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Additional Evidence for the Prevalence of the Impostor Phenomenon in Computing

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Have you ever had this thought before?

Do I deserve to be here?

(NOT SYNDROME)

What is Impostor Phenomenon (IP)?

- The Impostor Phenomenon (IP) was identified by Clance and Imes.
- Failure of recognizing personal success
- Expectations about their abilities

High anxiety

Low self-efficacy

Low performance

IP & Sense of Belonging

- Sense of Belonging
  - Feeling of being part of a community
  - Accepted by that community

- Not necessarily opposite to IP:
  - Feeling like you belong and have impostor symptoms.
  - Many people with impostor symptoms are struggling to belong.

Why do we care about IP?

- Evidence that there are higher rates of IP in CS than in other fields.
- Prevalent in underrepresented groups in computing.
- Can we generalize?

Replication Study

- Replication and extension of Rosenstein et al.: IP in CS.
- Using Clance Impostor Phenomenon Scale (CIPS)
- 57% of students present significant feelings of IP
- Additional questions
  - Year of study
  - Demographics: Gender and Ethnicity
  - Study status

20-40: None to mild
41-60: Moderate
61-80: Significant
81-100: Intense

Student Population

- Students have different challenges
- Categorize them by experiences and backgrounds
- Our setting: Study status

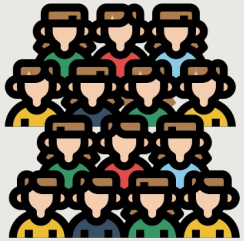
Domestic

International

Intervention Setting

- Two campuses: Site A and Site B
- Differences:

Admissions



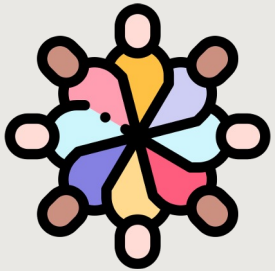
Population

- But results from both sites were statistically similar.

Replication Study

Large University

Different Country



Diverse Community

Program Admissions

Results

Table 1: Response counts, median CIPS scores, and the percent above the diagnostic criteria (a score ≥ 61) for various populations. Students did not answer all demographic questions, so *n* varies between populations. The rightmost columns report the results of a Kruskal-Wallis test between the two sites. Low p-values are in bold for emphasis.

Population	Count (% Total)		CIPS Median (IQR)		Above Diag. Criteria		Cross-Site Comparison	
	Site A	Site B	Site A	Site B	Site A	Site B	Test Stat.	p-value
All Valid Responses	519 (100%)	235 (100%)	70 (21)	70 (22)	69.94%	68.94%	1.111	0.267
Domestic Students	394 (76%)	167 (71%)	71.5 (22)	70 (21)	72.84%	70.66%	1.542	0.123
International Students	113 (22%)	62 (26%)	68 (21)	67 (25.5)	62.83%	62.90%	0.314	0.754
All Undergraduate Students	504 (97%)	228 (97%)	71 (21)	71 (22.75)	70.83%	69.74%	0.993	0.321
Year 1	100 (19%)	68 (29%)	70 (22)	69.5 (21.5)	71.00%	64.71%	0.480	0.631
Year 2	125 (24%)	60 (26%)	73 (20.5)	70 (16)	78.40%	71.67%	2.148	**0.032**
Year 3	117 (23%)	49 (21%)	71 (22)	77 (29)	67.52%	65.31%	-0.193	0.847
Year 4	162 (31%)	51 (22%)	70 (21)	69 (20)	67.28%	78.43%	-0.525	0.600
Graduated Students	14 (2.7%)	7 (3.0%)	59 (20.75)	57 (20)	42.86%	42.86%	0.970	0.332
Male Students	338 (65%)	151 (64%)	70 (20)	67 (22)	68.64%	62.93%	1.609	0.108
Female Students	123 (24%)	53 (23%)	77 (23)	76 (19)	76.42%	84.91%	0.382	0.702
Students of Other Gender Identities	9 (1.7%)	†	85 (28)	†	77.77%	†	†	†
Racially Represented Student Groups	385 (74%)	184 (78%)	70 (21.5)	70 (20.75)	70.39%	70.11%	1.118	0.264
European Origins	76 (15%)	22 (9.4%)	67 (26.75)	60.5 (28.75)	60.53%	50.00%	1.064	0.287
South Asian Origins	142 (27%)	66 (28%)	74.5 (23)	71.5 (19.25)	73.94%	77.27%	0.455	0.649
East and Southeast Asian Origins	167 (32%)	96 (41%)	70 (21)	69.5 (19)	71.86%	69.79%	1.022	0.307
Racially Underrepresented Student Groups	117 (23%)	43 (18%)	72 (23)	66 (28)	72.65%	60.47%	1.363	0.173
African Origins	13 (2.5%)	†	77 (17.5)	†	92.31%	†	†	†
Caribbean Origins	11 (2.1%)	†	75 (19)	†	90.91%	†	†	†
Latin, Central, South American Origins	11 (2.1%)	†	69 (34)	†	63.64%	†	†	†
Middle Eastern Origins	41 (7.9%)	15 (6.4%)	68 (16.5)	66 (27)	68.29%	53.33%	0.537	0.592
Mixed Origins	40 (7.7%)	18 (7.7%)	73 (25.75)	64.5 (29.25)	70.00%	66.67%	0.765	0.444
Other Origins	†	†	†	†	†	†	†	†

†*Populations with count < 5 are omitted.*

Results: Year of Study

Other fields
27-48%

No difference in CIPS scores

Population	CIPS Median (IQR)		Above Diag. Criteria	
	Site A	Site B	Site A	Site B
All Undergraduate Students	71 (21)	71 (22.75)	70.83%	69.74%
Year 1	70 (22)	69.5 (21.5)	71.00%	64.71%
Year 2	73 (20.5)	70 (16)	78.40%	71.67%
Year 3	71 (22)	77 (29)	67.52%	65.31%
Year 4	71 (21)	69 (20)	67.28%	78.43%

Results: Gender

Women and students of other gender identities have a higher CIPS score than men.

Population	CIPS Median (IQR)		Above Diag. Criteria	
	Site A	Site B	Site A	Site B
Men Students	70 (20)	67 (22)	68.64%	62.93%
Women Students	77 (23)	76 (19)	76.42%	84.91%
Students of Other Gender Identities	85 (28)	ł	77.77%	ł
ł Populations with count < 5 are omitted.				

Results: Ethnicity

Represented and underrepresented groups don't appear to be different.

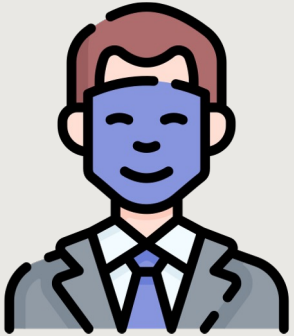
Population	CIPS Median (IQR)		Above Diag. Criteria	
	Site A	Site B	Site A	Site B
Racially Represented Student Groups	70 (21.5)	70 (20.75)	70.39%	70.11%
Racially Underrepresented Student Groups	72 (23)	66 (28)	72.65%	60.47%

Results: International vs Domestic Status

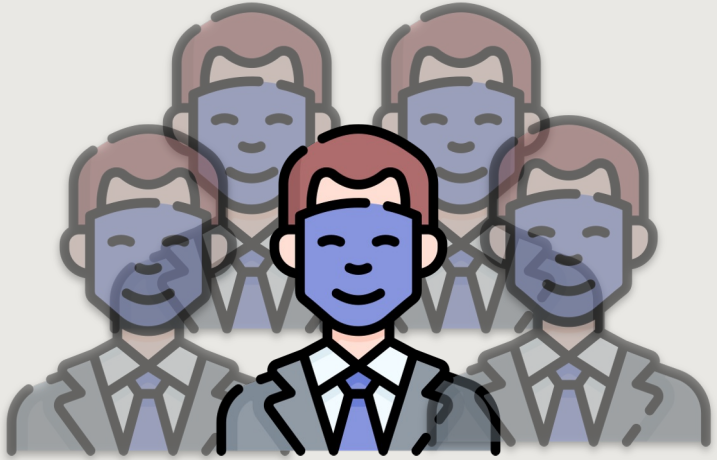
Domestic students have higher CIPS scores than international students.

Population	CIPS Median (IQR)		Above Diag. Criteria	
	Site A	Site B	Site A	Site B
All Valid Responses	70 (21)	70 (22)	69.94%	68.94%
Domestic Students	71.5 (22)	70 (21)	72.84%	70.66%
International Students	68 (21)	67 (25.5)	62.83%	62.90%

Goals of our Study



How common is IP in CS?

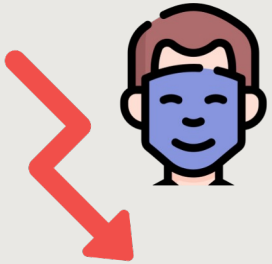


How common is IP in our setting and demographics?

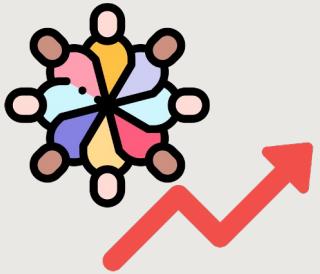
- Existing effort to replicate this broadly

Summary of our Interventions and Results

- Looking at only one factor may provide an incorrect picture.
- Experience in university is important
  - Domestic vs. International students
  - Ethnicity
- Efforts



Sense of impostor



Sense of belonging

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"I Am Not Enough": Impostor Phenomenon Experiences of University Students

What experiences and factors do students in computing associate with feelings of being an impostor?

Sense of Belonging and Identity

- Contribution to retention rates

- Students' experiences, expectations, program environment and support impact retention and success

Methods

- Previous studies: descriptive approaches for prevalence
- Interpretive framework: social constructivism
- Inductive thematic analysis.
  - Open-ended survey question
- Undergraduate computing program
- Recruitment: by email and a public announcement on the LMS

GOAL

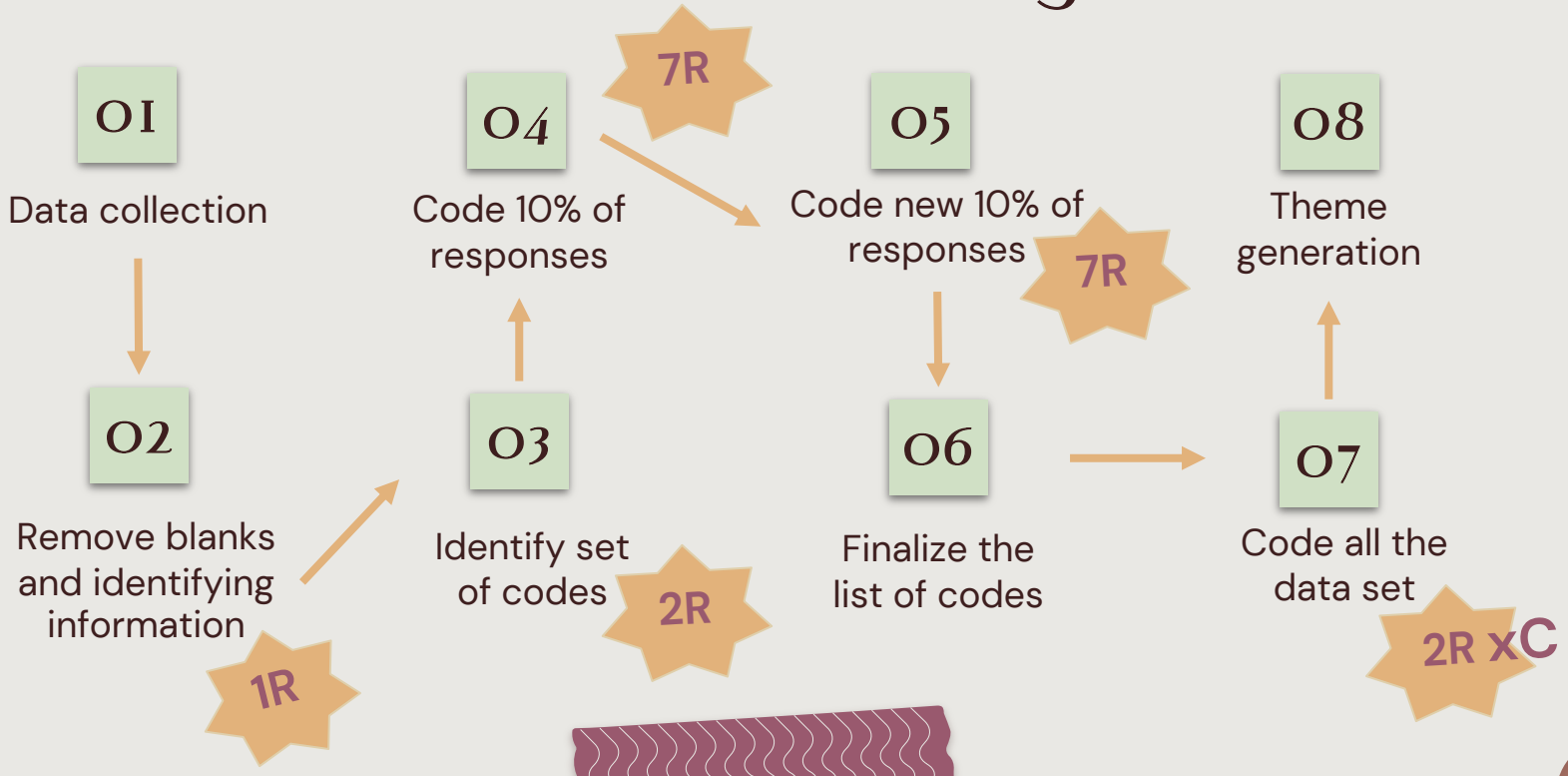
Identify elements of experiences that students identify as being connected to IP feelings

Methods

- Anonymous survey: 692 participants across three semesters: May 2021, December 2021, and May 2022.

The Impostor Phenomenon is characterized by self-doubt about skills and accomplishments and is commonly experienced even by highly successful people. These feelings can be accompanied by anxiety and decreased feeling of belonging. Consider your experiences in the [computing] community or in [computing] courses over the past year. **Are there any feelings, events, or stories that illustrate your experience with the Impostor Phenomenon that you would be willing to share?**

Data Processing

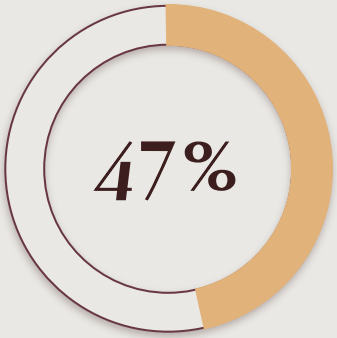


Codes


Environment
Social
IP
Expectation
Improvement
Wellbeing
Belonging
Failure
COVID
Irrelevant
Coping
Lack Confidence

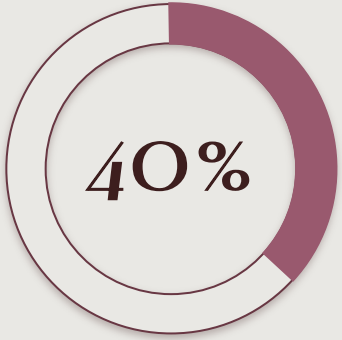
Results

- No variation in frequency of codes across years



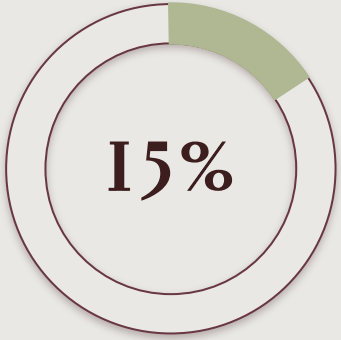
Environment

School/work and comparison with peers



IP

Description of impostor feelings



Expectations

Expectation about ability or success

Environment

> *Whenever I would attend those **lectures** I always feel like I **should understand everything** as its being told or should know a lot of these things already.*

-GikB

> *I always think about **whether I really learn anything** useful from the course and worry about if I can use it during the **future job**.*

-qEik

Social

> *I just feel like **I don't know anything compared to others** around me and that I am **incompetent**, even though others just have more **expertise** and have spent more time learning other fields.*

-z8wX

> *I feel that I would be doing extremely bad if I **didn't have** the **help** and **support** of my friends when we **work** and **study** on assignments and on upcoming tests.*

-qKzk

> *Taking a lot of the **same classes** with my [community] **involved friends** allows me to put my best interest forward in learning and trying my best to **show off** while building valuable skills.*

-269Z

IP

> *"**I was accepted** into a [research opportunity] even though I felt completely **incompetent** ... so I ended up **withdrawing** from the project.*

-eVL5

> *"I [placed] in a **hackathon** with a couple of my friends. I felt that **I did not** do much to **contribute** and maybe it was just **luck** and a **few people** who really brought our team to victory.*

-ak5C

Expectations

*"I feel like I **should know everything** about computer science. If someone asks me about something I haven't learned ... I **have failed**.*

-BS6Z

*"I was always worried that I **wouldn't be able** to answer a question, that I would let others down, or that someone would one day tell me that I **wasn't good enough** to keep the job.*

-gmZ8

Improvement

> *"I had to **stop worrying about others' accomplishments** and focus on creating some of my own.*

-dyw1

> *"I don't feel like I'm an imposter, because **they had the choice of hiring me and did**.*

-hQfr

Coping

> *About the feeling of anxiety from not feeling competent enough, I **often use that feeling as a source of energy** and motivation to work on a **side project**.*

-DaYF

> *I'm currently trying to manage these feelings by **changing perspective** so I don't constantly doubt myself and fall into patterns and **cycles of negative thought**.*

-zAUW

Belonging

> *Feeling isolated from the community due to the **overwhelming male presence** makes it tough to be proud of my accomplishments.*

-JxgF

> *There's a lot of **pressure** when you're **"the only"** in a room.*

-b7CF

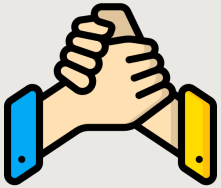
> *This [...] made it **difficult to ask for help** when other (male) students were around because I was **afraid of them** knowing that I didn't understand a concept etc. and **inevitably be ridiculed for it (which has happened)**.*

-hOTc

Takeaways

- Wide range of **experiences** and **factors** that contribute to IP feelings
- Should focus on:

setting **attainable expectations**



cultivating **supportive rather than competitive** communities

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Thanks!

Do you have any questions?

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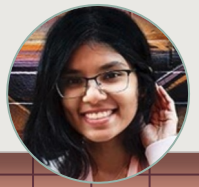

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