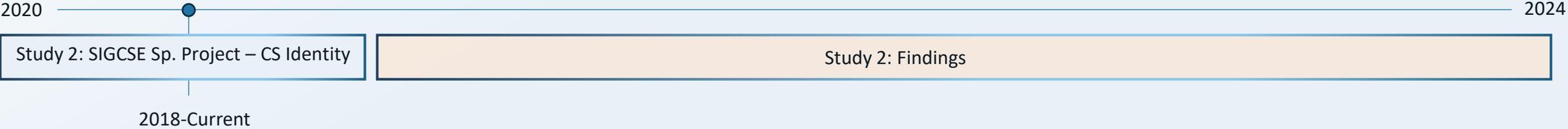
🔗 Common Factors

- Skill Building** – Worked on improving technical & professional skills
- Sought Guidance** – Learned from mentors & professional connections

Developing Personas: Fitting in altogether



Developing Personas: Fitting in altogether



Developing Personas: Fitting in altogether

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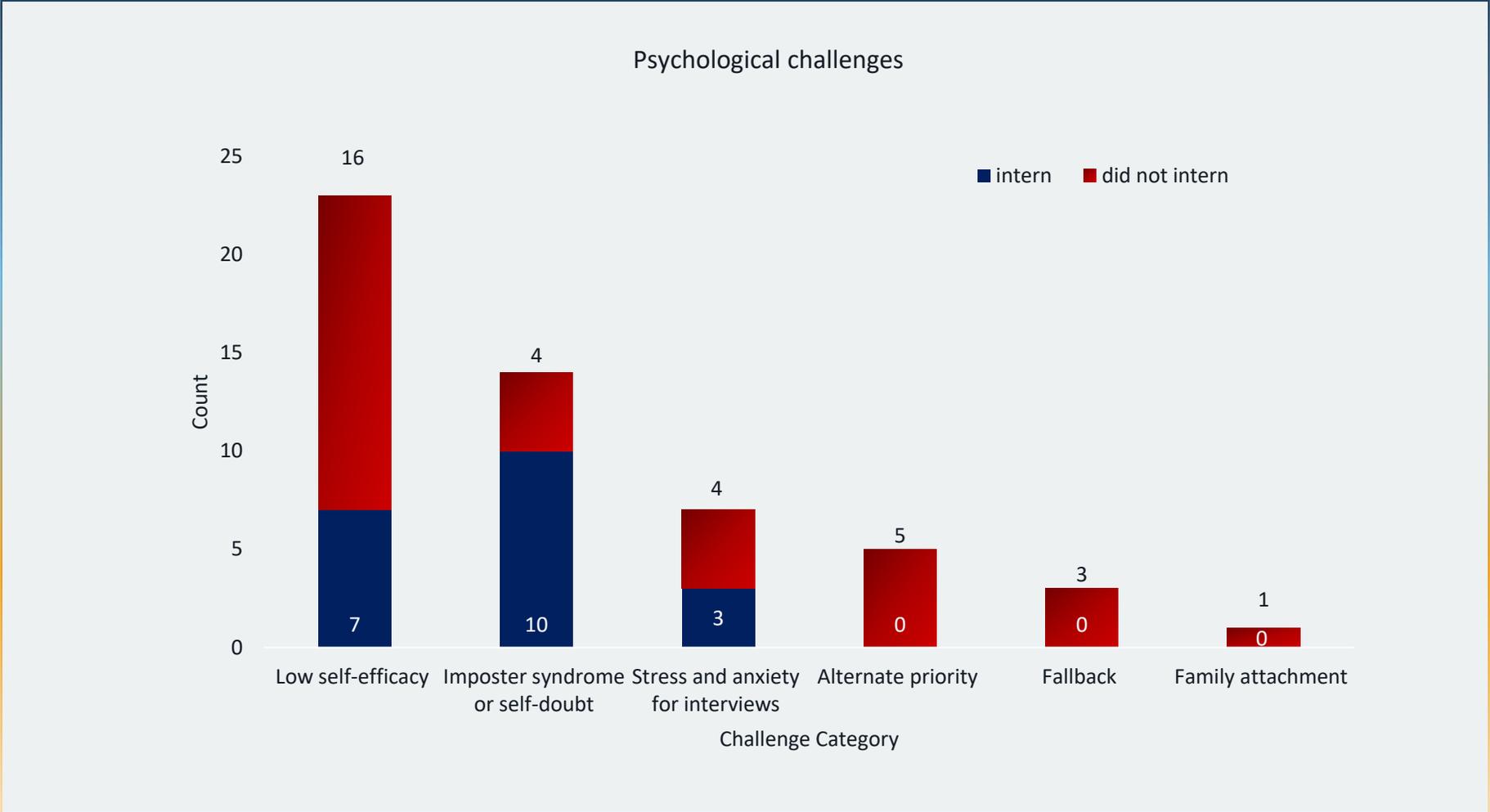


mixed-methods



survey
750+ respondents

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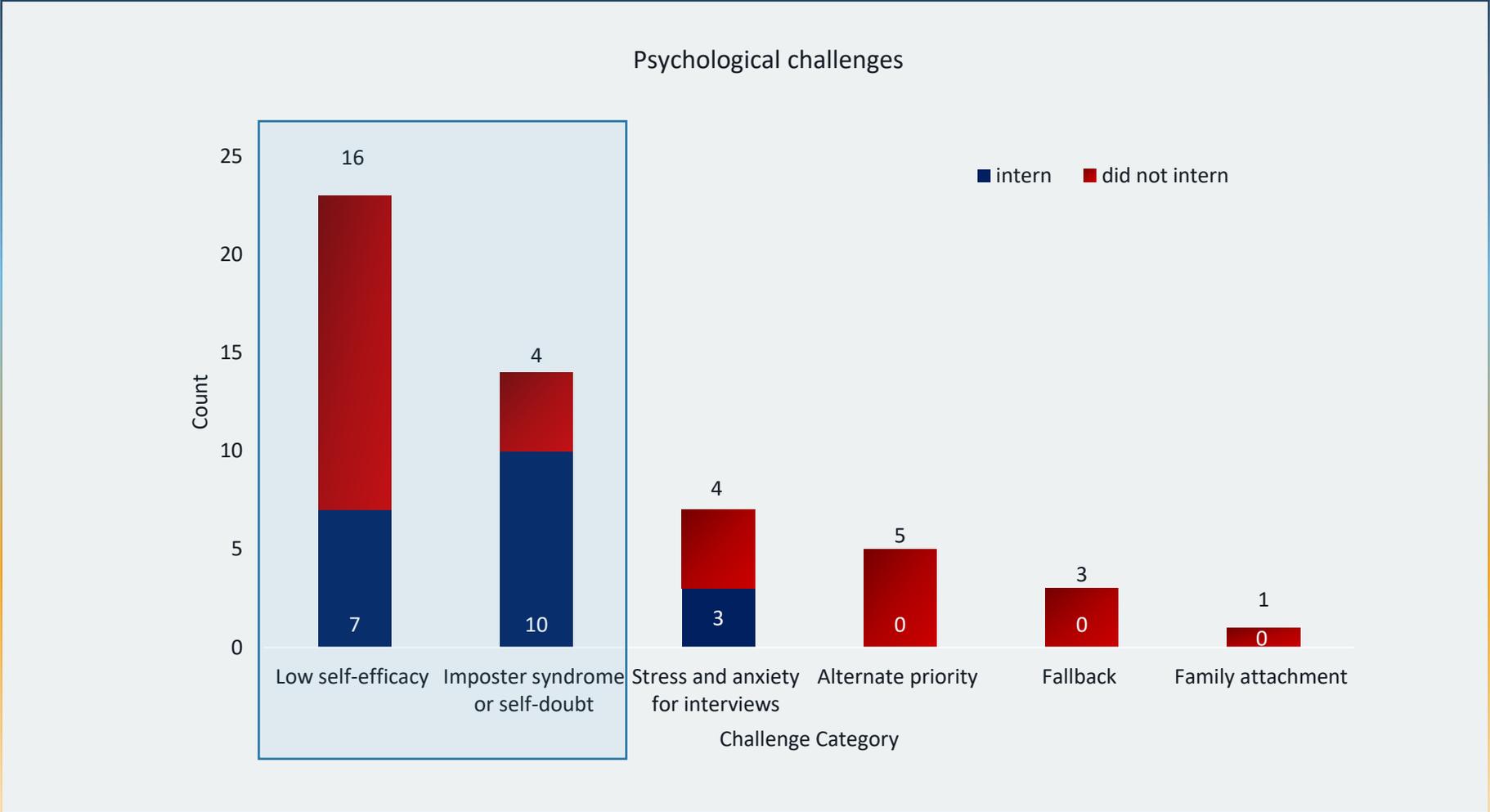
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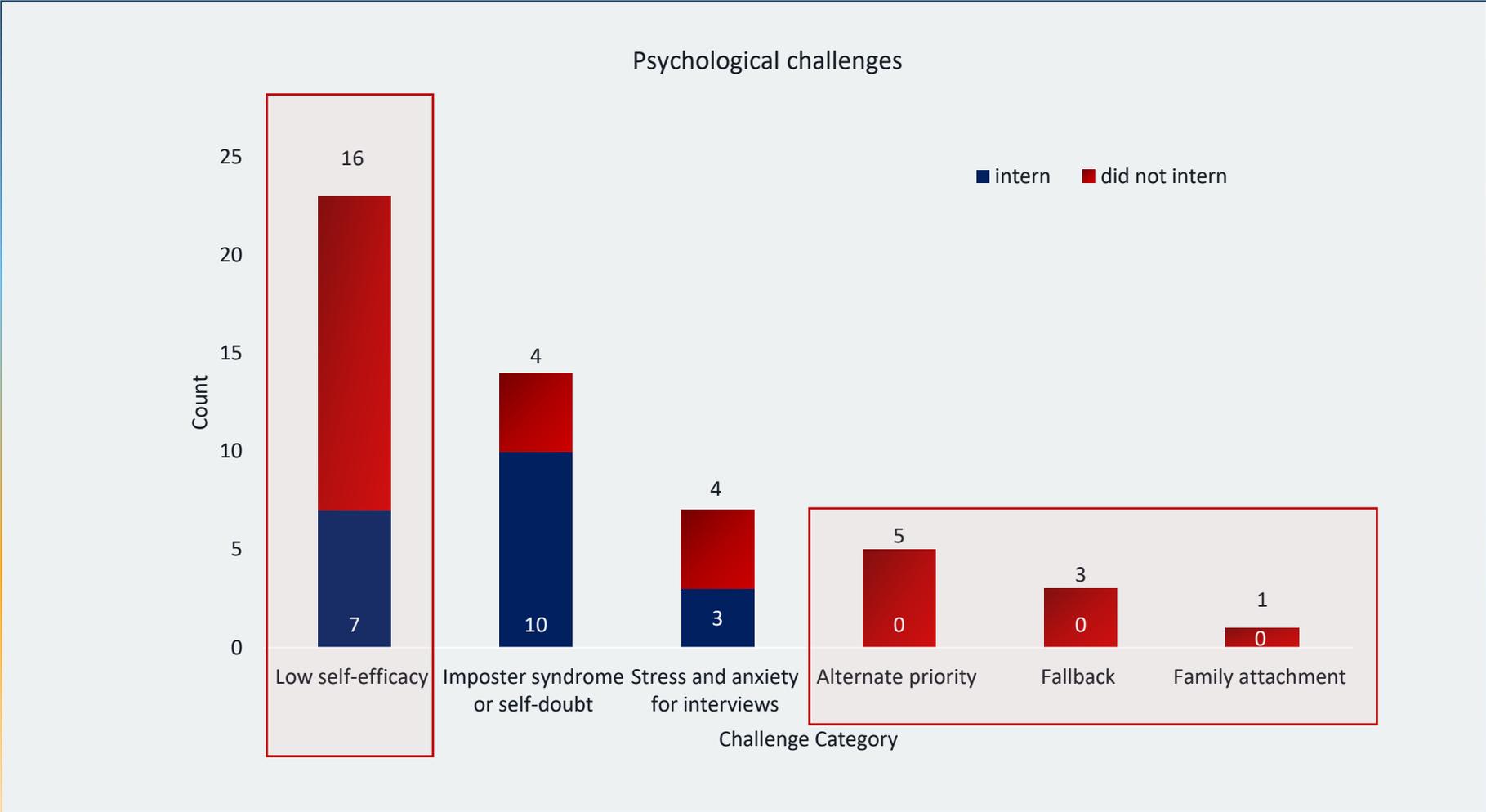
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survey

750+ respondents



interview

42 participants

Low Self-Efficacy

I think it's [failing technical interviews at small companies where he interviewed] because **I didn't have that much experience with the technical coding**, because I was still relatively new to coding at the time. And just my approach to **coding, I'm not the most proficient**. [...] I would say [I am] mildly confident in coding skills]. Because I'm still learning and still, even though it's been almost two years of being in the computer science program, **I feel like I'm not as proficient, as I would like, so I'm not as confident**.

P674

Male, Super-senior year, Transfer student

Did Not Intern

Imposter Syndrome

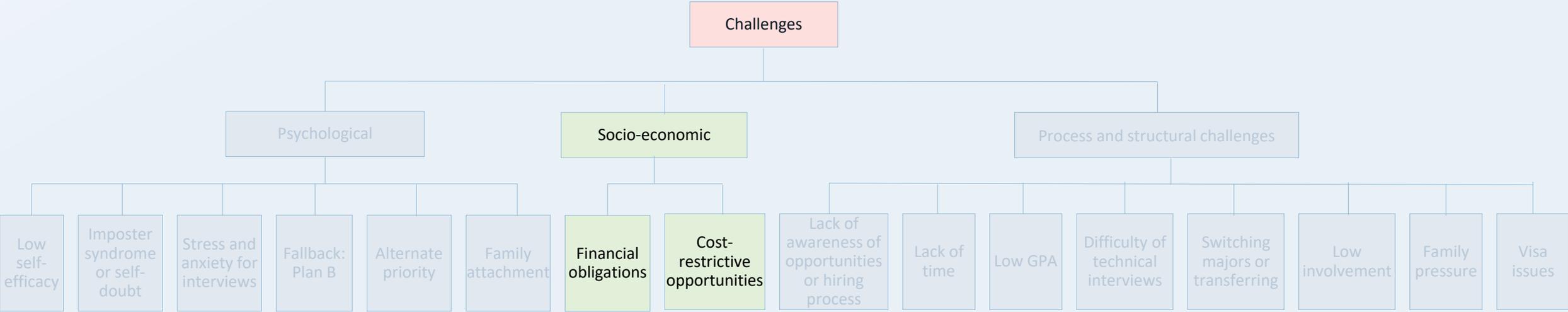
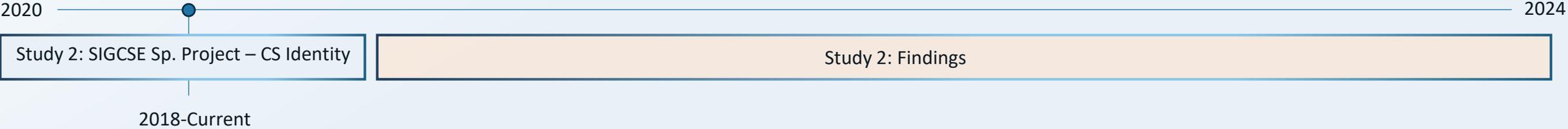
A lot of the people that I hang out with I guess are super smart. Several of them had jobs after their freshman year [...]. **I'm not an exceptional student. I'm very much like a B, C student.** [...] I feel like it's one of those things where nobody blasts their insecurities and shares those. They always try to pretend like they have everything together. [...] So it's comparing yourself to other people, especially when you're at a school like Rose which is very, very hard. And I guess to some extent, **I regret having chosen Rose only for this, since I feel like I'm a very small fish in a big pond.** [...] It very much feels like **imposter syndrome because you look around and you feel like everybody else is like so successful and you're like, God, what am I doing with my life? Because I feel like average.**

Y89

Female, Junior Year

2 Internships

Developing Personas: Fitting in altogether



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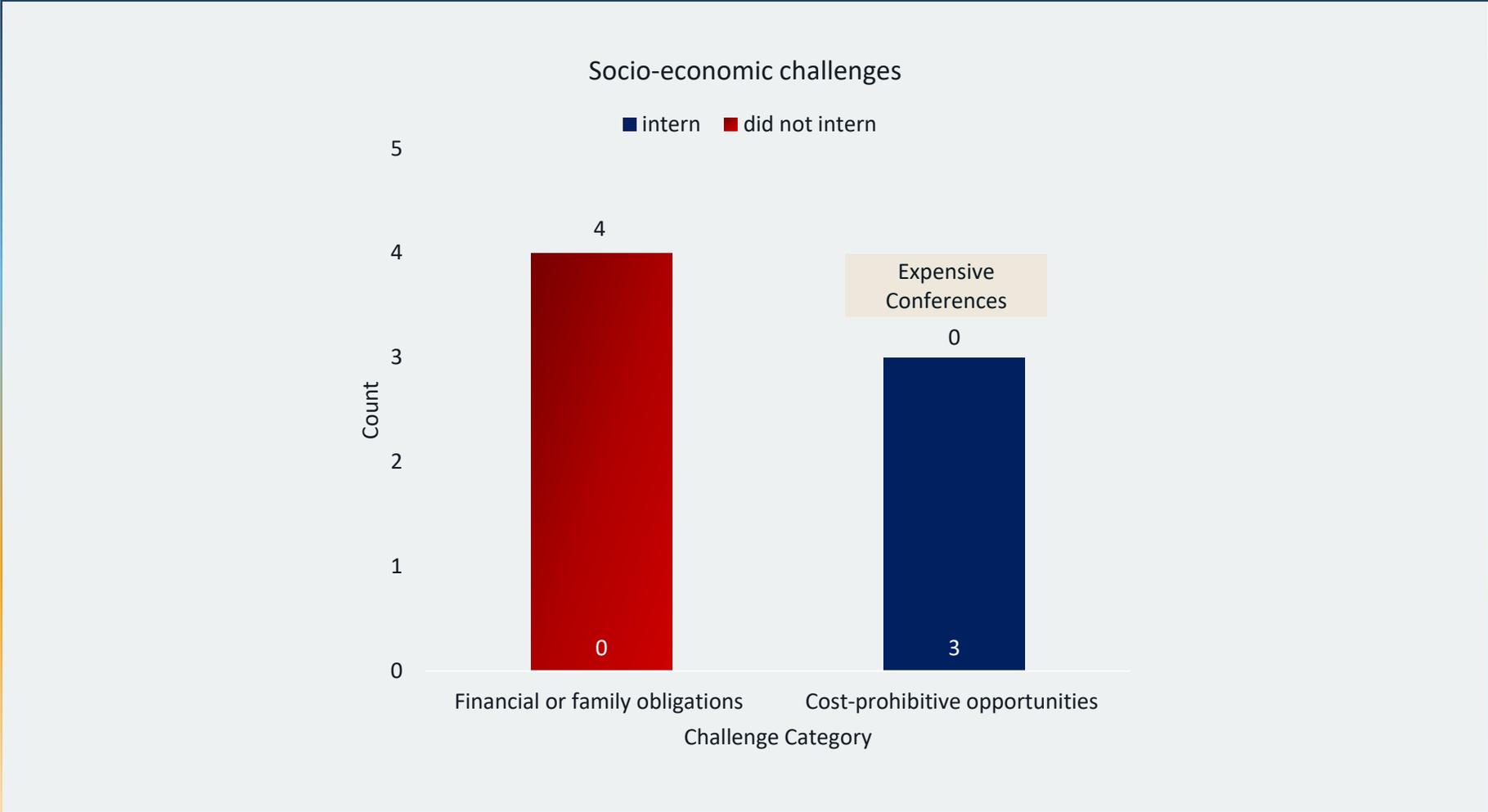
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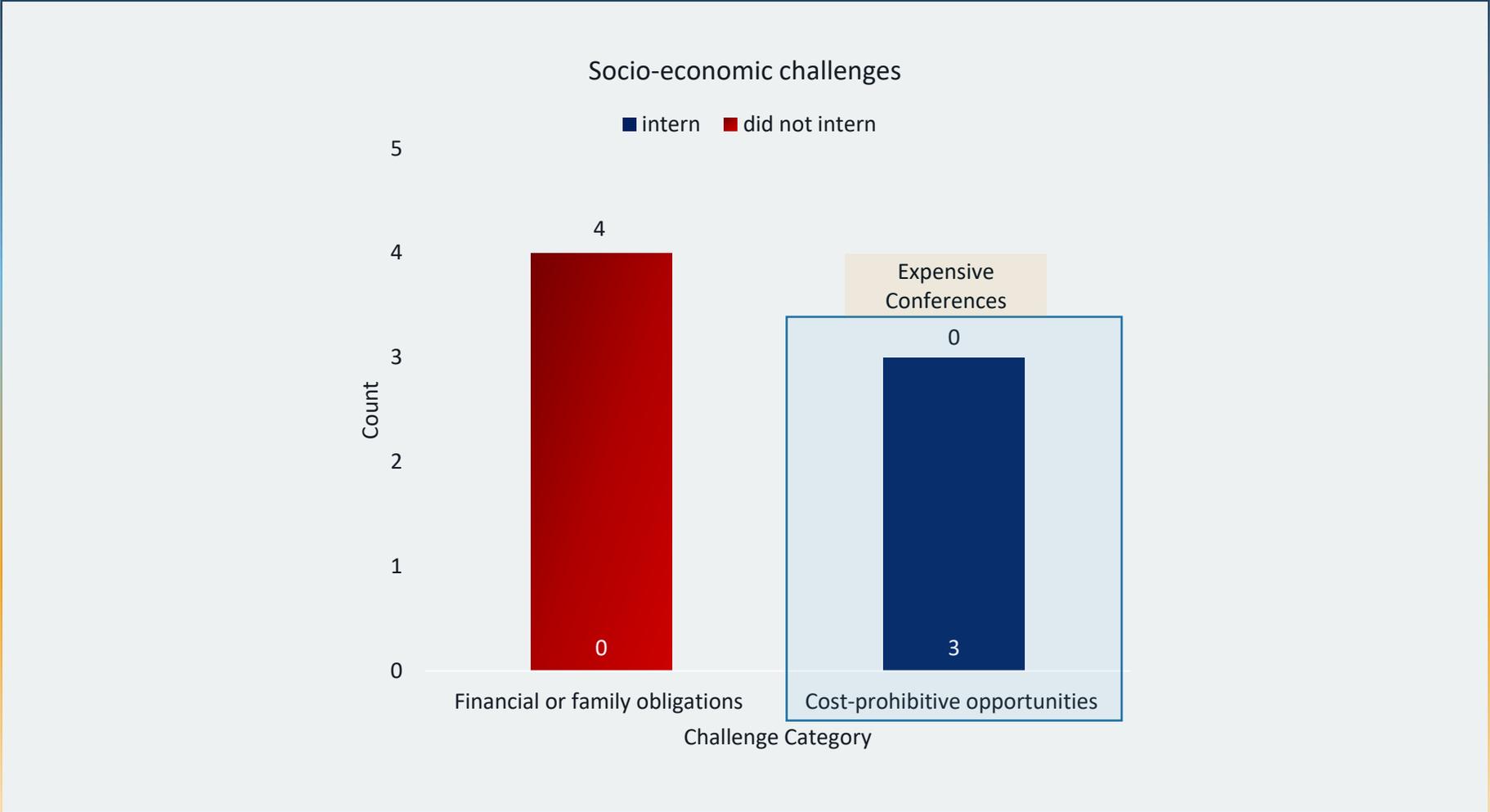
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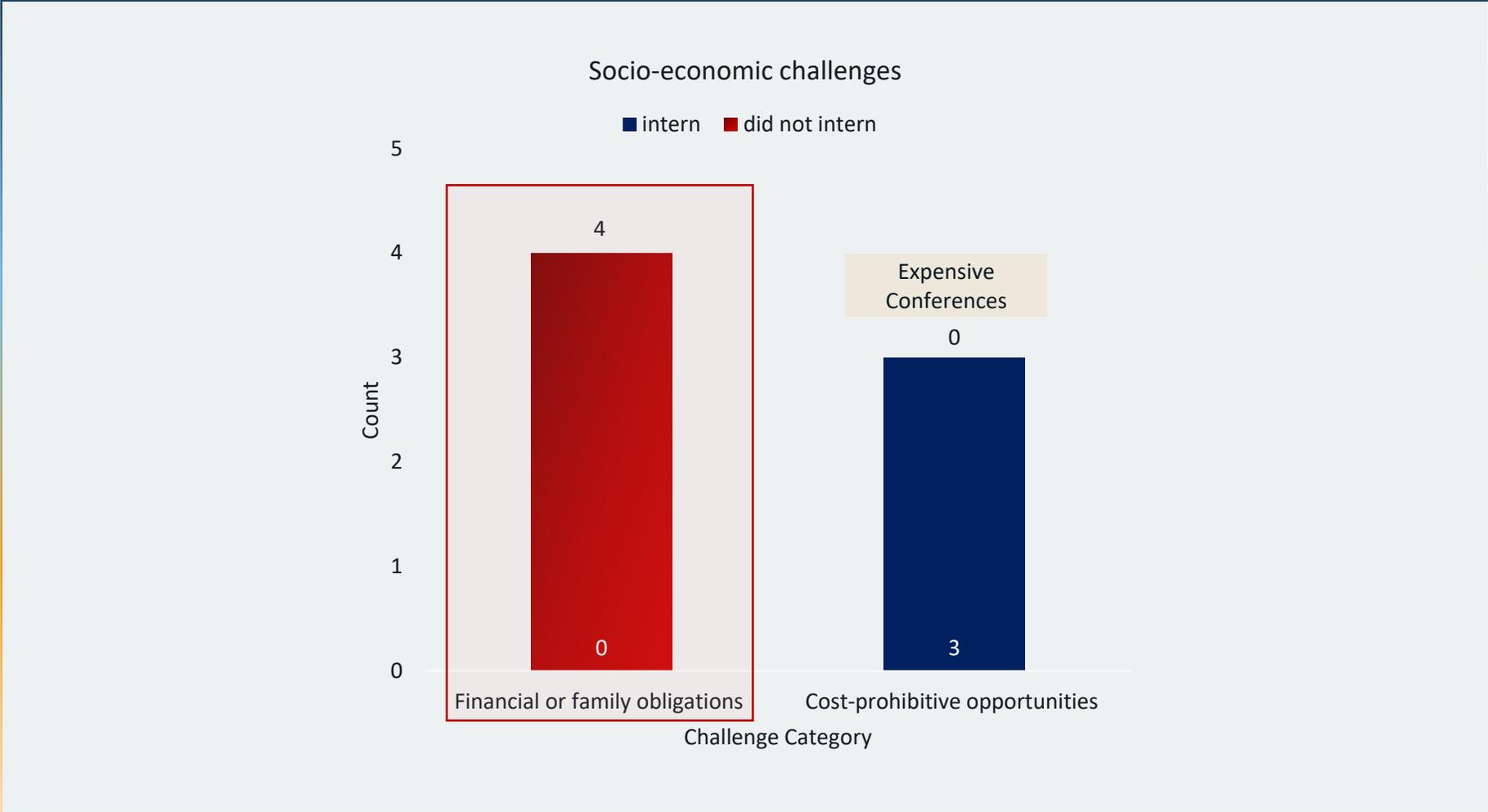
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mixed-methods

survey interview

750+ respondents 42 participants



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survey

750+ respondents



interview

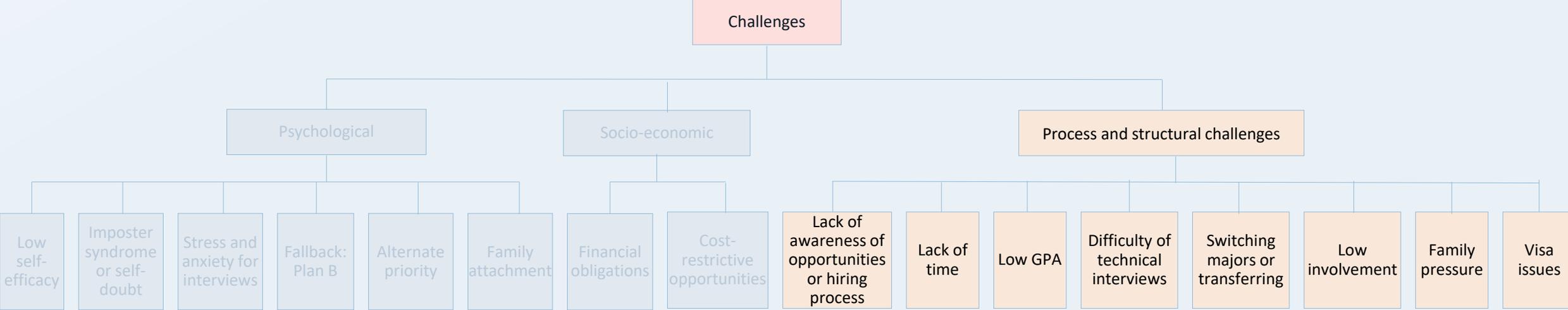
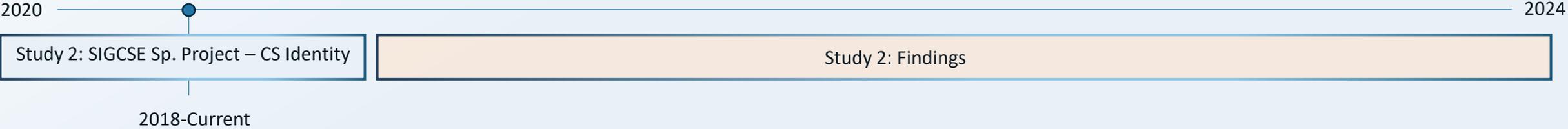
42 participants

Financial Obligations

I've been **working** since I basically started school. So, I **don't have that much time left to work on projects or do anything much. Or do much else outside of my coursework.** [...] First my financial situation, just having to work a lot of hours a week to help maintain myself during college. That has taken a **toll** on me, **physically and mentally**, since I can't really work as much as I would like in my studies. But, also just the long hours that I have to work, both school and work, it's tiring.

  P315
 Male, Senior year
 Did Not Intern

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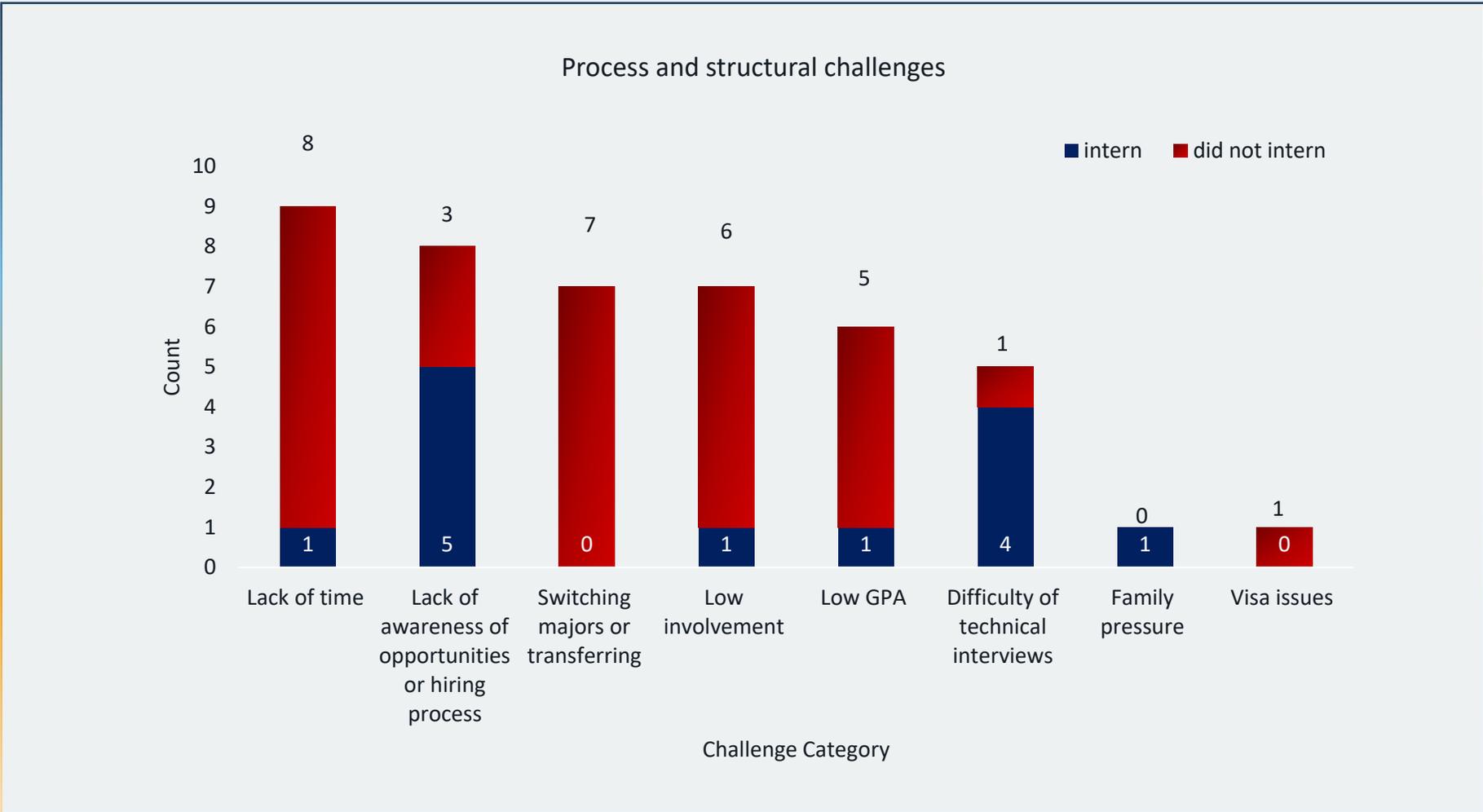
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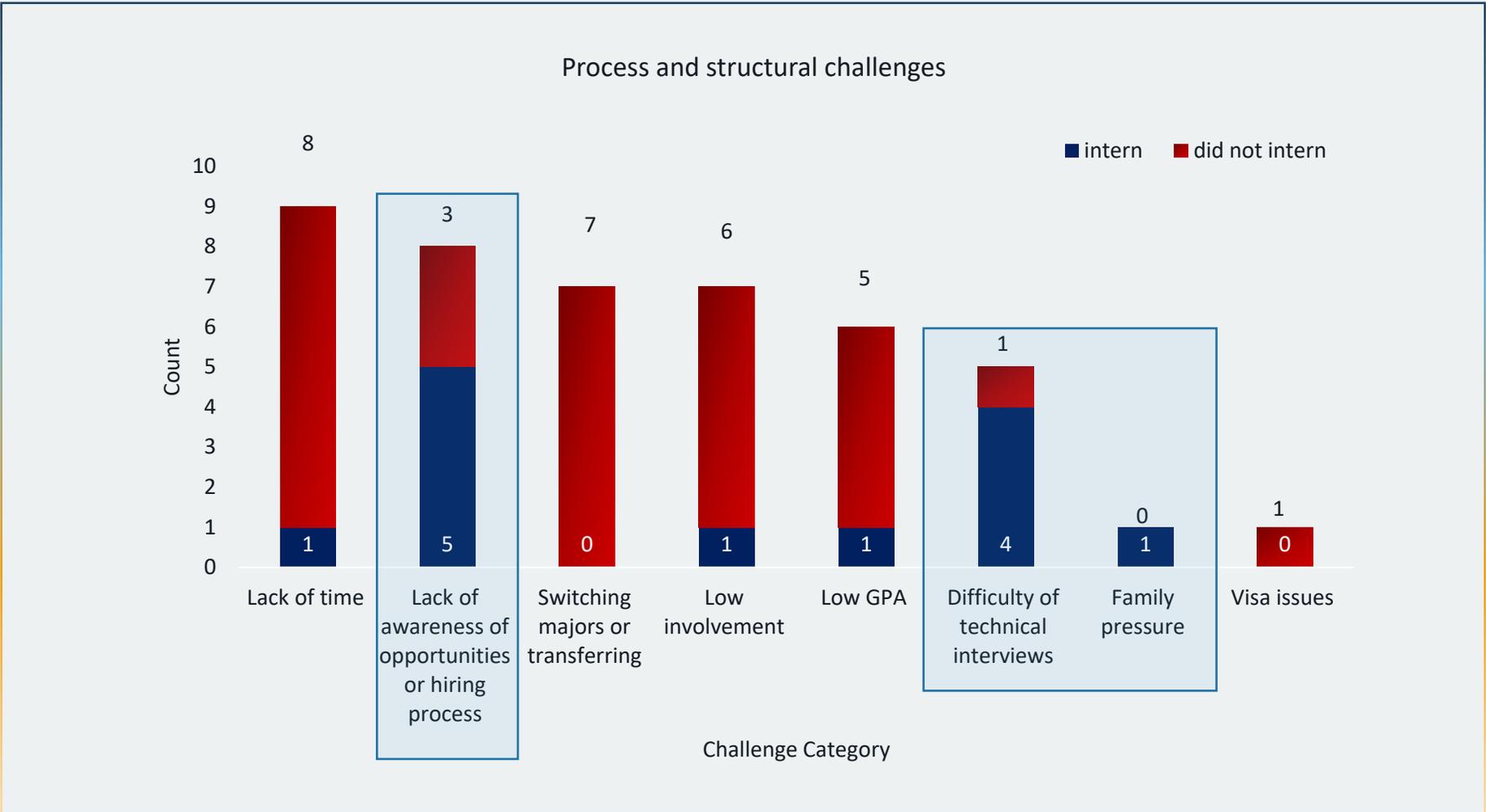
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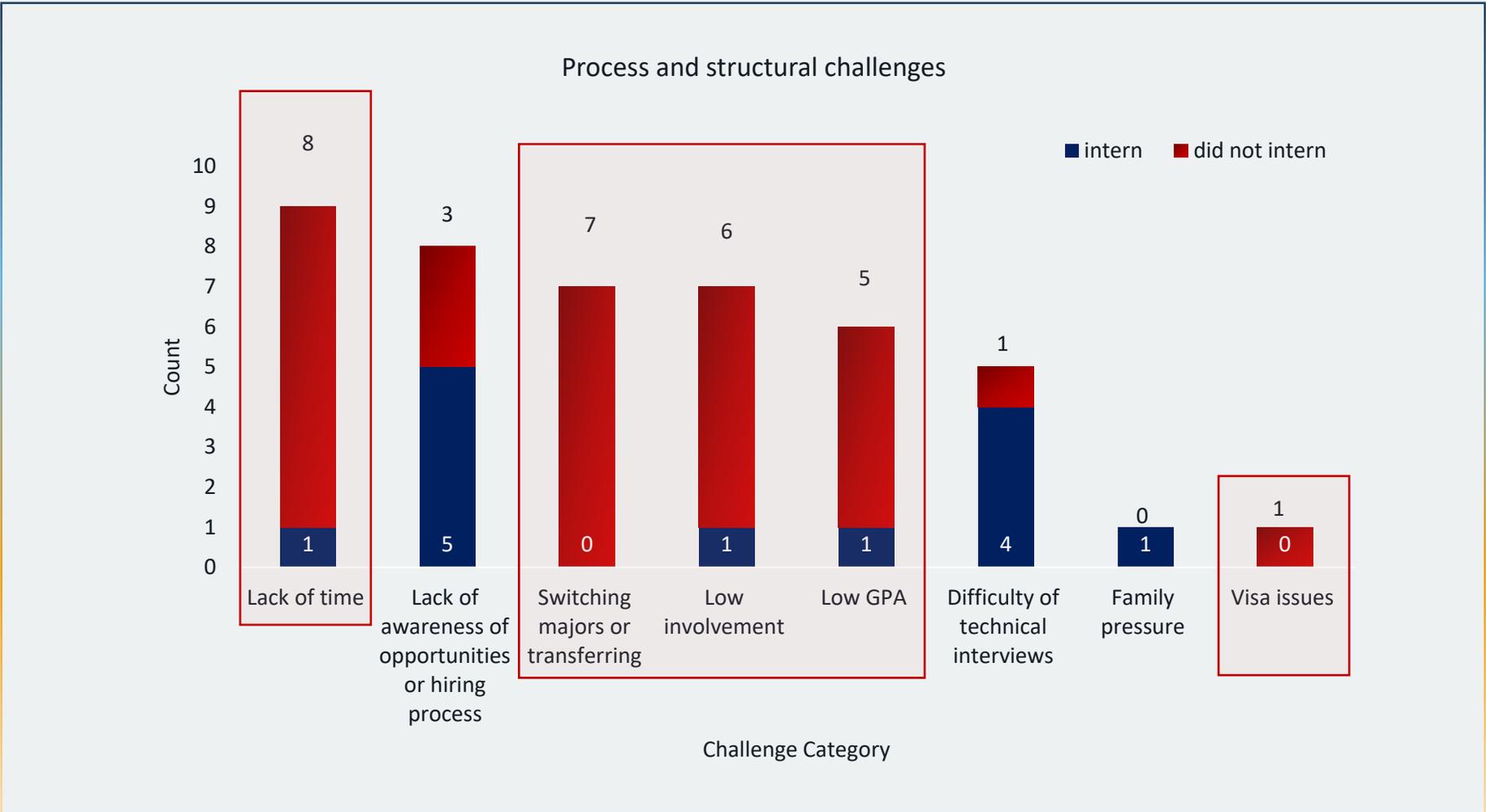
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survey
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interview
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Study 2: Findings



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survey

750+ respondents



interview

42 participants

Summary of Challenges



Participants who interned



Psychological Challenges – Low confidence and imposter syndrome



Interview Struggles – Found technical interviews particularly challenging



Lack of Awareness – Uncertainty about hiring process and expectations



Time Constraints – Juggling internship with other responsibilities



Participants who did not intern



Psychological Challenges – Low self-efficacy and reliance on fallback plans (Plan B)



Socio-Economic Barriers – Financial/family obligations, visa restrictions



Time Constraints – Prioritized hobbies, studying abroad, or other pursuits



Structural Barriers – Challenges related to community college transfer, low GPA, low extracurricular involvement

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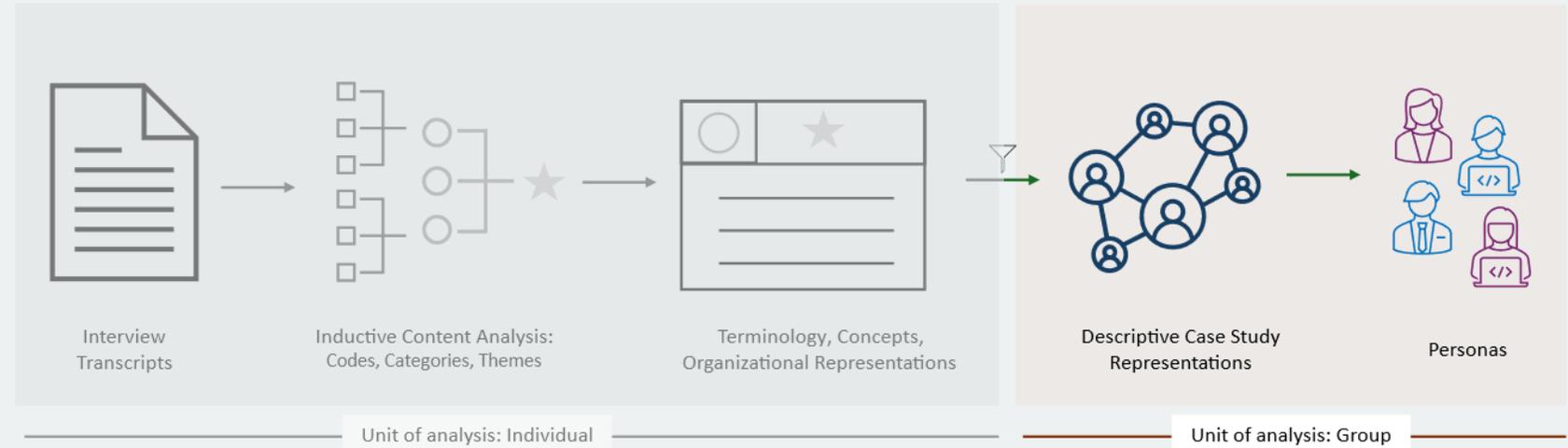
750+ respondents



interview

42 participants

Data analysis



Personas emphasize students':

- salient student **attributes** who participate and do not participate in internships
- **strategies** for securing internships,
- **challenges** encountered when securing internships,

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survey 750+ respondents interview 42 participants

High Agency High Involvement Medium explicit practice

Driven Billie (n=8) - interned

Key strategy: Agency



Year 1-2: 3 | Year 3: 2 | Year 4-5: 3

M: 4 | F: 4

Goal

Secure and participate in multiple internships during the program

Attributes

- Year 1-5 students
- High agency¹ ↑
- Resilient ↑
- Ambitious ↑
- Moderately High GPA (μ: 3.5) ↑
- Participated in 1-5 internships (μ: 2)

Strategies

- Applying many and applying early ↑
- Highly involved ↑
- Networking ↑
- Proactive or reactive interview preparation³ ↘
- Mentorship² ↑

Challenges

- Lack of time ↓
- Stress and anxiety of technical interviews ↓
- Imposter syndrome ↓
- Low self-efficacy ↓

I **would just reach out**¹ to software developers and particularly **project managers, program managers**² at [a Big Five US Tech company] and ask them like, "**Can you give me a mock interview?**"³ And I did that so many times. They were the ones that really helped me figure out the science of answering PM questions or the science of answering technical questions. – P354

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survey
750+ respondents

interview
42 participants

High Agency

High Involvement

Medium explicit practice

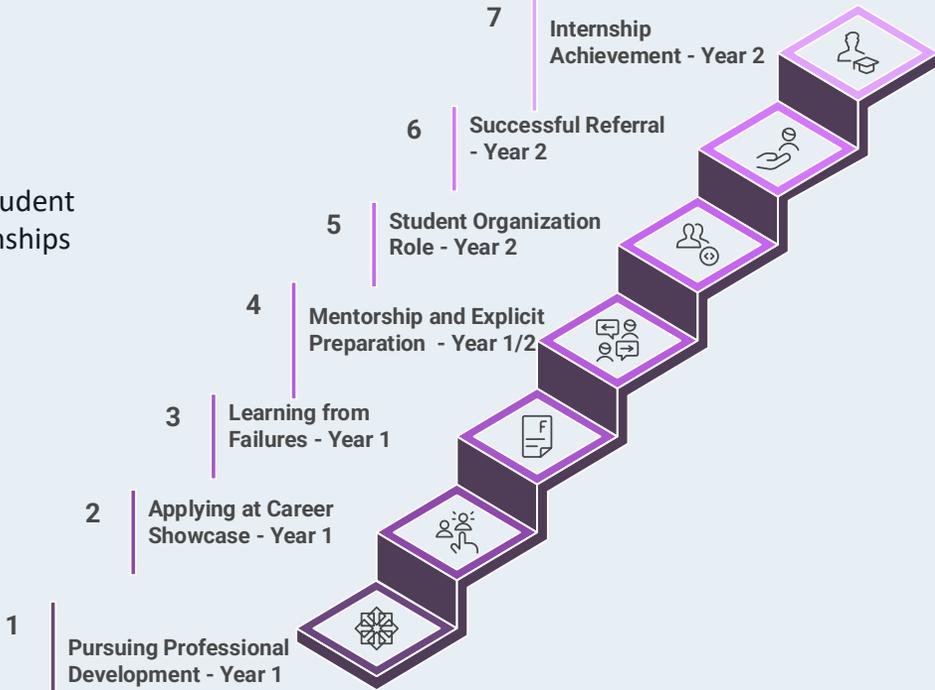
Driven Billie (n=8) - interned

Key strategy: Agency



P354
Senior Female CS Student
Completed 5 Internships

Journey to Internship Success



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High Agency High Involvement Medium explicit practice

Driven Billie (n=8) - interned

Key strategy: Agency

The first one I ever got. It wasn't the first interview I did. I've definitely failed a lot of interviews. I think it started my freshman year. So as soon as I got to college, I immediately started pursuing professional development opportunities. So, working on my leadership skills, working on my resume, working on leading things. I remember I heard of career showcase because I took a tour from the engineering ambassadors full circle. And they were like, "Go to career showcase even if you're a freshman, even if you feel like you don't have anything, just try it and learn."

So then next year came [...] and I was prepping and I did interviews. I did interview with [large industrial company], but I didn't get it that freshman year. So it was like really pushing to learn, like get interviews, resume, etc., learn and get mentors. Mentors is a big thing. I had a lot of mentors in different organizations, whether it was alumni mentors or career mentors.

And then sophomore year came around, same time of your career showcase. And at the time I joined [a student organization teaching coding essentials] and I met this lady or this girl who's the president or something [...] and they needed a social media chair and I was like, "Hey, I'll do it". And then I guess [the president], I don't know what she saw in me, but she was like, "Hey I worked at [Big five US tech company], do you want a referral?" And I was like, "Yes." So she gave me a referral, which then I guess put my... resume up to be seen. [...]

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survey

750+ respondents



interview

42 participants

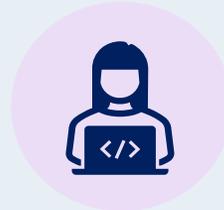
Some Agency

Some Involvement

Low explicit practice

Resourceful Alex (n=6) - interned

Key strategy: Conferences



Year 3: 3 | Year 4: 3

M: 3 | F: 3

Goal

Secure in an internship strategically

Attributes

- Year 3-4 students
- Low to High agency** ⚡
- High resilience ⬆️
- Securing internships via behavioral interviews at conferences³
- 5 of the 6 students identified racial/gender identities as underrepresented

Strategies

- Applying many and applying early ⬆️
- Reactive or no interview prep ⬇️
- Prioritizing coursework ⬇️
- Networking ⬆️
- Conferences**¹ ⬆️
- Referrals** ⬆️
- Parent connections ⚡
- Some involvement ⚡

Challenges

- Lack of time ⬇️
- Costly conferences² ⬇️
- Stressful interviews ⬇️
- Low self-efficacy ⬇️

One of my **closest friends** is in NSBE and he saw that I was struggling to get internships. I got a couple interviews from career showcase, but it didn't pan out. And he said, "**Come to NSBE**¹ because they hand out those things left and right." And I was like, "Yeah, sure." It was a **little expensive**², but I flew out to the NSBE conference in spring. [...] So being what they consider a good GPA and from a really good school and being able to pass basic questions³, they really don't even look beyond what's on your resume. They check a couple things. **Going to NSBE beforehand, I had never gotten a single offer. Coming out of NSBE I had six internship and coop offers.** – P665

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survey 750+ respondents interview 42 participants

High Agency High Involvement High explicit practice

All-in Haku (n=3) - interned

Key strategy: Explicit preparation



Year 3: 1 | Year 4: 2

M: 3

Goal

Secure an internship in Top 5 technology companies in the USA

Attributes

- Year 3-4 students
- High agency² ↑
- High self-regulation skills³ ↑
- High ambition ↑
- Working at Big 5 Technology companies in USA
- Participated in 1-3 internships (μ: 2)

Strategies

- Applying many and applying early ↑
- Proactive and regulated interview prep¹ ↑
- Networking ↑
- Highly involvement ↑
- Collaborative preparation⁴ ↑

Challenges

- Imposter syndrome ↓
- Difficulty of technical interviews ↓

I asked a couple of people in some of my classes and some of my other friend - "What are you guys doing for your technical prep right now?" And everyone is **kind of doing the same thing that I was before [individual practice]**¹ and I was like, "It kind of works, but we kind of need to take it to the next level now." And so we told each other that we wanted to hold each other **accountable**². And what we ended up creating is a **huge Excel omni grid**³ and in that grid, we had a bunch of questions that we knew we had to target for a specific company that we already had interviews to. We had columns for me and my other two buddies. And what we ended up doing is we had **mock interview sessions**⁴. - P440

Developing Personas: Fitting in altogether

2020

2024

Study 2: SIGCSE Sp. Project – CS Identity

Study 2: Findings

2018-Current

multi-institutional



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mixed-methods



survey

750+ respondents



interview

42 participants

High Agency

Some Involvement

Low explicit practice

Unconventional Morgan (n=2) - interned

Key strategy: Opportunity from institution



Year 3: 1 | Year 4: 1

M: 1 | F: 1

Goal

Become an entrepreneur
and get an internship
without explicit preparation

Attributes

- High agency ↑
- High confidence ↑
- High ambition ↑
- High self-regulation ↑

Strategies

- Applying for few companies and applying late ↓
- Reactive or no interview prep¹ ↓
- Prioritizing coursework ↓
- Relying on institution for internships ↓
- Somewhat involved ⊖

Challenges

- Lack of time ↓

No [I didn't prepare for interviews]¹, but the thing is also is that a lot of these interview questions that they give you in computer science are very textbook-y, very discrete math type of thinking, and if you really understand algorithms, you understand turning machines and state machines and graph theory and stuff, you can pretty much derive most of these algorithms right off the top of your head. **You don't really need to study at all.** – P219

Developing Personas: Fitting in altogether

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Study 2: Findings

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survey

750+ respondents



interview

42 participants

Low Agency

Some Involvement

Low explicit practice

Tardy Taylor (n=1) - interned

Key strategy: Part-time experiences



Year 5: 1

F: 1

Goal

Secure an internship before graduation or look for a full-time if not.

Attributes

- **Low agency** ↓
- Low self-regulation skills ↓
- **Low Ambition** ↓

Strategies

- Not applying for internships till late¹ ↓
- Applying too few companies ↓
- Reactive or no interview prep ↓
- Prioritizing coursework ↓
- Somewhat involved³ ⊖

Challenges

- **Low GPA²** ↓
- Difficulty of technical interviews ↓
- Transfer challenges ↓

No, I **didn't even apply**¹[in Years 1-4 of degree program] because of **my GPA²**, but at this point, I was like, "Okay. Well, it's better to do it even if you don't make it. Just try." [...] I'm slightly below a 3.0. GPA and how I'll be graduating soon is a wake-up call, so that's been pushing me a lot to actually **start on [personal] projects³** and learn things. – P401

Developing Personas: Fitting in altogether

2020 ————— 2024

Study 2: SIGCSE Sp. Project – CS Identity

Study 2: Findings

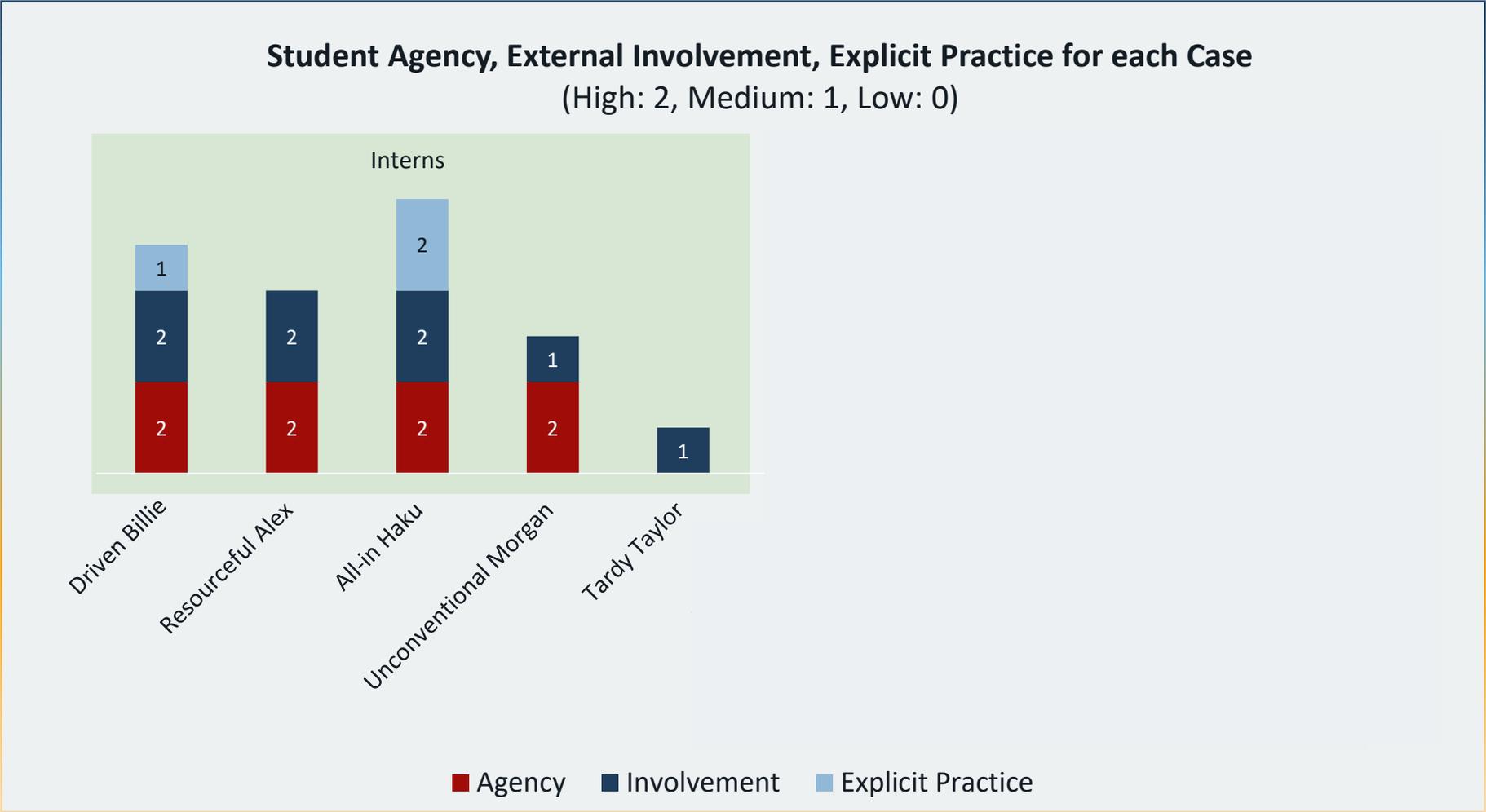
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Developing Personas: Fitting in altogether

2020

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Study 2: SIGCSE Sp. Project – CS Identity

Study 2: Findings

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mixed-methods



survey
750+ respondents

interview
42 participants

High Agency High Involvement Low explicit practice

Upskilling Veda (n=8) – did not intern

Key challenge: Low self-efficacy



Year 1: 6 | Year 2: 2
M: 3 | F: 4 | DNS: 1

Goal

Secure an internship in the future

Attributes

- Year 1 or 2 students
- High agency ⬆️
- High self-regulation skills ⬆️
- Low ambition ⬇️

Strategies

- **Not applying**¹ but ⬇️ developing skills sought by employers to apply in the future
- Involvement in ⬆️ activities outside of coursework
- Reactive interview ⬇️ preparation or no preparation³

Challenges

- Lack of time ⬇️
- Low self-efficacy² ⬇️

“I’ve **never applied for anything**¹ [any internship]. I feel like I **need to get more skills overall**², to secure an internship. Like more technical skills, and I also need to practice interviewing skills³ and those types of things to get better.” – P578

Developing Personas: Fitting in altogether

2020

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Study 2: SIGCSE Sp. Project – CS Identity

Study 2: Findings

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survey

750+ respondents



interview

42 participants

Low Agency

Some Involvement

Low explicit practice

Delayed and Preoccupied Sage (n=7) – did not intern

Key challenge: Low GPA



Year 3: 2 | Year 4: 4 | Year 5: 1

M: 2 | F: 5

Goal

Secure an internship before graduation or apply for full-time

Attributes

- Year 3-5 students
- **Transfer students or switched majors late**
- Low ambition ⬇️
- Low agency due to alternate priorities of coursework and part-time work ⬇️

Strategies

- **Applying very late** ⬇️ **due to low awareness**
- Some external involvement ⚡️
- **Reactive or no interview prep** ⬇️
- **Prioritizing coursework** ⬇️

Challenges

- **Low self-efficacy**¹ ⬇️
- Lack of awareness of expectations of the recruitment process ⬇️
- Lack of time ⬇️
- **Perception of Low GPA** ⬇️
- Low involvement² ⬇️
- Financial challenges ⬇️

“I think [I didn’t secure an internship] because **I lack the skills¹ and personal projects² to compete with much more experienced students¹**. My **GPA isn't the best⁴** either, as most engineering students GPA average to a 3.0.” – P382

Developing Personas: Fitting in altogether

2020

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Study 2: SIGCSE Sp. Project – CS Identity

Study 2: Findings

2018-Current

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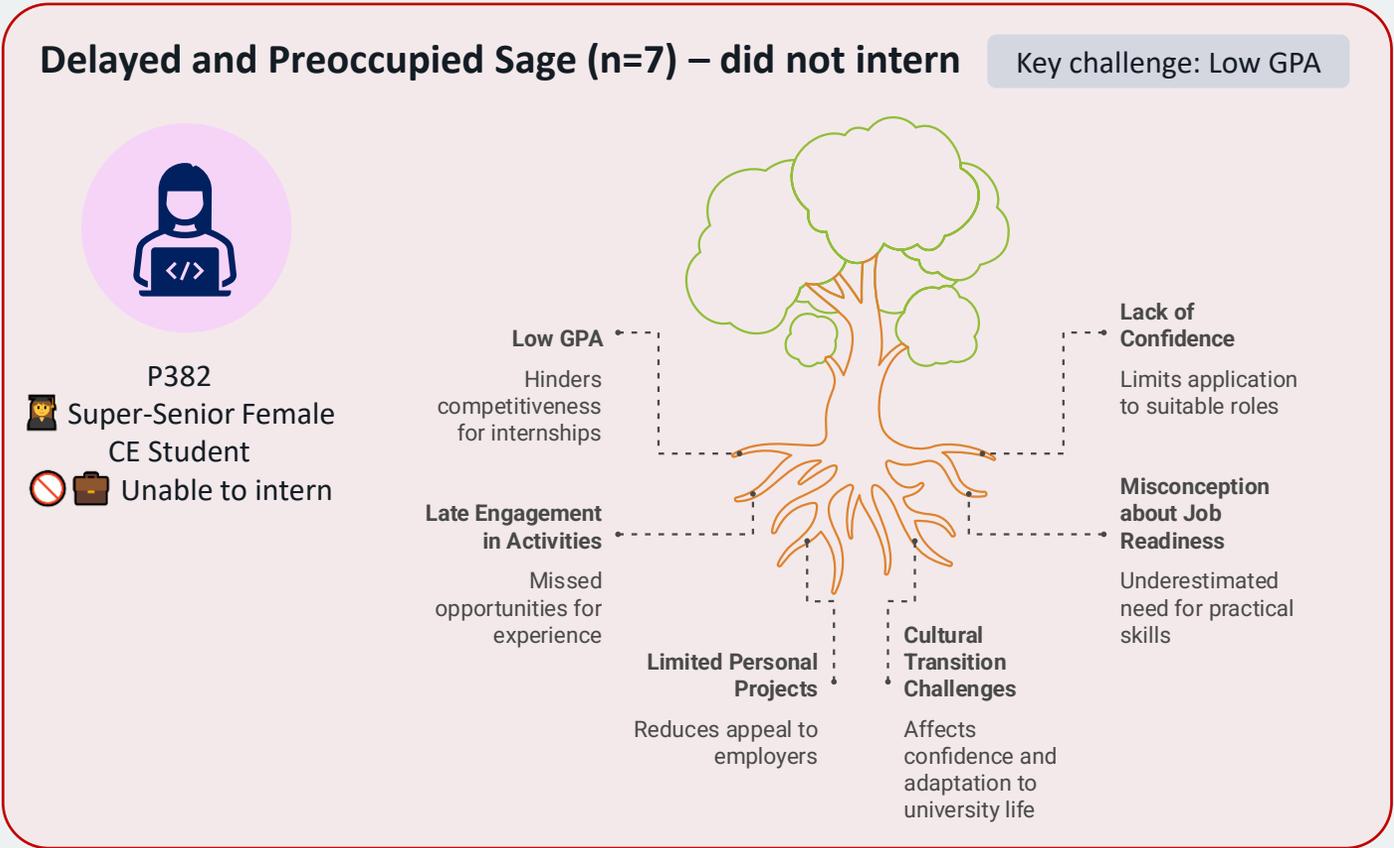
mixed-methods



survey
750+ respondents

interview
42 participants

Low Agency Some Involvement Low explicit practice



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mixed-methods



survey 750+ respondents interview 42 participants

Low Agency Some Involvement Low explicit practice

Delayed and Preoccupied Sage (n=7) – did not intern Key challenge: Low GPA

I transferred from a university that weren't up to par as UF. And so seeing these people who started at UF as freshmen, and they know so much more than I do. So, that was kind of discouraging. [...] I finally passed [Digital Logic] spring, that was my third time taking it. When I failed at a second time, I was like, Oh my God, I needed to get out of this career. Maybe I can get into like computer science.

I had the misconception that once I get a degree then I'll get a job. But I realized that in senior year or at my year now that you needs more experience than what the school has taught you. And nobody was there to tell me that like, what you learn at school isn't enough to get you a job unless you have a good GPA.

I was denied to every paid internship and had begun to apply to unpaid internships for the next summer. [...] I don't have any personal projects done, but I am working on it. And at my year now, I should probably have like two, or three personal projects done. I mean I have all my resume, like I put down things that I've done for class, but I kind of like said that add personal projects so that I have some sort of leverage in getting an internship.

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Study 2: SIGCSE Sp. Project – CS Identity

Study 2: Findings

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survey 750+ respondents interview 42 participants

Low Agency Low Involvement Low explicit practice

Hesitant Cameron (n=3) – did not intern

Key challenge: Plan B



Year 2: 1 | Year 4: 1 | Year 5: 1

M: 3

Attributes

- Year 2-5 students
- Low agency ↓
- **Lack of ambition or complacent** ↓
- Low resilience³ ↓

Strategies

- Applying late ↓
- Applying too few companies¹ ↓
- Reactive or no interview prep ↓

Challenges

- **Low self-efficacy⁴** ↓
- Lack of awareness of expectations of jobs and process ↓
- Low involvement ↓
- **Fallback(Plan B)²** ↓

Goal

Explore options after graduation and if none are available, go with Plan B

I've **applied to a couple¹** [of internships ...]. Sometimes, I think that the fact I am **interested in something else like Taekwondo²** will set me aside from other people, but I know that it also hinders me because I don't have as much technical skills as other do [... as] I haven't been fully committed to developing my technical skills. [...] I did get a **little bit disheartened³** even though it was only a few. I thought if **I couldn't even get this one, what makes me a good applicant for others⁴**. – P591

Developing Personas: Fitting in altogether

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Study 2: SIGCSE Sp. Project – CS Identity

Study 2: Findings

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survey

750+ respondents



interview

42 participants

High Agency

High Involvement

Low explicit practice

Obligated Jollie (n=2) – did not intern

Key challenge: Financial/Others



Year 3: 1 | Year 4: 1

M: 1 | F: 1

Goal

Finding an internship that meets their needs

Attributes

- Year 3-4 students
- High ambition ⬆️
- High agency ⬆️
- High self-regulation skills ⬆️
- High GPA ⬆️
- Confident ⬆️

Strategies

- **Applying, securing but declining** ⬇️
- High external involvement ⬆️
- **Reactive or no interview prep** ⬇️

Challenges

- Financial challenges¹ ⬇️
- Alternate priorities²

I am a non-traditional student with a family and **cannot afford to take an internship**¹ when I instead need long-term employment. I wanted to focus on my school and graduate quickly so that I could **support my family**². I **actually interviewed for and was accepted for a Summer 2019 internship**, but I **could not afford to travel to Tampa and support my family with the offered compensation.** – P600

Developing Personas: Fitting in altogether

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Study 2: SIGCSE Sp. Project – CS Identity

Study 2: Findings

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survey 750+ respondents interview 42 participants

High Agency Low Involvement Low explicit practice

Uninterested Jing (n=2) – did not intern

Key challenge: Goal Misalignment



Year 4: 1 | Year 5: 1

M: 1 | F: 1

Goal

Graduate with multiple majors or pursue full-time job directly

Attributes

- Year 4-5 students
- High agency ↑
- High self-regulation skills ↑
- Goal misalignment: full-time job or start graduate school

Strategies

- Not applying for internships ↓
- Reactive or no interview prep ↓
- Prioritizing coursework¹ ↓

Challenges

- Lack of time ↓
- Low involvement ↓

I guess I haven't pursued it at all because I thought I'd **focus more on summer classes**¹ and getting the right classes that I can triple degree. – Y81

Developing Personas: Fitting in altogether

2020 ————— 2024

Study 2: SIGCSE Sp. Project – CS Identity

Study 2: Findings

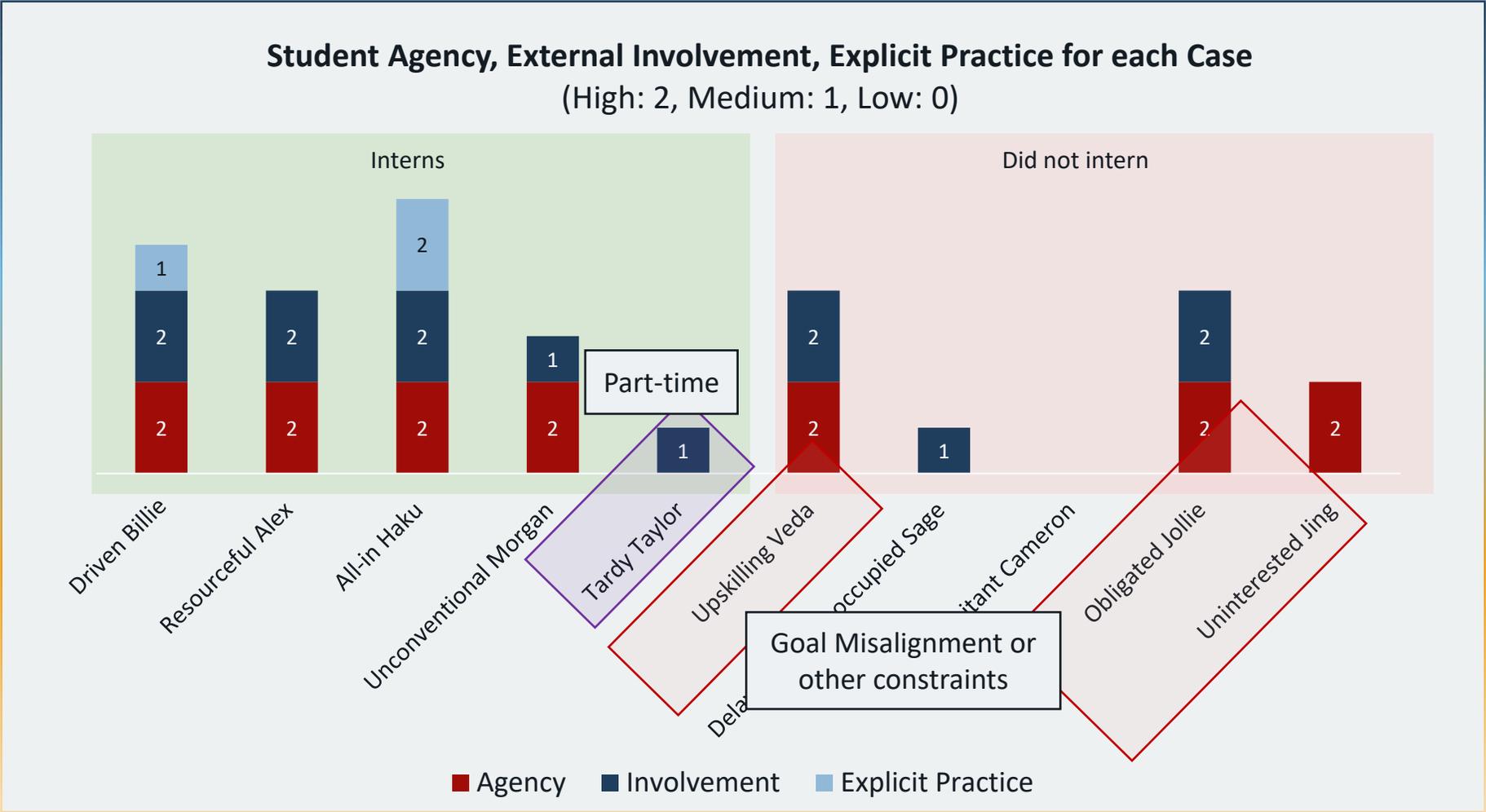
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750+ respondents 42 participants



Developing Personas: Fitting in altogether

2020 ————— 2024

Study 2: SIGCSE Sp. Project – CS Identity

Study 2: Discussion

2018-Current

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survey 750+ respondents interview 42 participants

Discussion

Barriers and Challenges

- Socio-economic & Process/Structural Barriers
- Psychological Barriers

Strategic Approaches & Attributes

- Resilience and Self-regulation
- Agency and Ambition

Internship Participation

- ✓ 🏆 Secure an Internship =
- 🎯 Goal to secure an internship
- ✉️ Actually applying
- 🔧 Extracurricular involvement
- 🧠 Interview Preparation

What is the role of curriculum and advising in securing an internship? 😞

social structures

Self Efficacy & Agency

Goals

Behavior

Cognitive Development

Outcome securing an internship

13

Developing Personas: Fitting in altogether

Study 2: SIGCSE Sp. Project – CS Identity

Study 2: Discussion

2018-Current

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survey 750+ respondents interview 42 participants

Discussion

- Most students (interns or unsuccessful interns) fell under **Moratorium** or **Achieved Identity Statuses**

- Most identity statuses except diffusion status **do not predict** internship participation (Wolf et al., 2023)

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

Developing Personas: Fitting in altogether

2020

2024

Study 2: SIGCSE Sp. Project – CS Identity

Study 2: Limitations

2018-Current

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mixed-methods



survey

750+ respondents



interview

42 participants

Recommendations

-  **Increase awareness** of the importance of internships, the recruitment process, and available opportunities
-  **Encourage** students to **apply early** and to **multiple companies**
-  **Emphasize involvement in activities outside the curriculum** and **support for funding** these initiatives
-  Recommend interview preparation and **offer courses or interventions** to ensure readiness
-  **Promote conferences** and **provide financial support** for attendance
-  Instructors **adjust coursework** during peak **recruiting periods**

Developing Personas: Fitting in altogether

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Study 2: SIGCSE Sp. Project – CS Identity

Study 2: Limitations

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survey

750+ respondents



interview

42 participants

Limitations

- sample consists of students across institutions in the United States (US)
- personas are based on generalized characteristics which may not represent diverse students
 - purposefully recruited students in our sample
 - developing multiple personas beyond the dichotomy of successful vs unsuccessful student personas
- risk of creating personas that reinforce stereotypes
 - transparency
 - quotes
 - empirical data backed by frequency analysis
 - positionality

Agenda

- **Part I: Overview**

- Introduction
- Theoretical Grounding

- **Part II: Internship Participation**

- ✓ Study 1: Why are internships important?
- ✓ Study 2: Who is participating in internships and how?
- Developing Personas: Fitting in altogether

- **Part III: Intervention & Evaluation**

- ✓ Study 3: How can we improve our curriculum so that more students intern?
- Study 4: How effective is our pedagogical intervention in preparing students for securing internships?

- **Part IV: Contributions & Conclusions**

Study 3: How can we improve our curriculum so that more students intern?

2020

2024

Study 3: Hire Thy Gator (HTG) Activities

Context and Outcomes for Hire Thy Gator (HTG) Activities

2020-2024

single-institutional



design and development research



mixed-methods & pedagogical intervention



survey

363 respondents



artifacts

257 participants

Context and Outcomes for Hire Thy Gator (HTG) Activities

- Goal of the study: **introduce an intervention to prepare students for securing internships**
- Study 3 was designed during Summer 2020 and data was collected starting Fall 2020
- Data analysis and outcomes:
 - **Papers**
 - ✓ *Introducing a Technical Interview Preparation Activity in a Data Structures and Algorithms Course* (ITiCSE 2021)
 - ✓ *Implementation and Evaluation of Technical Interview Preparation Activities in a Data Structures and Algorithms Course* (SIGCSE 2023, undergraduate student second author, Sajani Panchal)
 - **Others**
 - ✓ [Invited Talk]: *Introducing a Technical Interview Preparation Activity in a Data Structures and Algorithms Course* (ACM Compute 2021)
 - ✓ [Creative Assessment Repository]: *Hire thy Gator Interview Exercises* (Center for Teaching Excellence, UF, 2022)
 - ✓ [Course Transformation Grant]: *Preparing Computing Students for Technical Interviews through Open Educational Resources*, (Center for Teaching Excellence & George A. Smathers Libraries, UF, 2022)

Study 3: How can we improve our curriculum so that more students intern?

2020

2024

Study 3: Hire Thy Gator (HTG) Activities

Study 3: Intervention

2020-2024

single-institutional



design and development research



mixed-methods & pedagogical intervention



survey

363 respondents

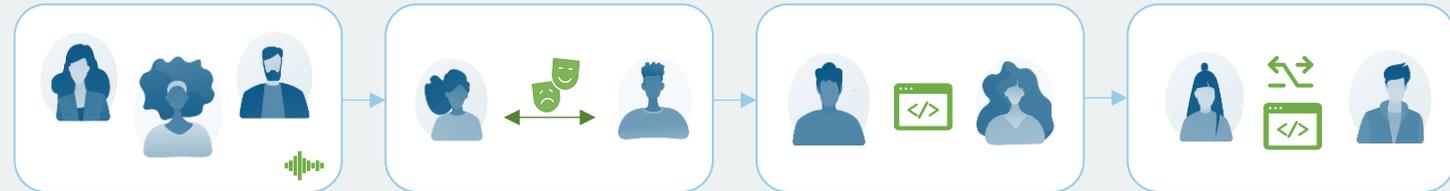


artifacts

257 participants

Intervention: Hire Thy Gator Technical Interview Exercises

Intervention introduced in a Data Structures and Algorithms course at the University of Florida in Fall 2020



Panel on internship experiences
Week 5

Role play on Interviews by TAs
Week 6

Interview 1: Self-selected pairs
Week 8

Interview 2: Random pairs
Week 13

Study 3: How can we improve our curriculum so that more students intern?

2020

2024

Study 3: Hire Thy Gator (HTG) Activities

Study 3: Findings

2020-2024

single-institutional



design and development research



mixed-methods & pedagogical intervention



survey

363 respondents



artifacts

257 participants

Key Findings

RQ1a. What do undergraduate computing students gain from participating in mock interview exercises?

Analysis: Inductive content analysis on “How was your experience in Hire Thy Gator Interview Exercises? Should they be a part of future course offerings?”

92%

Activity should be continued as-is or with minor modifications

awareness of the technical interview process

preparation for future technical interviews

motivation to apply for internships/jobs

building students' confidence to succeed in an interview

self-evaluation of one's strengths and weaknesses

Study 3: How can we improve our curriculum so that more students intern?

2020

2024

Study 3: Hire Thy Gator (HTG) Activities

Study 3: Findings

2020-2024

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design and development research



mixed-methods & pedagogical intervention



survey

363 respondents



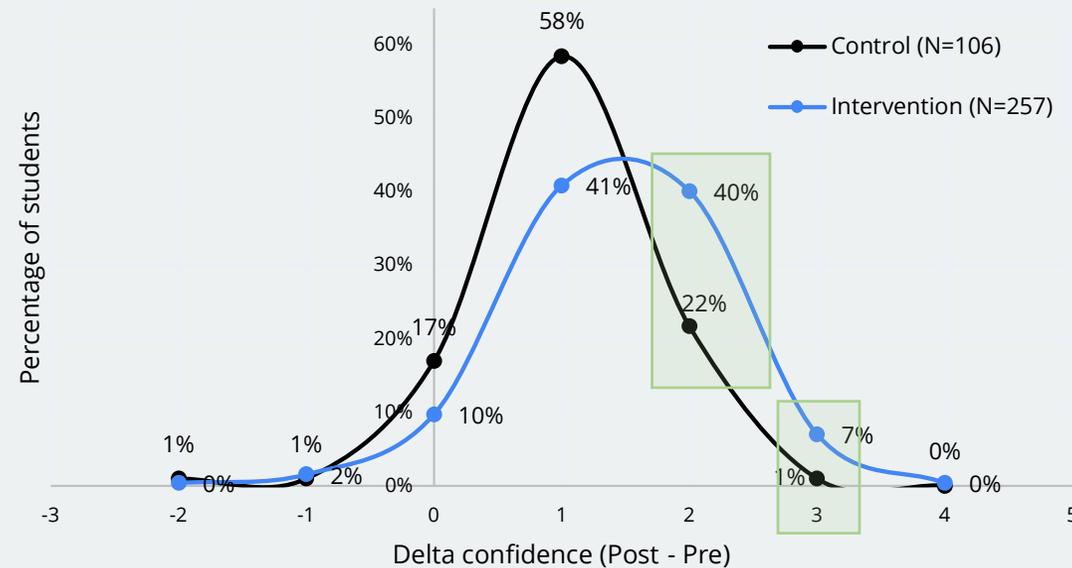
artifacts

257 participants

Key Findings

RQ2. How does participation in technical interview preparation activities influence students' perceived confidence levels for programming in a technical interview?

Percentage of students with specific confidence increase



6%↑
Higher confidence gain compared to the control group

Average normalized confidence gain: Control = 0.36 | Intervention = 0.42

Agenda

- **Part I: Overview**

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- **Part II: Internship Participation**

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- Developing Personas: Fitting in altogether

- **Part III: Intervention & Evaluation**

- ✓ Study 3: How can we improve our curriculum so that more students intern?
- Study 4: How effective is our pedagogical intervention in preparing students for securing internships?

- **Part IV: Contributions & Conclusions**

Study 4: How effective is our pedagogical intervention in preparing students for securing internships?

2020

2024

Study 4: Retrospective efficacy of HTG

Study 4: Study Design

2024 (Proposed work)

single-institutional



efficacy research



survey-based (retrospective)



survey

512 respondents

Study Design

- Research Question: How effective are Hire Thy Gator Technical Interview Exercises in preparing computing undergraduate students for securing industry internships?
- Goal: Evaluate the effectiveness of Hire Thy Gator exercises on:
 - future technical interview preparation
 - securing an internship or job
- Study Type: Longitudinal panel survey study in Fall 2024 at UF
- Status: Work is **accepted** and will be published to **ACM ITiCSE 2025 Conference**

Study 4: How effective is our pedagogical intervention in preparing students for securing internships?

2020

2024

Study 4: Retrospective efficacy of HTG

Study 4: Participants

2024 (Proposed work)

single-institutional



efficacy research



survey-based (retrospective)



survey

512 respondents

Participants

- Population: **3526** Undergraduate computing students in my Data Structures and Algorithms (DSA) course that was offered at the University of Florida from Fall 2020 to Summer 2024.
- Expected Responses: 10% of the overall sample ~ **352** students (Gabel & Shindlecker, 1990)
- Actual Responses: 15% of the overall sample ~ **512 students**
- Participant recruitment: Courses after Data Structures & Algorithms + offering extra credit for the survey

Study 4: How effective is our pedagogical intervention in preparing students for securing internships?

2020

2024

Study 4: Retrospective efficacy of HTG

Study 4: Data Analysis

2024 (Proposed work)

single-institutional



efficacy research



survey-based (retrospective)

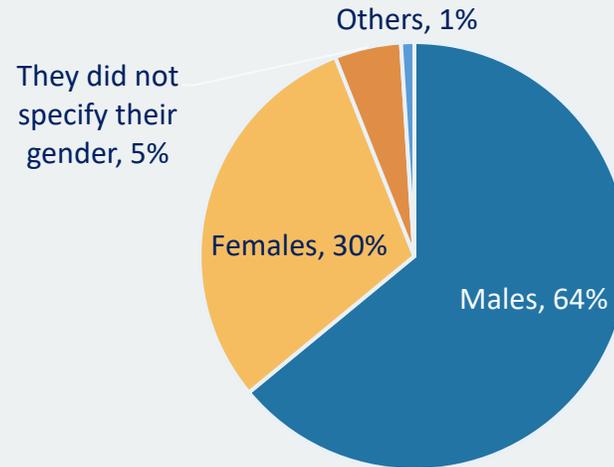


survey

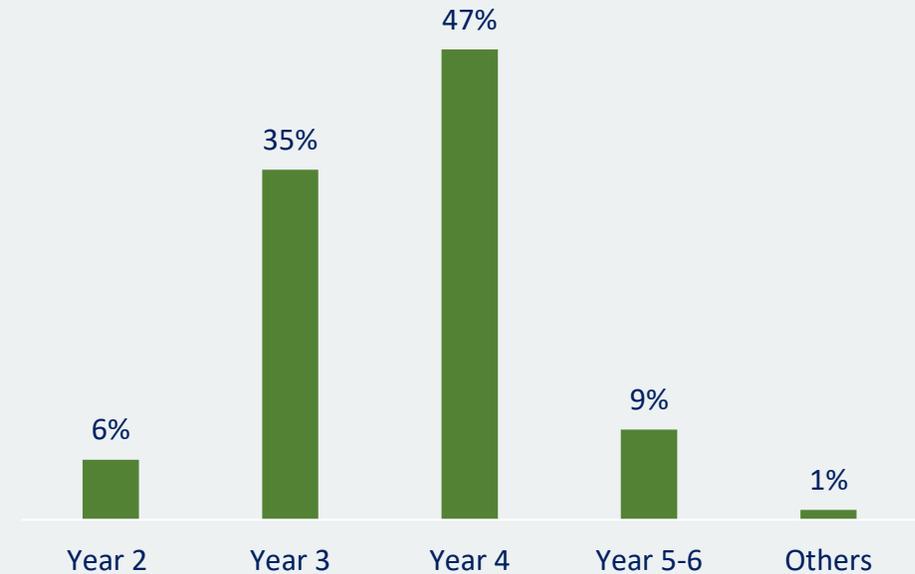
512 respondents

Participant Demographics (N=512)

Gender (N=512)



Academic Standing (N=512)



Study 4: How effective is our pedagogical intervention in preparing students for securing internships?

2020

2024

Study 4: Retrospective efficacy of HTG

Study 4: Data Analysis

2024 (Proposed work)

single-institutional



efficacy research



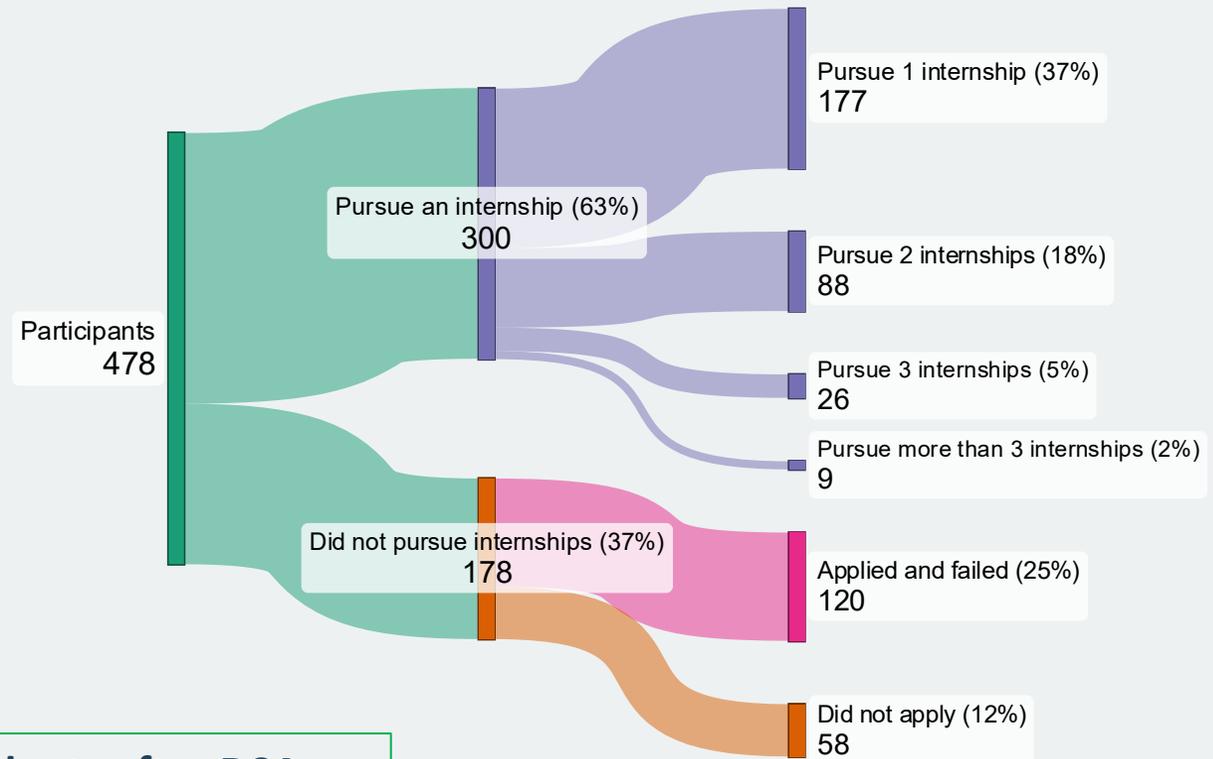
survey-based (retrospective)



survey

512 respondents

Participant Demographics (N=478)



Data from students after DSA

Study 4: How effective is our pedagogical intervention in preparing students for securing internships?

2020

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Study 4: Retrospective efficacy of HTG

Study 4: Findings

2024 (Proposed work)

single-institutional



efficacy research



survey-based (retrospective)

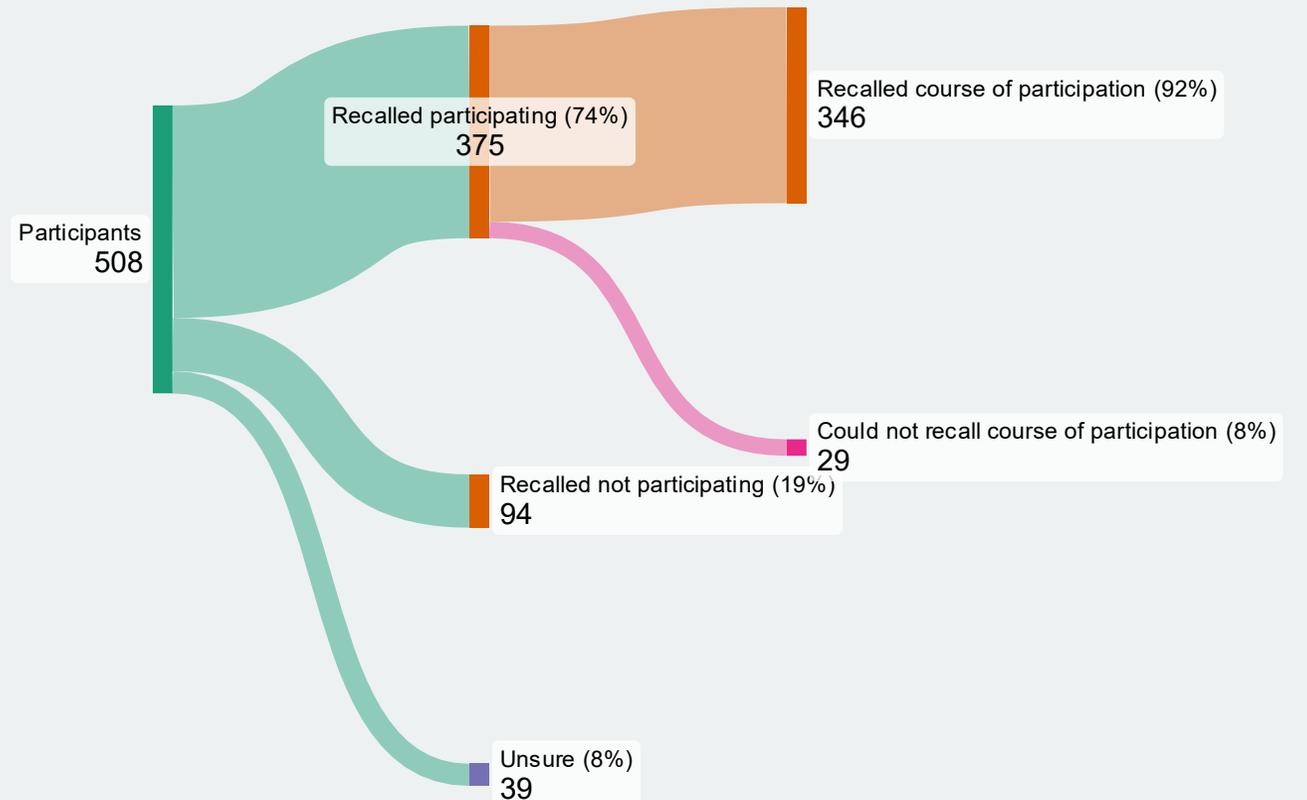


survey

512 respondents

RQ1. Recall: *Are students able to recall participating in our activities?*

**74%
Recalled**



Study 4: How effective is our pedagogical intervention in preparing students for securing internships?

2020

2024

Study 4: Retrospective efficacy of HTG

Study 4: Findings

2024 (Proposed work)

single-institutional



efficacy research



survey-based (retrospective)



survey

512 respondents

RQ2. What are student opinions on the **effectiveness of our activities**, *n*-semesters after their participation?

RQ	Metric	Likert Scale - (5- Strongly agree)				
		5	4	3	2	1
RQ.2	increased my familiarity with the technical interview	45%	47%	4%	2%	1%
	allowed me to understand my weaknesses and strengths	40%	41%	10%	6%	3%
	increased my self-confidence to succeed in a technical interview	23%	38%	23%	11%	5%
	are a useful activity that is beneficial for me to succeed in an interview	45%	42%	9%	3%	1%

RQ2. Metric	Likert Scale (0-4): 4 is Strongly Agree		
	Right After (N=256)	N-semesters After (N=363)	Delta (δ)
familiarity	3.46	3.33	-0.13
self-evaluation	3.34	3.09	-0.25
confidence	3.09	2.63	-0.46
usefulness	3.42	3.25	-0.17

Study 4: How effective is our pedagogical intervention in preparing students for securing internships?

2020

2024

Study 4: Retrospective efficacy of HTG

Study 4: Findings

2024 (Proposed work)

single-institutional



efficacy research



survey-based (retrospective)



survey

512 respondents

RQ3. *Did our activities **motivate and prepare** students for subsequent interview preparation after our course as well as **foster their agency to apply for internships/jobs**?*

RQ	Metric	Likert Scale - (5- Strongly agree)				
		5	4	3	2	1
RQ.3	prepared me to - participate in subsequent mock interviews	26%	38%	28%	5%	3%
	prepared me to - participate in subsequent individual programming	33%	46%	16%	3%	2%
	prepared me to - apply for actual internships or jobs related to computing	26%	38%	26%	6%	3%
	motivated me to - participate in subsequent mock interviews	21%	33%	29%	13%	5%
	motivated me to - participate in subsequent individual programming	38%	40%	13%	7%	2%
	motivated me to - apply for actual internships or jobs related to computing	30%	34%	23%	9%	4%

After the activities,

- **82%** students practiced solving technical interview questions (e.g., Leetcode style) **independently**
- **19%** students practiced solving technical interview questions **collaboratively**
- **18%** students practiced **mock interviews** with a friend, peer, etc.
- **16%** students **did not participate in any subsequent preparation activities** after our intervention

Study 4: How effective is our pedagogical intervention in preparing students for securing internships?

2020

2024

Study 4: Retrospective efficacy of HTG

Study 4: Findings

2024 (Proposed work)

single-institutional



efficacy research



survey-based (retrospective)



survey

512 respondents

RQ4. *What role did our activities play in helping students secure an internship or job post their participation?*

RQ	Metric	Likert Scale - (5- Strongly agree)				
		5	4	3	2	1
RQ.4	helped me in securing an internship/full-time job	6%	27%	49%	9%	9%

Study 4: How effective is our pedagogical intervention in preparing students for securing internships?

2020

2024

Study 4: Retrospective efficacy of HTG

Study 4: Findings

2024 (Proposed work)

single-institutional



efficacy research



survey-based (retrospective)



survey

512 respondents

RQ4. What role did our activities play in helping students secure an internship or job post their participation?

Qualitative analysis (N=347): What role did mock interviews play in helping you to secure an internship or a full-time job?

- ↓ 456 codes
- ↓ 29 unique codes
- ↓ 3 themes

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survey-based (retrospective)



survey

512 respondents

RQ4. *What role did our activities play in helping students secure an internship or job post their participation?*

Theme 1: Derived value (71%, 248 of 347 students)

Positive impact: Activities were useful for preparing students for the recruitment process

No direct attribution: Students did not explicitly state that the activities helped them secure a job

Prominent Codes:

- Promoting awareness of the process – 155 students
- Practicing technical interviews – 42 students
- Building self-confidence – 33 students
- Fostering self-evaluation – 21 students

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survey

512 respondents

RQ4. *What role did our activities play in helping students secure an internship or job post their participation?*

Theme 1: Derived value (71%, 248 of 347 students)

I have **not technically secured an internship** as of today, but **the HTG activities provided strong hands-on experience of the process**. It certainly made me **gain** a substantial **amount of confidence** for my future technical interviews.

– S396, Fall 2023

confidence

awareness

The exercise helped **open my eyes to how much I need to prepare**. It's one thing doing problem on your own and another thing doing them in an interview setting.

– S27, Fall 2023

self-evaluation

At the time I hated it, but looking back it was essential as that was my first introduction into how interviews for computing jobs work and **what is expected in a technical interview**.

– S182, Fall 2022

awareness

Study 4: How effective is our pedagogical intervention in preparing students for securing internships?

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efficacy research



survey-based (retrospective)



survey

512 respondents

RQ4. *What role did our activities play in helping students secure an internship or job post their participation?*

Theme 2: Limited, unclear, or no role (39%, 139 of 347 students)

No or unclear impact: Activities played a limited role or had no role in them securing an internship

Prominent Codes:

- Not securing an internship– 34 students
- Applying to non-technical or computing roles without coding interviews – 13 students
- Not having applied for internships – 8 students
- Poor experience due to an unprepared interviewer – 5 students

Study 4: How effective is our pedagogical intervention in preparing students for securing internships?

2020

2024

Study 4: Retrospective efficacy of HTG

Study 4: Findings

2024 (Proposed work)

single-institutional



efficacy research



survey-based (retrospective)



survey

512 respondents

RQ4. *What role did our activities play in helping students secure an internship or job post their participation?*

Theme 2: Limited, unclear, or no role (39%, 139 of 347 students)

I have **yet to participate in a technical interview** for this hiring season, so I am **unsure**. It was valuable to learn what to expect, however.

– S283, Fall 2023

It didn't but that's because I think **much more preparation is needed** in addition to mock interviews, which I did AFTER the DSA one and then in Enterprise SWE I did the interview after preparing on my own and securing an internship

- S146, Fall 2023

None, I am going to work in the **Networking/Cybersecurity** Engineering field and **my past interviews did not include coding** as they were not strictly programming roles where I interviewed.

– S284, Fall 2021

Study 4: How effective is our pedagogical intervention in preparing students for securing internships?

2020

2024

Study 4: Retrospective efficacy of HTG

Study 4: Findings

2024 (Proposed work)

single-institutional



efficacy research



survey-based (retrospective)



survey

512 respondents

RQ4. *What role did our activities play in helping students secure an internship or job post their participation?*

 **Theme 3: Positive outcome** (2%, 7 of 347 students)

 **Direct attribution:** Students explicitly stated that the activities helped them secure an internship or clear an interview

 **Prominent Codes:**

- clear technical interviews (n=2)
- secure an internship (n=5)

Study 4: How effective is our pedagogical intervention in preparing students for securing internships?

2020

2024

Study 4: Retrospective efficacy of HTG

Study 4: Findings

2024 (Proposed work)

single-institutional



efficacy research



survey-based (retrospective)



survey

512 respondents

RQ4. *What role did our activities play in helping students secure an internship or job post their participation?*

Theme 3: Positive outcome (2%, 7 of 347 students)

Helped me practice talking out loud while solving coding problem. Get to know my strengths and areas that needed improvement before a technical interview. **Helped me secure a software engineering internship** with JP Morgan Chase

– S166, Fall 2023

HTG helped me prepare for career fair and the Grace Hopper conference in which I had to interview with recruiters, and **ultimately ended up receiving an internship offer.**

– S23, Fall 2023

Study 4: How effective is our pedagogical intervention in preparing students for securing internships?

2020

2024

Study 4: Retrospective efficacy of HTG

Study 4: Discussion

2024 (Proposed work)

single-institutional



efficacy research



survey-based (retrospective)



survey

512 respondents

Discussion

Evaluation: Retrospectively assessed our activities, adding empirical insights.

Baseline Data: Provides useful data for researchers and practitioners developing similar initiatives.

Efficacy: Our activities made students **aware** of computing internship recruitment process and boosted their **self-confidence**, and **self-assessment** fostering **agency development**.

Supplementary Preparation: While effective, our activities should be complemented with subsequent practice to secure an internship.

forethought

self-reactiveness

self-reflectiveness

(Bandura, 1989)

Study 4: How effective is our pedagogical intervention in preparing students for securing internships?

2020

2024

Study 4: Retrospective efficacy of HTG

Study 4: Limitations

2024 (Proposed work)

single-institutional



efficacy research



survey-based (retrospective)



survey

512 respondents

Limitations

- Locating students in longitudinal panel studies can be challenging especially graduating students
- Maturation effect
 - additional checks in our instrument such as recalling the course for the HTG activities and explicitly asking it's attribution to securing a job
- Validity of qualitative analysis
 - transparency of research process
 - using participants' quotes
 - revealing the researchers' positionality

Agenda

- **Part I: Overview**

- Introduction
- Theoretical Grounding

- **Part II: Internship Participation**

- ✓ Study 1: Why are internships important?
- ✓ Study 2: Who is participating in internships and how?
- Developing Personas: Fitting in altogether

- **Part III: Intervention & Evaluation**

- ✓ Study 3: How can we improve our curriculum so that more students intern?
- Study 4: How effective is our pedagogical intervention in preparing students for securing internships?

- **Part IV: Contributions & Conclusions**

CONTRIBUTIONS

■ Empirical contributions in Computing Education Research Literature

foundational research

- Value students receive from participation (SIGCSE 2019a)
- Attributes of students' who participate in internships (SIGCSE 2020, SIGCSE 2023a)
- Student preparation for securing internships (SIGCSE 2019a, SIGCSE 2019b, SIGCSE 2020)
- A **qualitative categorization model** describing barriers to participation (ACE 2020)
- A **statistical model** for identifying internship participation (SIGCSE 2023a)

Study 1

Study 2

■ Theoretical contribution

foundational research

- **Personas** of successful vs unsuccessful students with emphasis on:
 - student goals, attributes, strategies and challenges
 - processes for participation and preparation
 - stakeholders involved in these processes
 - participation in formal, non-formal, and informal education

Study 1

Study 2

■ Curriculum and Pedagogical Contributions

design and development research

efficacy research

- Integration of **Technical Interview Exercises within Curriculum** and Instructor Resources (ITiCSE 2021)
- **Effectiveness** of our intervention (SIGCSE 2023b, ITiCSE 2025)

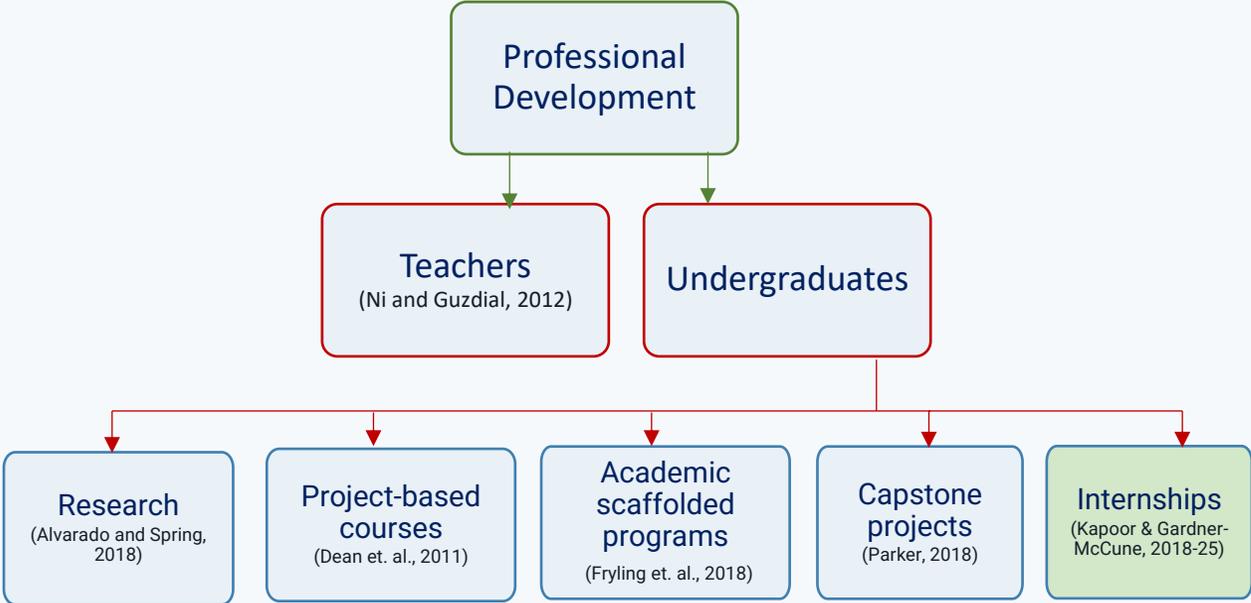
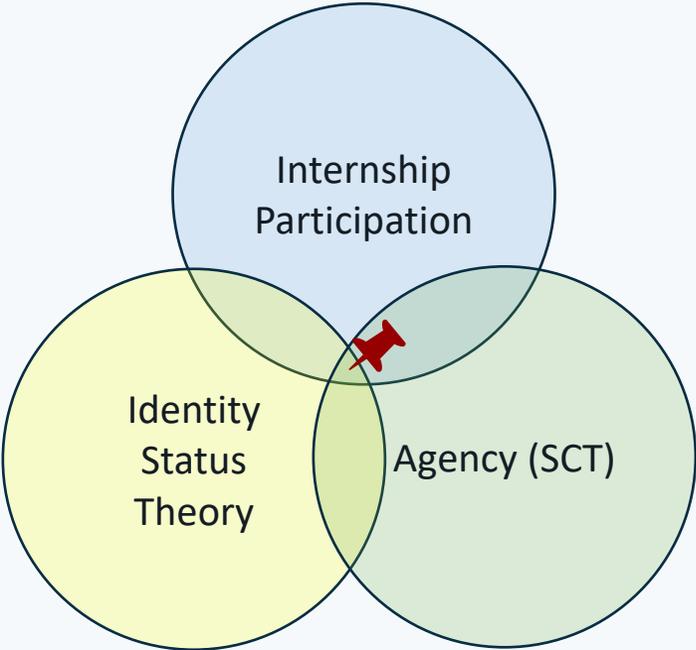
Study 3

Study 3

Study 4

CONCLUSIONS

🎓 Research Focus: Computing students' participation in internships



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CONCLUSIONS

 **Research Focus:** Computing students' participation in internships

 **Key Insights:**

-  Successful interns: High agency, ambition, self-regulation, external involvement & proactive prep
-  Students who did not intern: Relied on coursework, lower self-efficacy, lack of structured prep

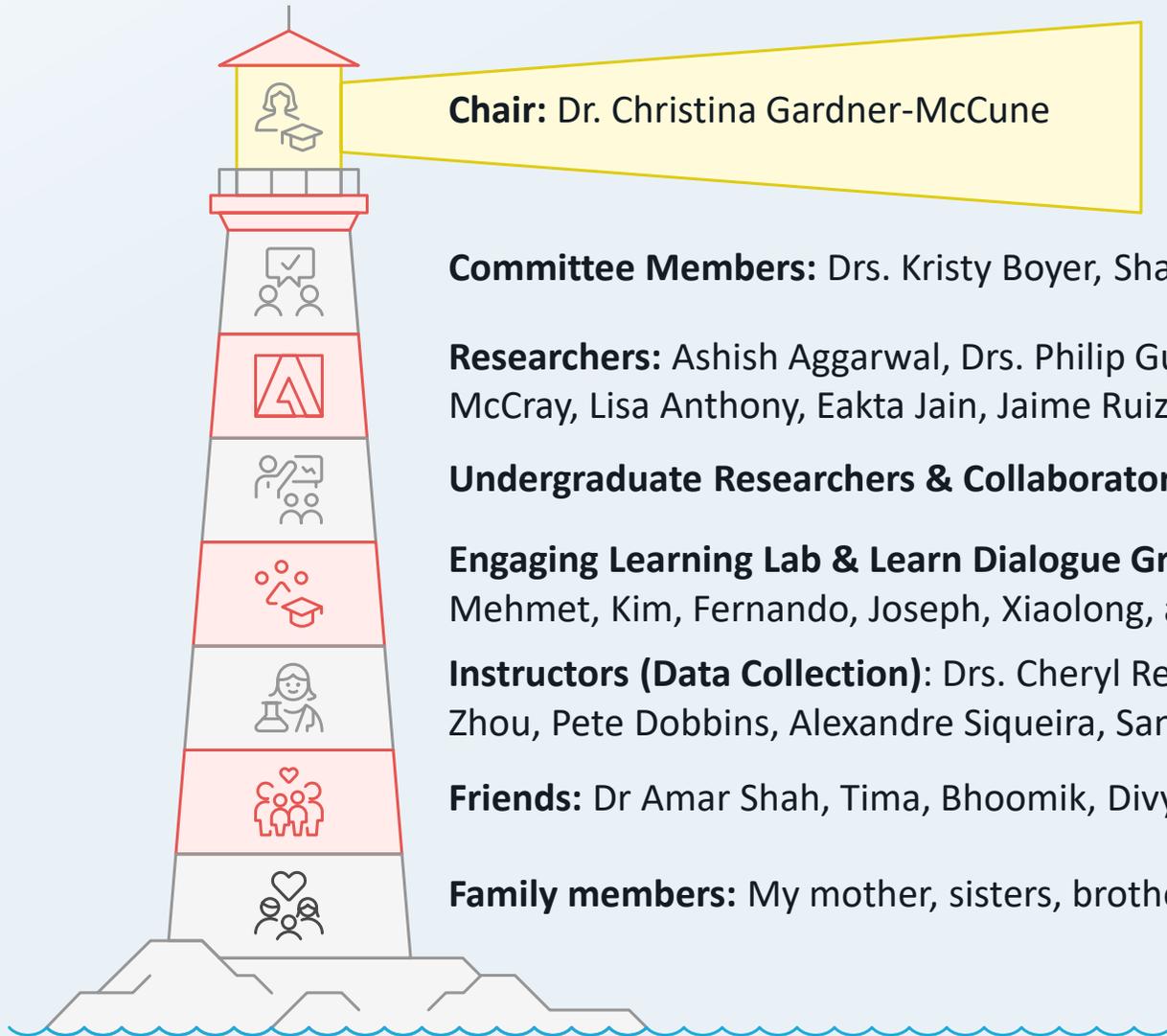
 **Intervention:** *Hire Thy Gator* – Technical interview exercises

-  Increased awareness & confidence in recruitment process
-  Helped preparation but required continued practice

 **Future Directions:**

-  Study student transitions between personas
-  Build predictive models to identify at-risk students
-  Examine internship trends post-COVID across contexts

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QUESTIONS



Questions?

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What's next?



— Edugator

AI assisted preparation for Internships



Grasshopper Lab aims to advance collective understanding of human **agency** and **accelerate** its development **among key stakeholders in computing education.**