SoS Lablet Impact on the Community of Practice: Students, Alumni, and Collaborators

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SoS Lablet Goals

- Solve hard problems in cybersecurity
- Develop and use scientifically rigorous methodology
- **Develop a community of practice around the science of security**
  - **Collaboration & Training**

Overview

- Methodology Seminar Presenter Survey
  - Seminar assessment and impact
- Student & Alumni Survey
  - Training assessment
  - Impact on Skills
  - Student Career Preparedness
  - Alumni Career Outcomes
- Co-authorship Analysis
  - Multi-institutional, multidisciplinary, cross-sector collaboration

METHODOLOGY SEMINAR: PRESENTER FEEDBACK SURVEY RESULTS

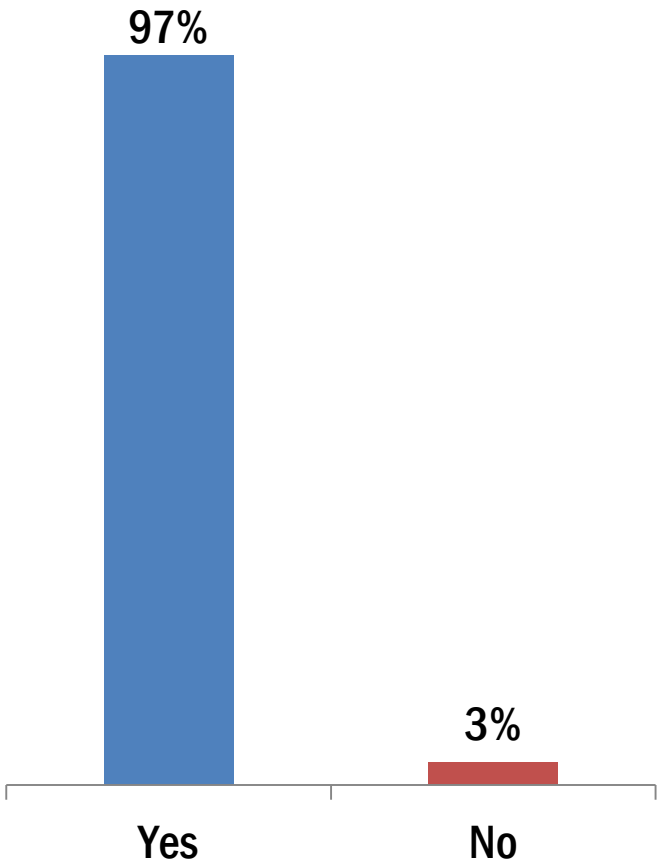
Methodology Seminars: Background

- Students present research plans or manuscripts to Lablet faculty and student participants
- Lablet participants provide feedback on how to improve the study methodology and scientific reporting
- Held weekly during the academic year
  - Fall 2014 – Spring 2017
  - 53 research presentations

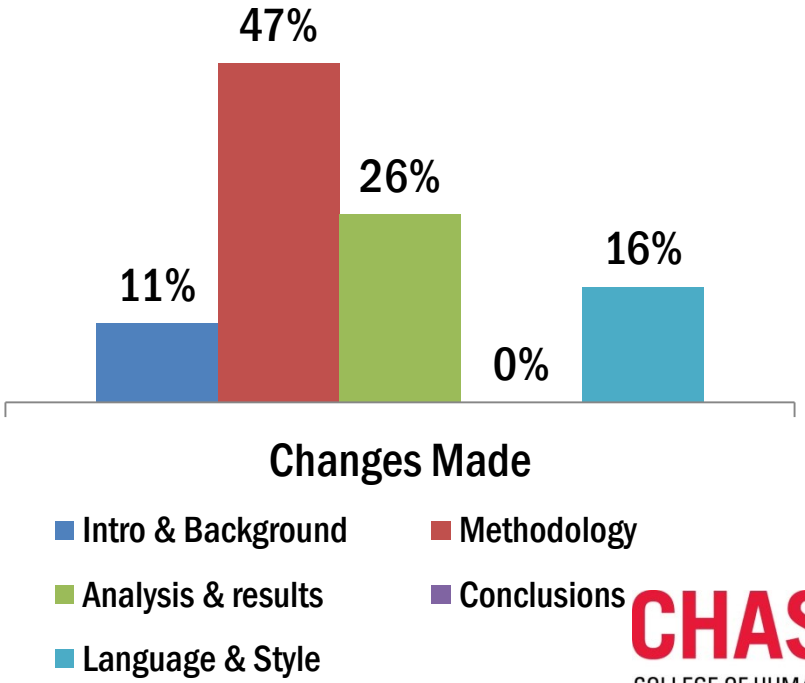
Presenter Survey: Methodology

- How is Lablet methodology support impacting student presenter research methodology?
- How can the methodology support be improved?
- Survey sent to student presenters at methodology seminars at the end of each semester
- Survey focus
  - Feedback on seminar format
  - Use of feedback
  - Additional methodology support
- Response rate = 35/53, 66%

Presenter Feedback Utilization

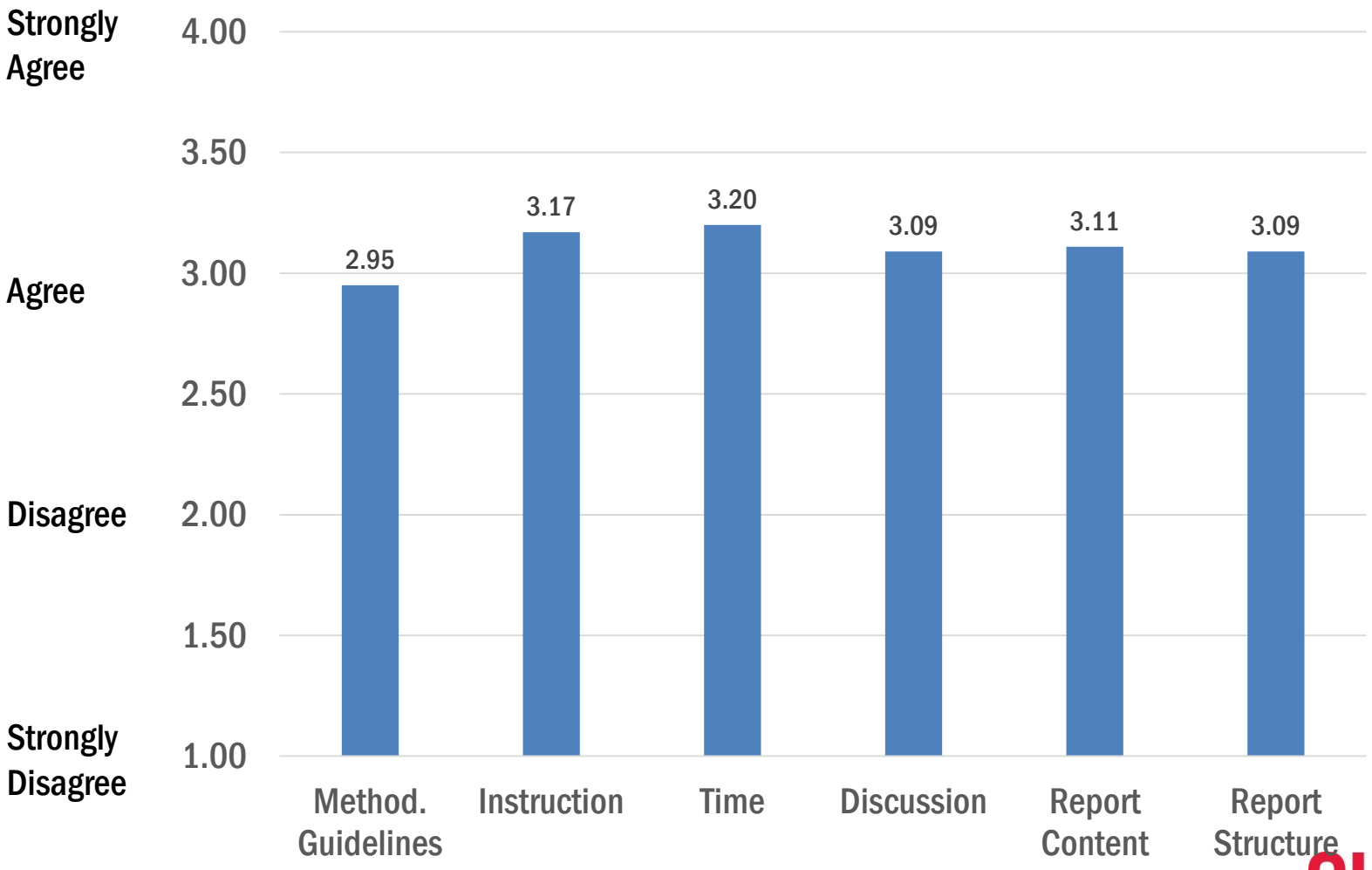


Feedback Used to Make Changes to Research

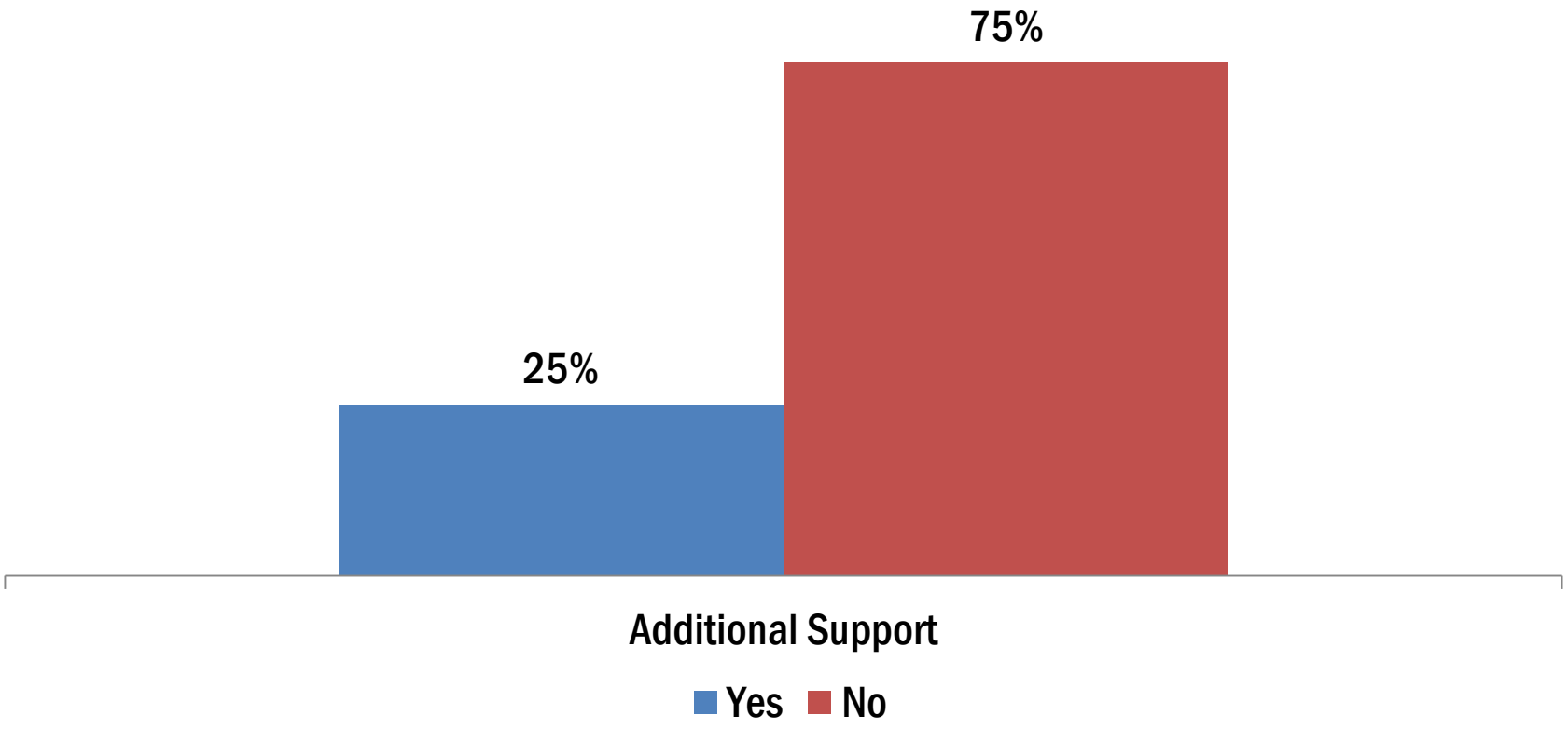


Semester	Comment
Metrics	We try to give more clear separations among the metrics so as to avoid further confusions.
Study motivation	“Discussion about why we want to write this paper” “The feedback provides a more interesting and practical way to introduce the topic which arouses the interest of readers.”
Research Goals/Questions	“Feedback helped me rephrase and rewrite research questions and goals of the study.”
Goal-Question-Metric	Make the goal, hypotheses, and the experiment more clear
Language & Style	“I have changed my documentation. For example, I needed to add more contents in introduction section for readers' understanding. Also, I added more fine-grained methodology.”, “Most of the feedback are related to clarity and presentation formats.”
Methodology/Design	“Structure of the research“ “I also got advice on the examples I have presented. I am revising the various scenarios we use in our research” “The feedback revealed a lot of problems with my original research plan. I changed my research plan dramatically. “ “The way of considering and solving the problem is improved.”
Analysis / Results	“The feedback helped improve structure the paper and presentation to be more result-oriented.” “Added more explanation and clarification to the analysis methodology.”
Conclusions/ Limitations	The presentation was also modified to identify measures to overcome the limitations outlined.
Suggested Resources	I received feedback on relevant work that I should look at
External Validity	I tried to make the problem more realistic.

Effectiveness of Seminar Structure



Seek additional methodology support?



Suggestions for Improvement

Semester	Comment	Status
Fall 2014	I would like it to be more interactive.	
Fall 2014	If there could be an easier way to get the feedback sent to the students, that would be helpful. My scribe wasn't able to write down everything said, so some things were lost during the feedback.	✓
Fall 2014	It could be improved by keeping abreast with current research by means of a newsfeed/newsletter.	
Sp 2015	1) Allocate more time for presentations to get some quality output. 2) Create common forms where the audience fills the review details while the presentation is going on. 3) Once it is done, the presenter should go through the excel results and discuss the review points and get the details. 4) More participants required in the seminar series.	✓ ✓ ✓
Sp 2015	Perhaps the form is a bit too specific, as we all have different types of presentations and research materials. I think one or two big boxes with higher-level instructions would suffice, and perhaps allow attendees to include information that they don't currently find relevant to the existing questions.	✓
Fall 2015	The discussions during the presentation tend to get off track; having a designated moderator to keep discussions from going too far off track might be useful…?	X
Fall 2015	Guidelines for theoretical works, methods, proofs should be added.	X
Sp 2016	I thought the connection to security for some of the presented work was not very clear. I suggest the guidelines may advise presenters to have motivating examples on how their work is relevant to security problems.	✓
Sp 2016	I think this semester, there was more discussion and feedback than last semesters (probably due to the attendance requirement) which should continue. May be have some more guidelines about different methods of evaluation (e.g., qualitative / quantitative / formal or mathematical proofs / proof of concepts etc).	X
Fall 2016	Have a session early in the semester where you discuss how these seminars should be formatted, content you expect, etc. I think it would be useful for new students AND experienced students.	✓
Sp 2017	Have a session early in the semester where you discuss how these seminars should be formatted, content you expect, etc. I think it would be useful for new students AND experienced students.	
Sp 2017	The seminars might be too short for some of the topics. One to two hours would be better.	

SOSL STUDENT & ALUMNI EVALUATION

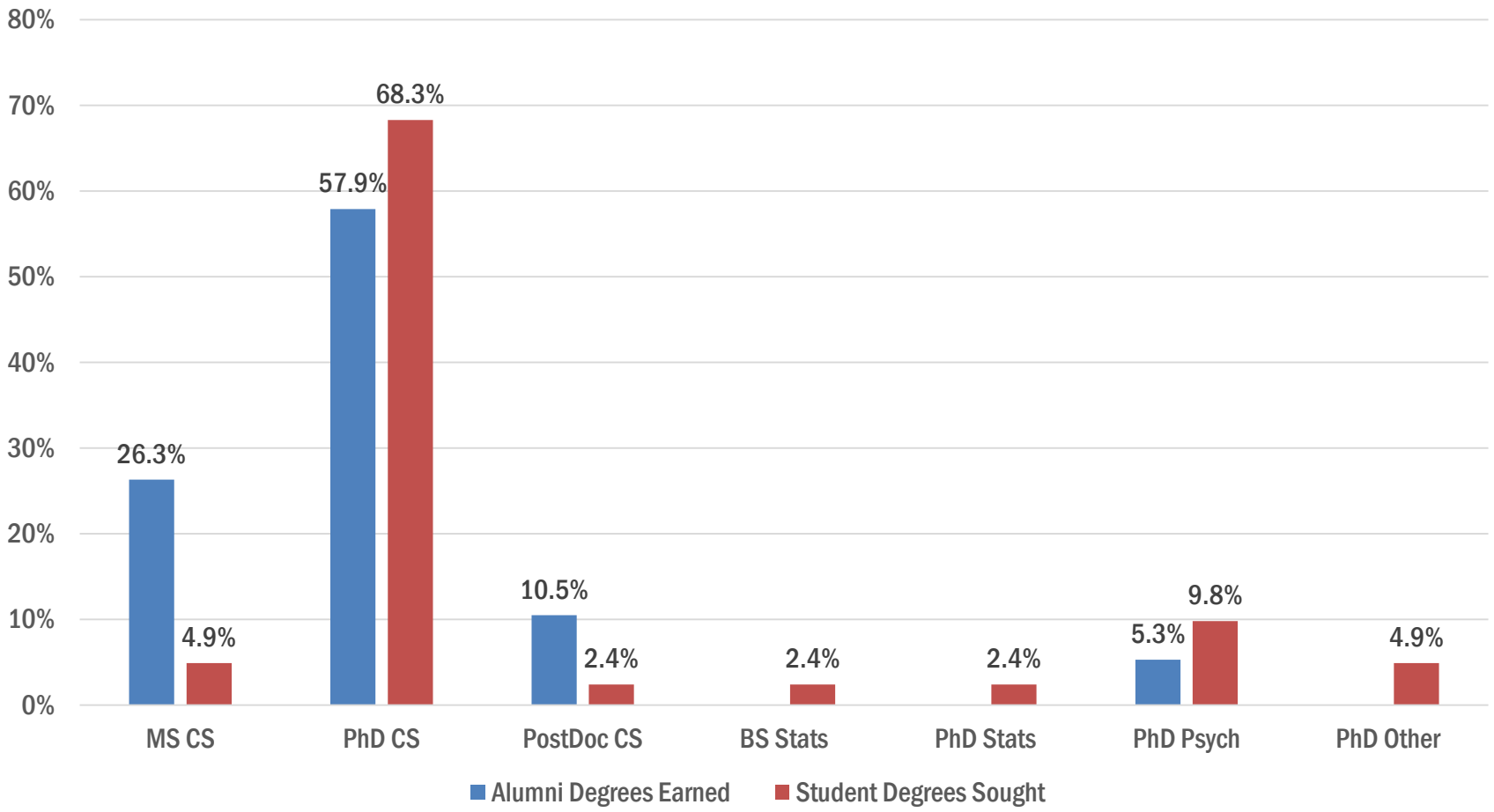
SoSL Student & Alumni Evaluation

- Goal: To assess the quality and impact of SoS Lablet participation on students and alumni
  - How satisfied are Lablet students and alumni with the training opportunities?
  - What impact has Lablet participation had on student and alumni skills, professional networks, and career preparedness?
  - What career outcomes and professional accomplishments have been achieved by Lablet trained alumni?
- Methodology: Online survey will all students and alumni involved with the NCSU Lablet between Fall 2014 and Spring 2017
- SoSL student population = 74
  - Student respondents N = 33
  - Alumni respondents N = 15
  - Response rate = 69%

Demographics

- 66% NCSU, 44% from partner universities
  - UNC, Charlotte
  - UNC, Chapel Hill
  - University of Alabama
  - Purdue University
- 63% International
- 73% Male
- 51% fully supported on Lablet funds, 32% partially supported

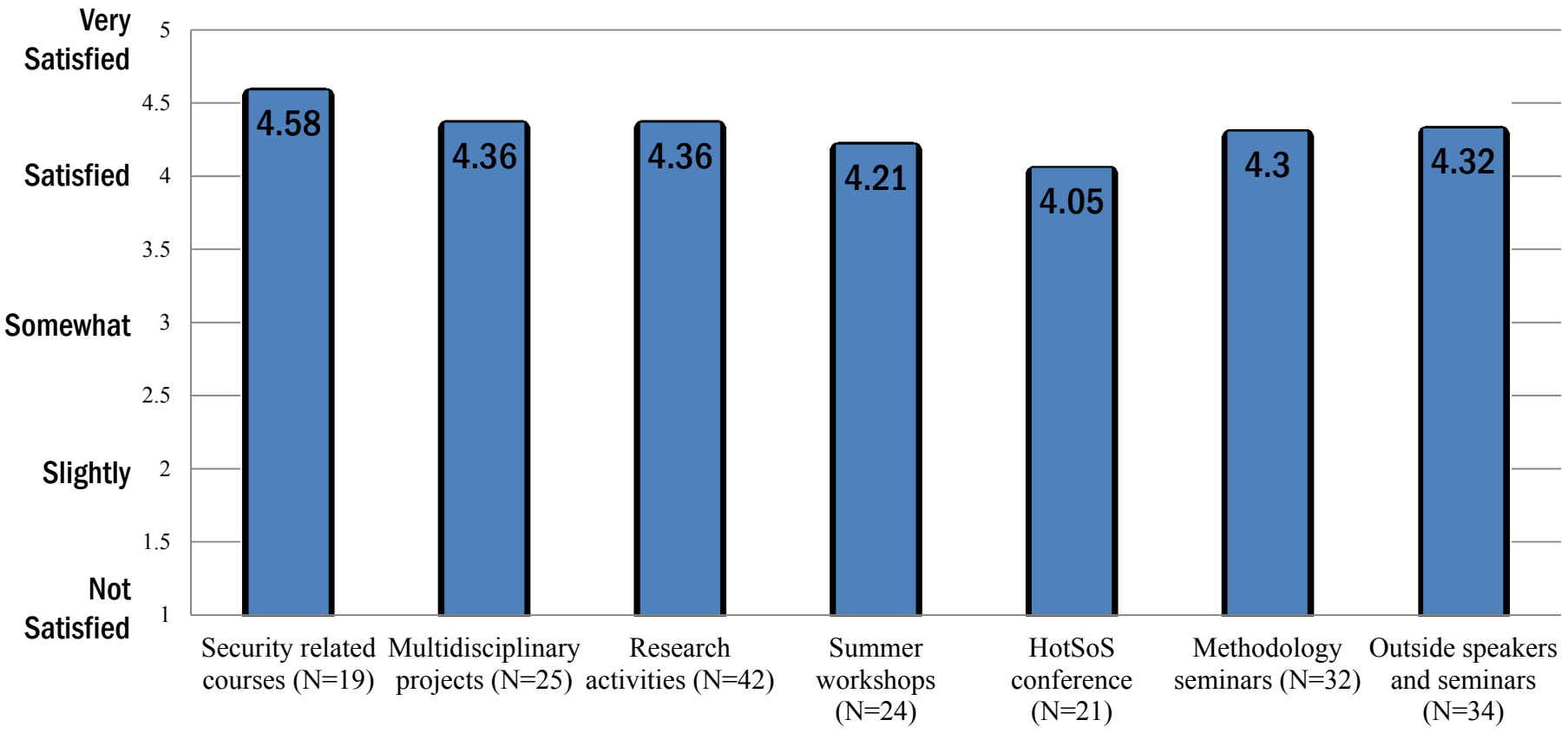
Degrees Sought/Earned



- 17 Alumni earning 17 degrees and 2 Lablet Postdocs
- 41 Students pursuing 43 degrees

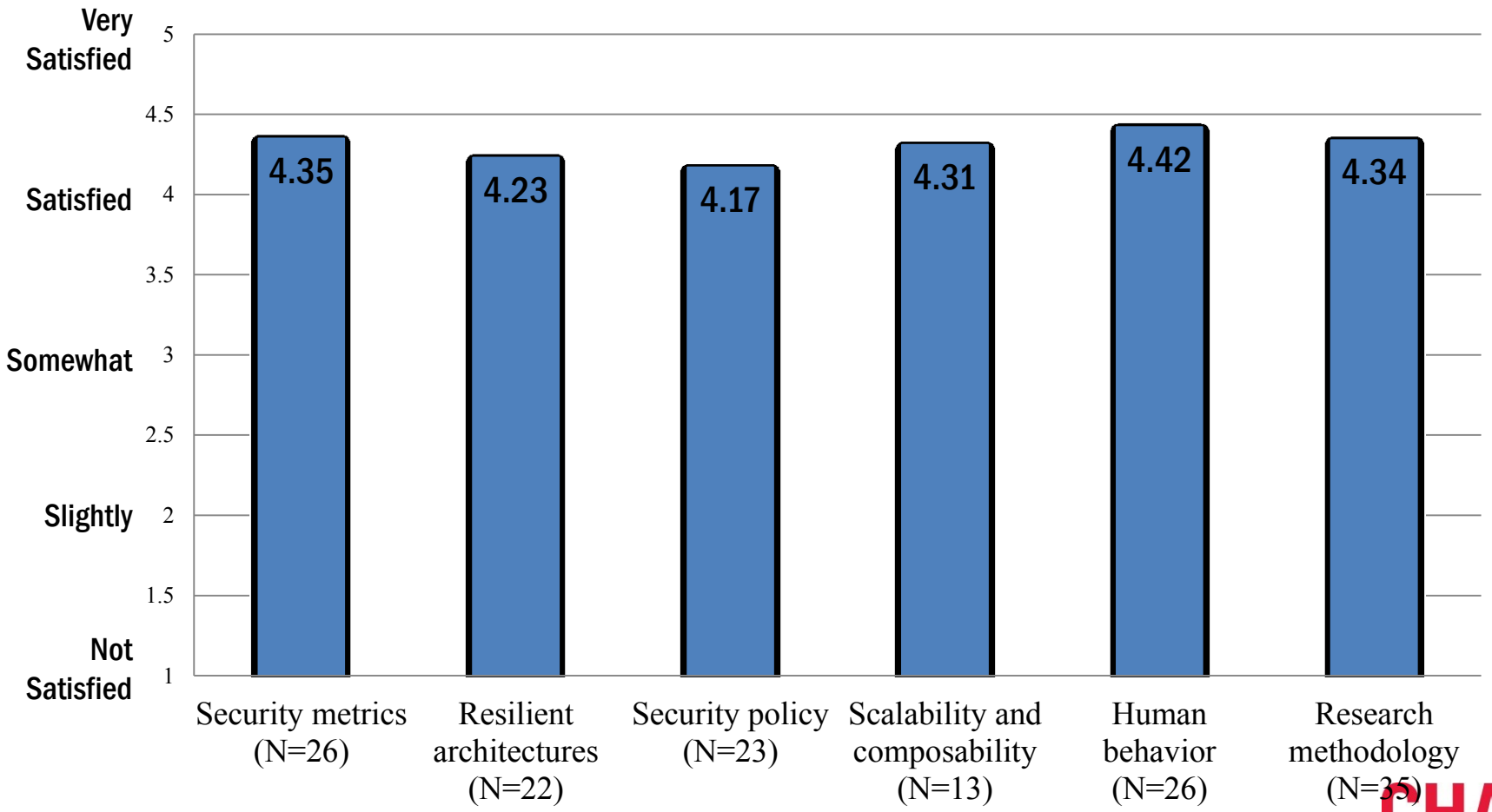
TRAINING EVALUATION

Satisfaction with Lablet Training Modalities



*N for each category represents people who had these activities available to them and who participated in them.

Satisfaction with Training in Security Topics



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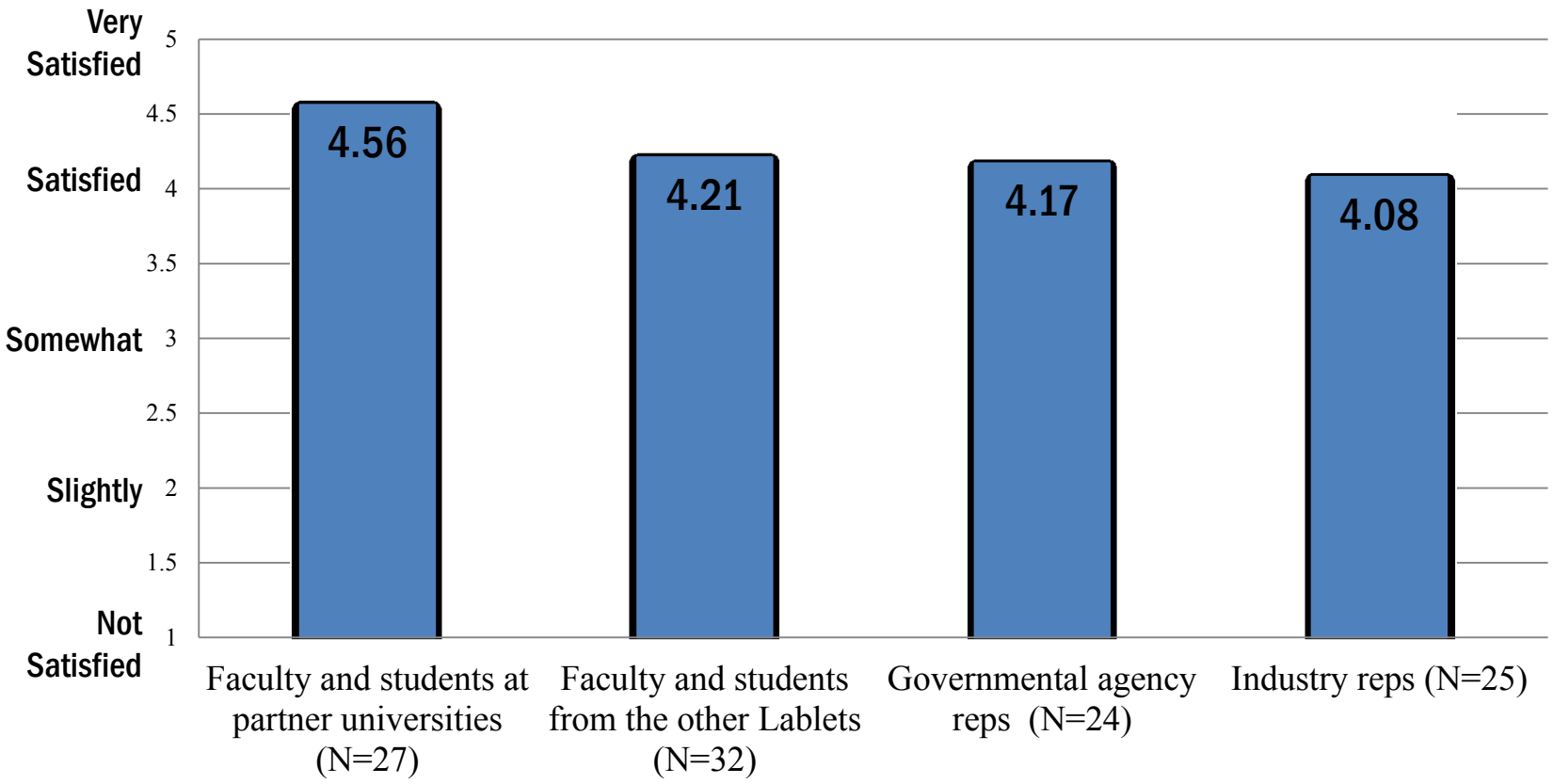
Satisfaction with Collaborative Opportunities

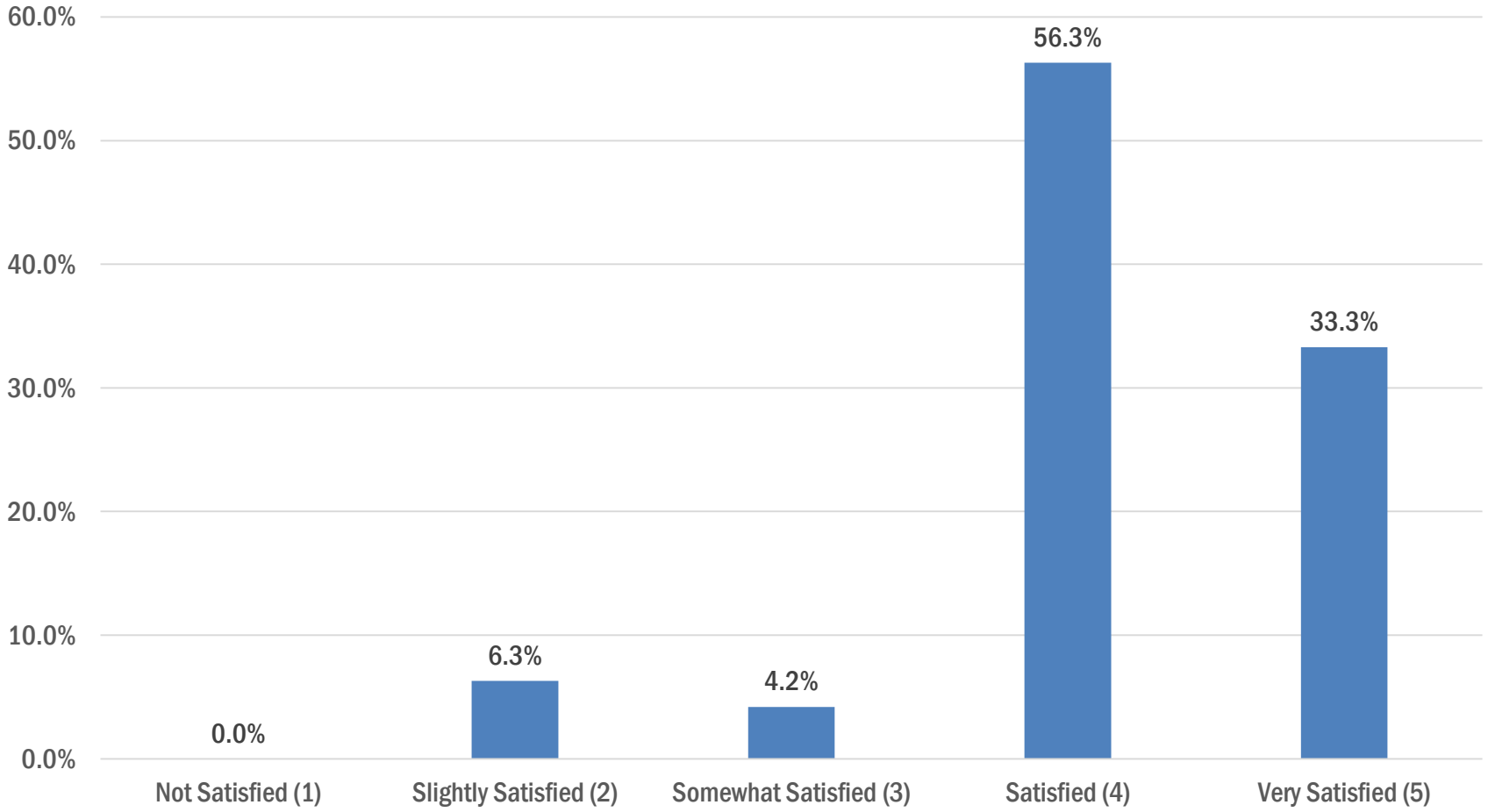


NC State students were more likely to report more opportunity to interact with governmental agency reps ($r = .373$, $p = .009$, $N = 48$) and with industry representatives ($r = .305$, $p = .035$, $N = 48$) than students from other universities

*N for each category represents people who had these opportunities available to them and who participated in them.

Overall Satisfaction

(Mean = 4.17)

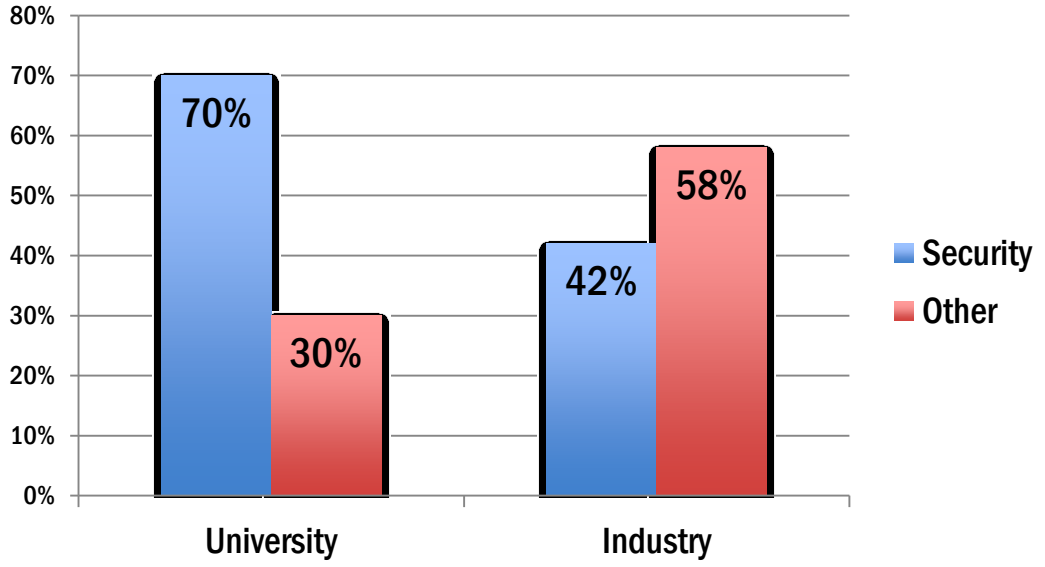


Impact on Knowledge & Skills

	Mean	SD
• Understanding of scientific methodology for security research	4.06	0.91
• Ability to develop methodologically rigorous studies addressing hard problems in the science of security	3.96	1.01
• Understanding the big picture of how research results are used in advancing security technology development to address cyber security and privacy concerns	3.92	0.94
• Ability to work as a member of a larger research team and ability to perform as a team player	3.88	1.10
• Skills in presenting at conferences, meetings and workshops	3.83	1.21
• Technical skills at analyzing security hard problems and developing solutions	3.83	1.04
• Understanding of how research in the five hard problems impacts the field of cyber security	3.71	0.94
• Skills at presenting to an industrial audience	3.67	1.24

STUDENT CAREER GOALS

Current Student Career Goals

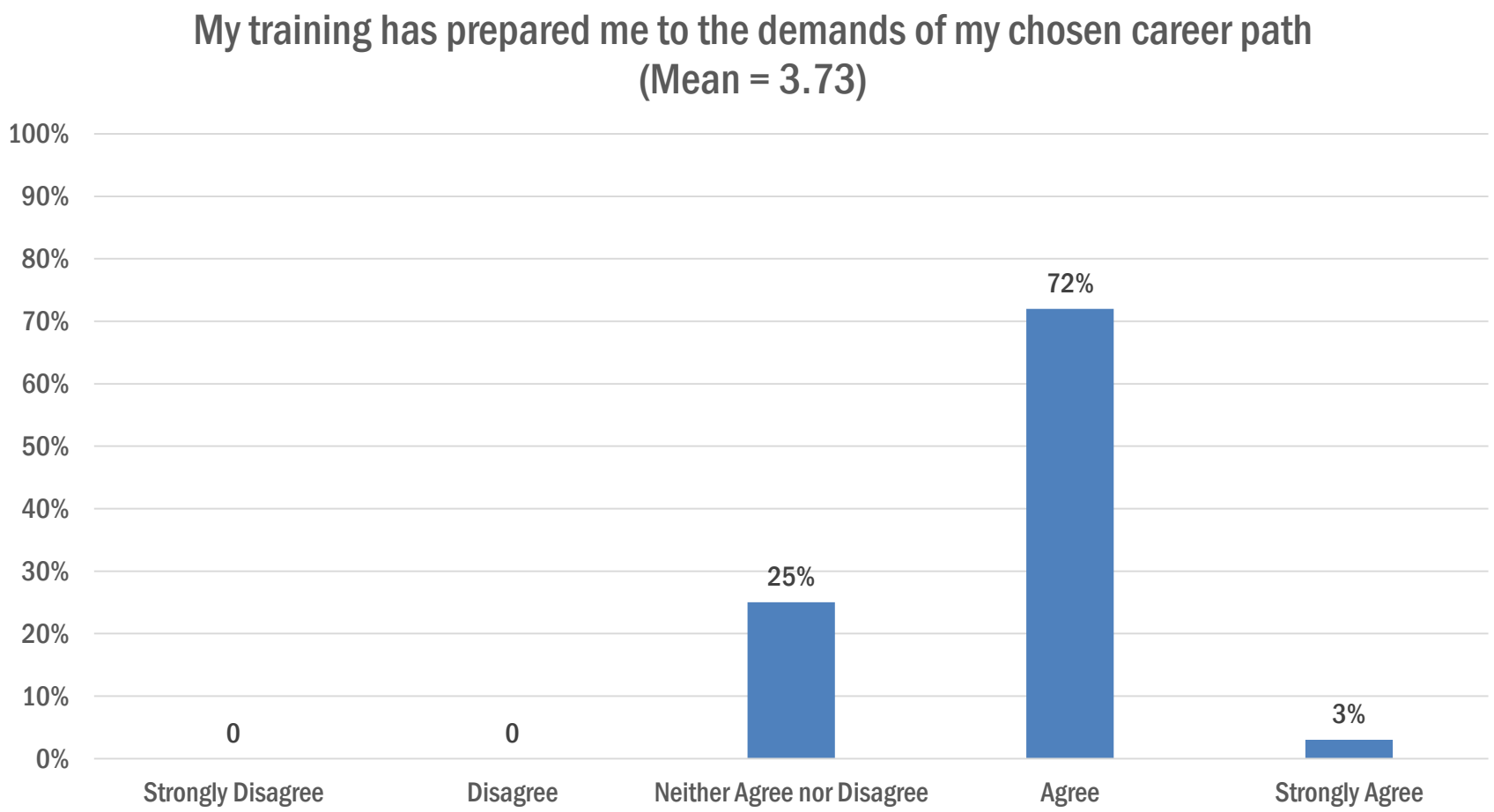


"I have no security interests in mind before I took SOSL position, but now I understand many security concerns while developing a system."

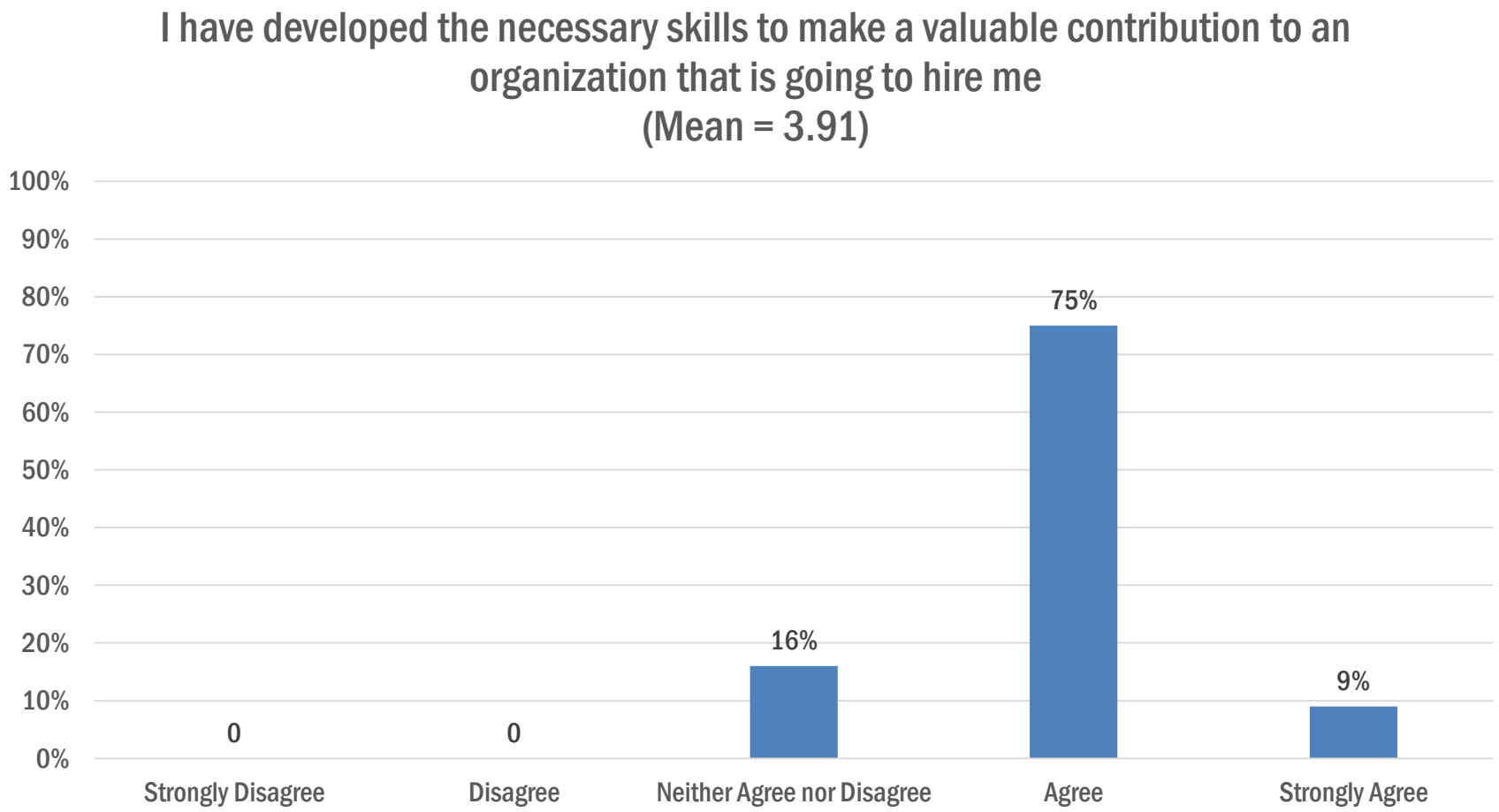
"I am more inclined to focus on security-related research positions and research opportunities."

Answer	N	%	% Security	% Other
University	10	30%	70%	30%
Industry	19	58%	42%	58%
Government	0	0%	0%	0%
Other	0	0%	NA	NA
Not Sure	4	12%	NA	NA
Total	33	100%	51%	49%

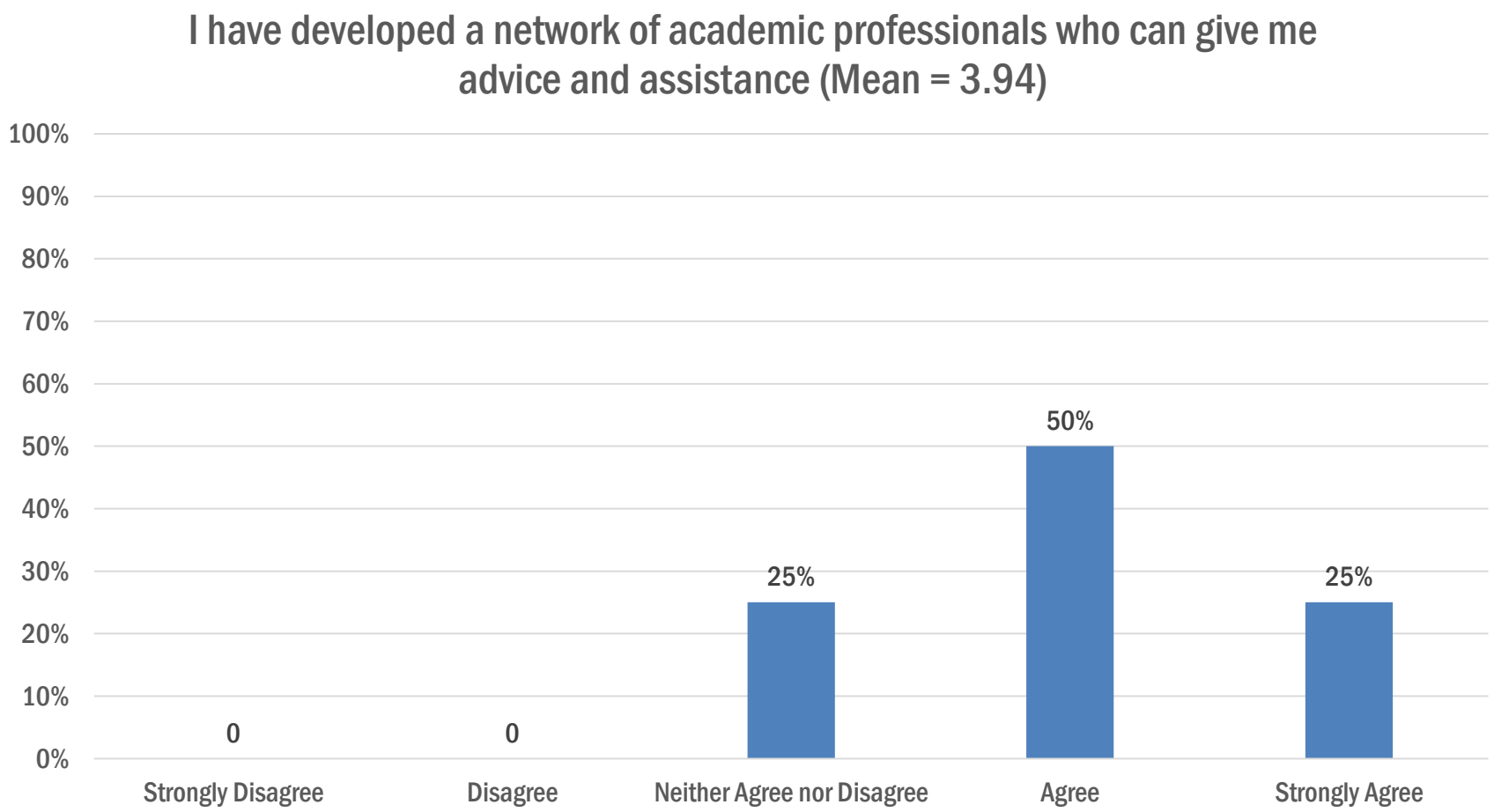
Career Preparedness



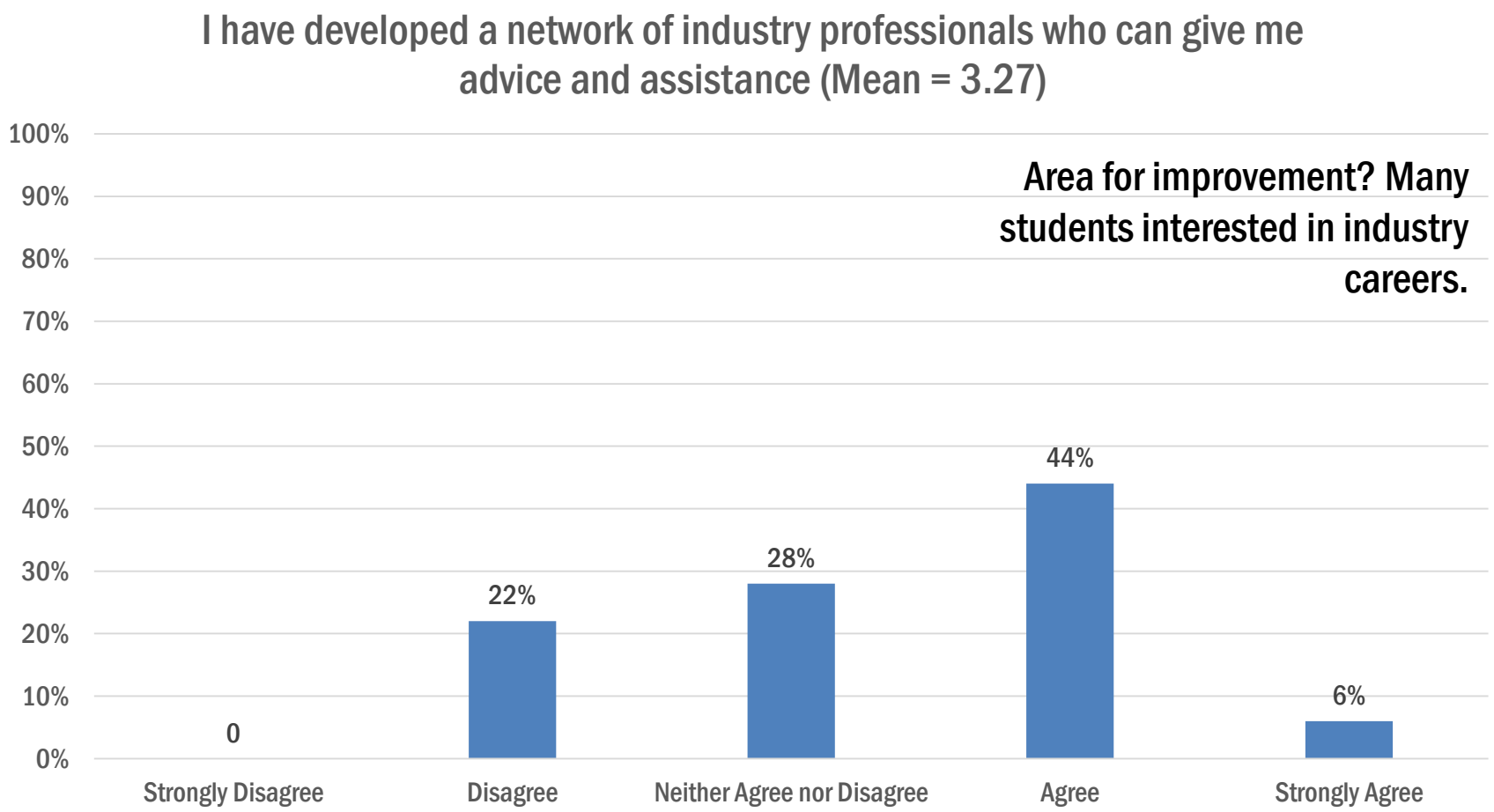
Career Preparedness



Career Preparedness

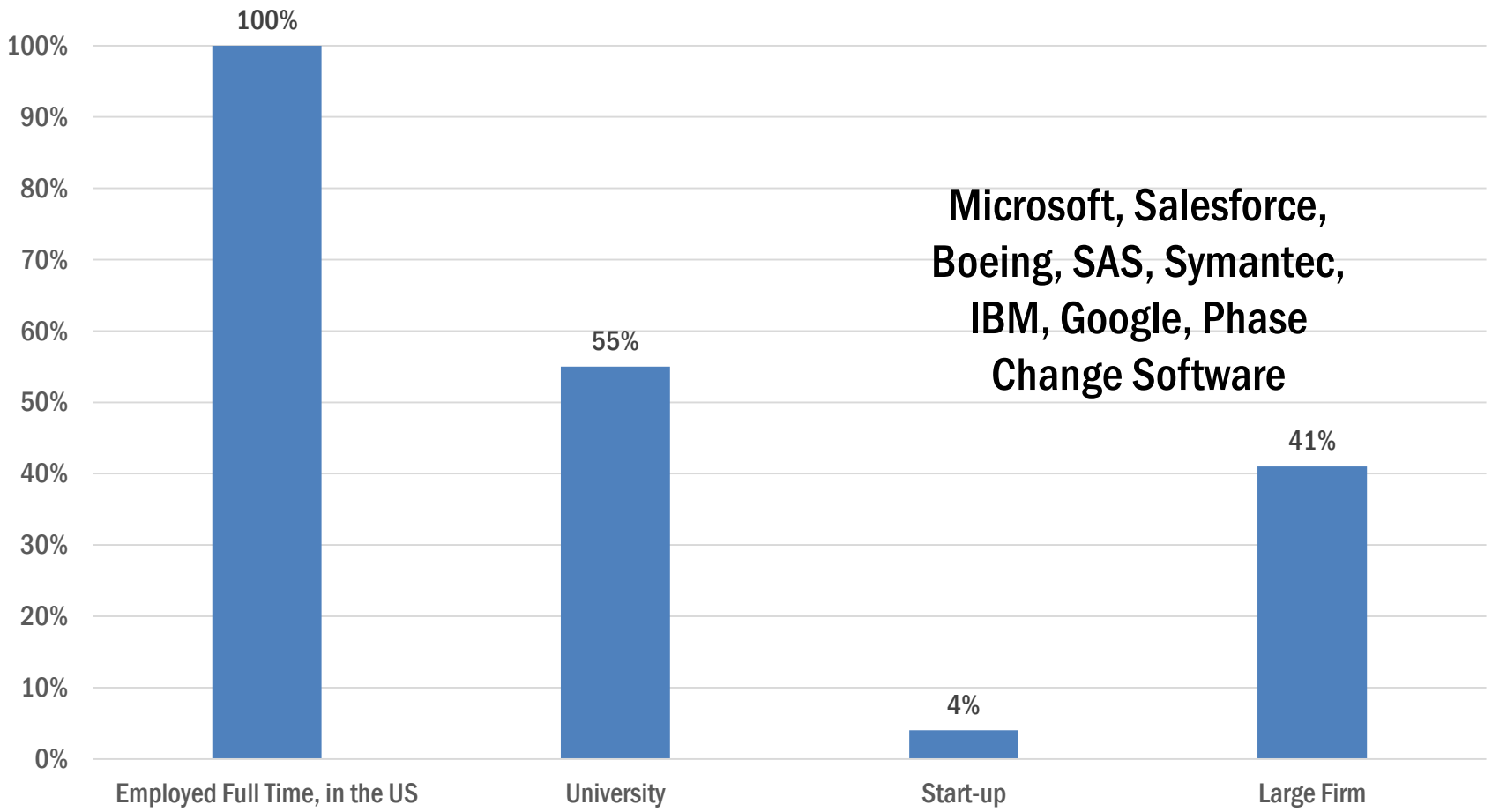


Career Preparedness

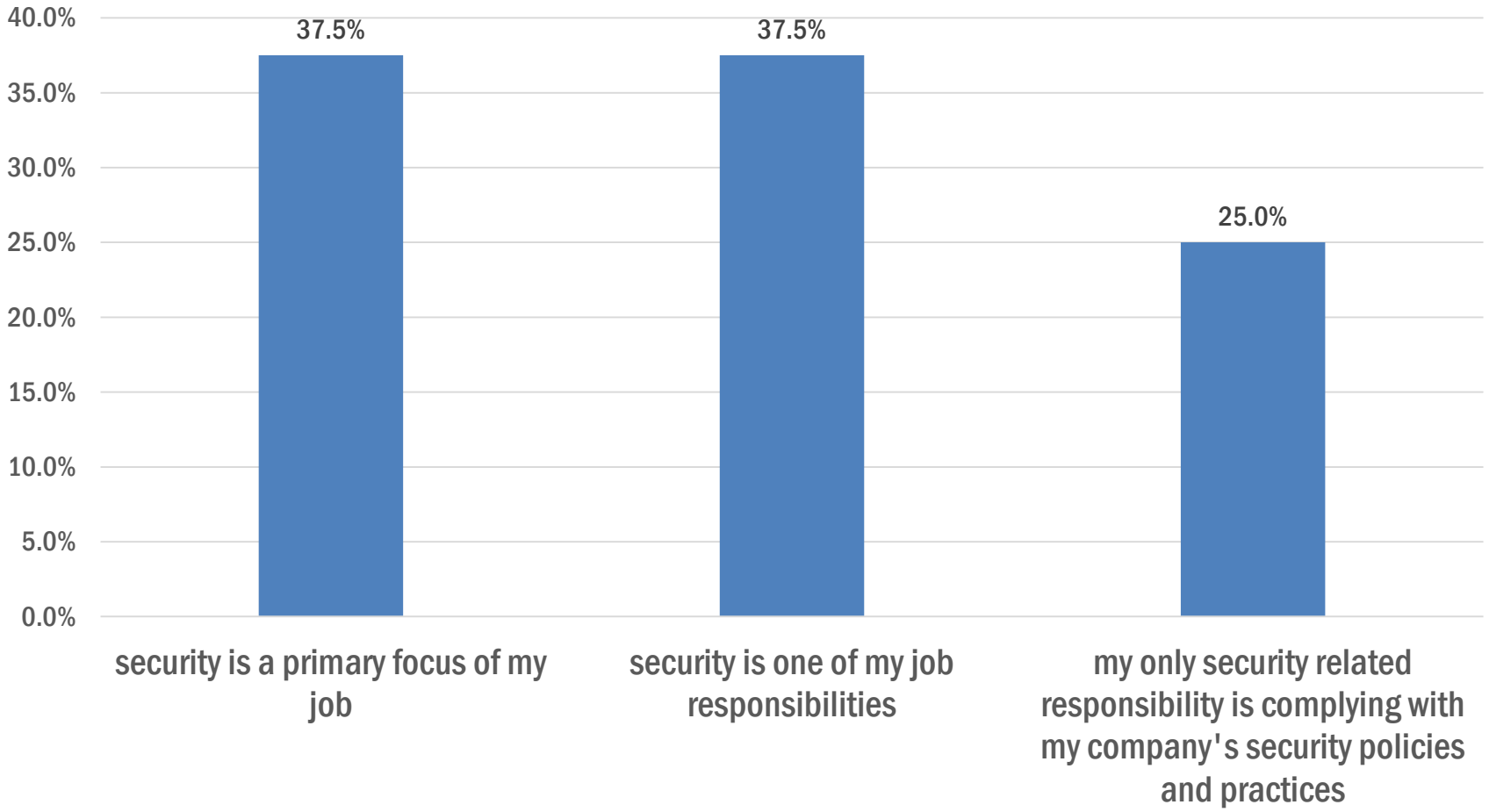


ALUMNI CAREER OUTCOMES

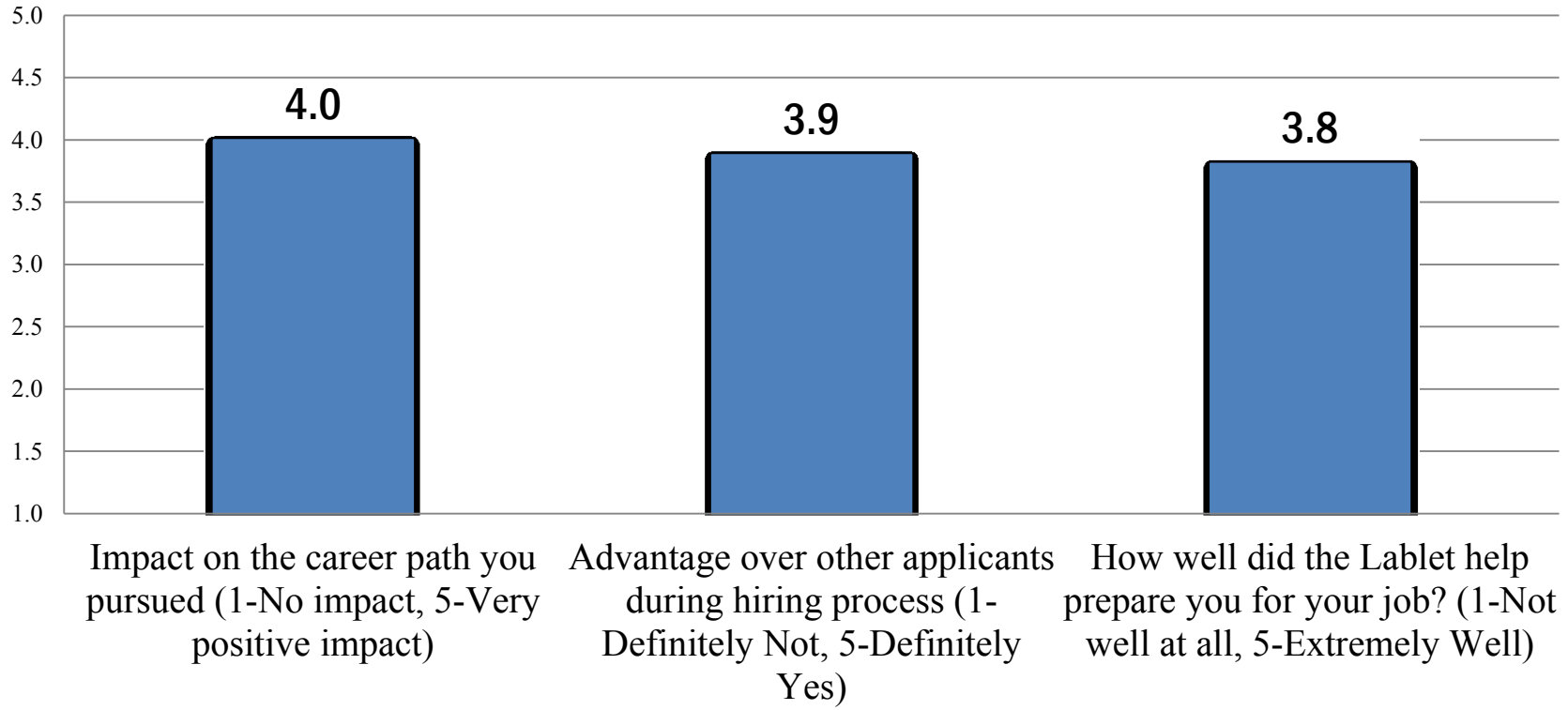
Alumni Employment



Security Focus



Alumni Career Preparedness



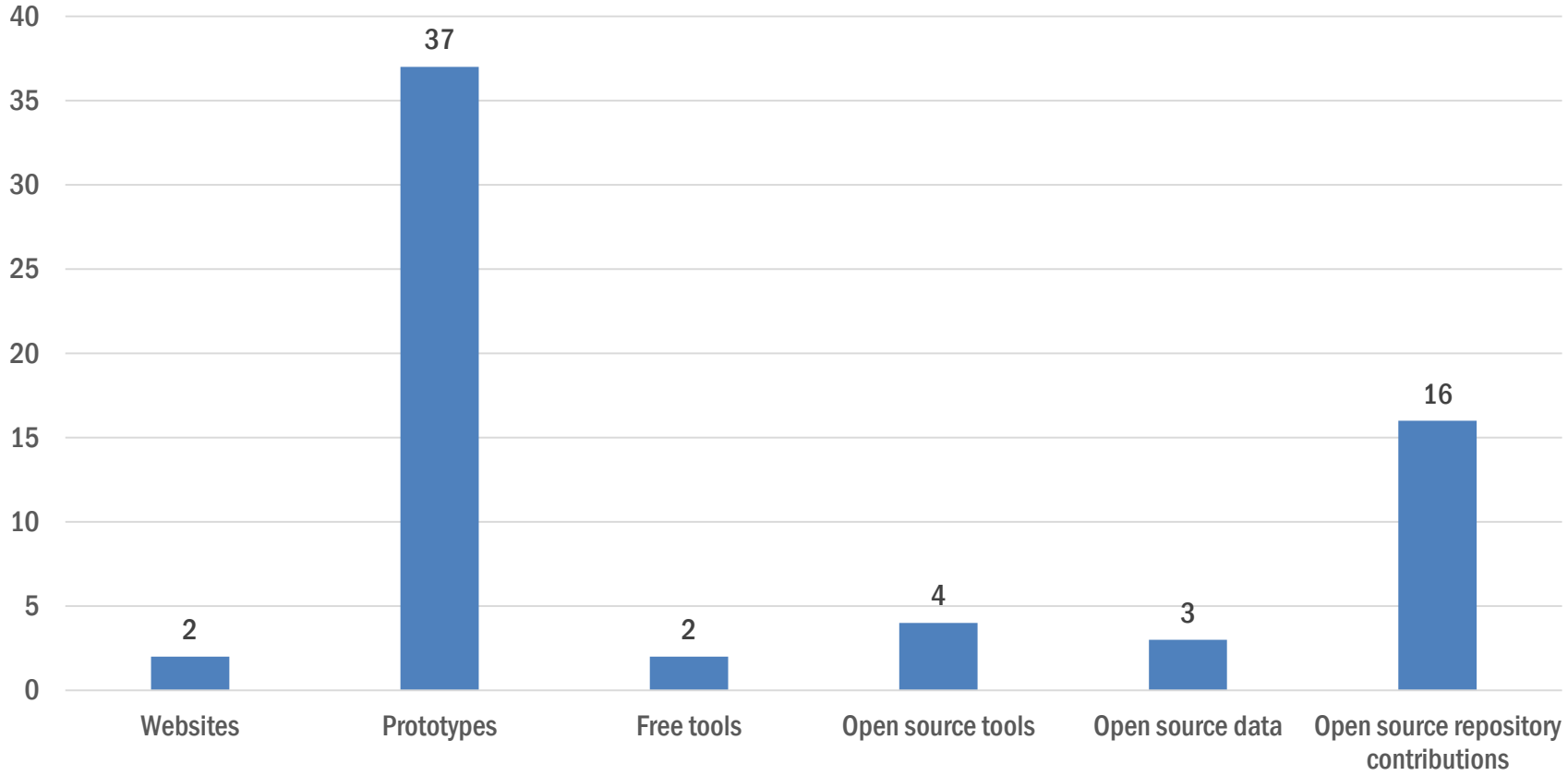
"The lablet has helped me build collaborations with researchers working on security and privacy related topics. In addition to the publication record, having a track record of these collaborations gave me an edge over other applicants."

Impact on Career

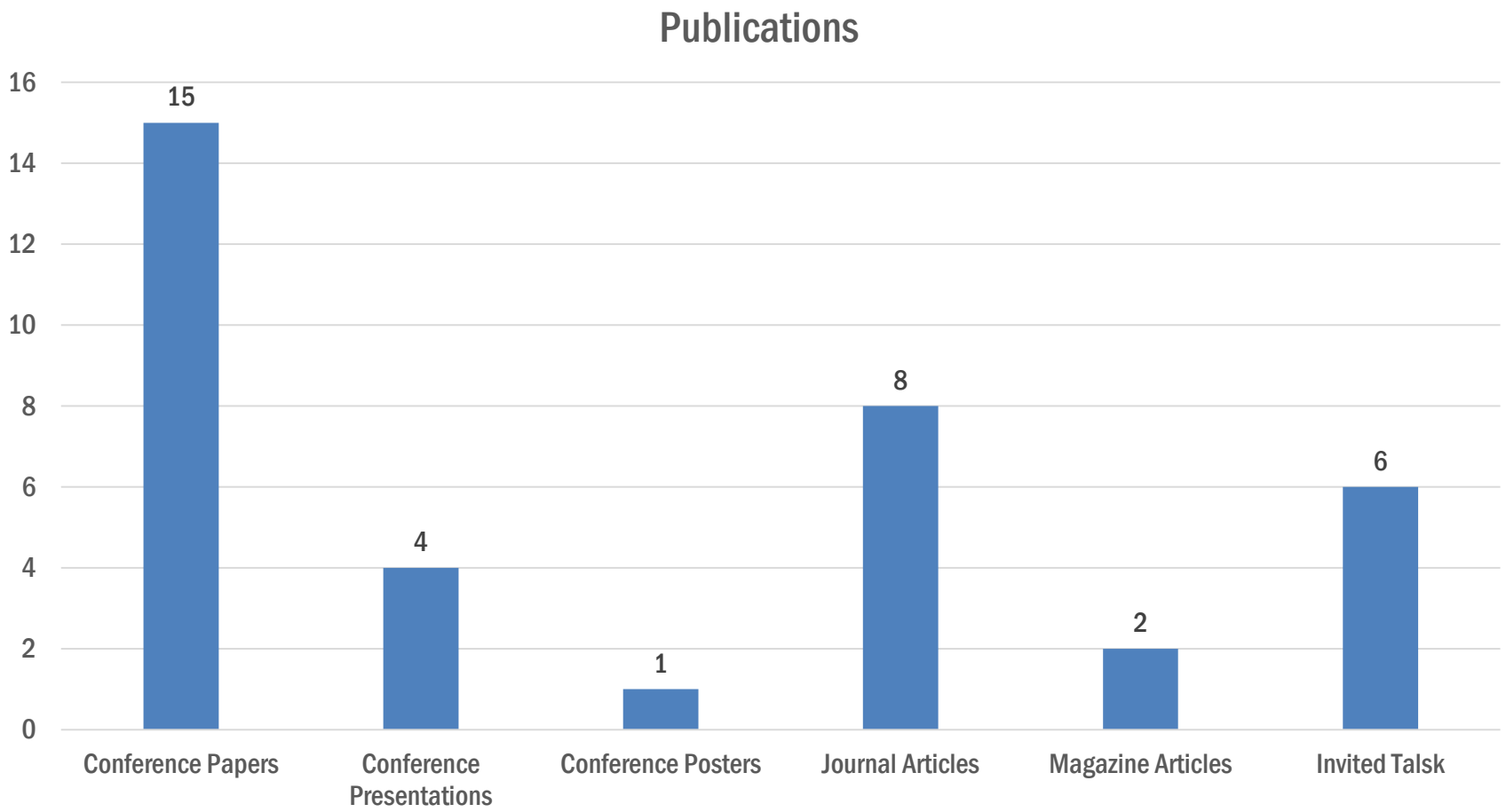
- *"Privacy is one of the research topics I am continuing to work on as a postdoc.* ***The Lablet was pivotal in shaping my privacy-related research and supporting it.****"*
- *"The SOS Lablet helps me broaden my knowledge and perspective in security.* ***The training and comments received in the Lablet helped me a lot in academic growth.****"*
- *"It provided me breadth of exposure to security related issues. It also provided me* ***a deeper understanding of empirical research and analysis****. I use these skills to find solutions to real world problems."*
- *"My experience working with the computer scientists on cybersecurity* ***really benefited me when I was on job market*** *and for my current research too."*
- *"Allowed me to* ***hone my critical thinking skills in terms of research design****."*
- *"Made me more aware of good security practices while developing software* ***rather than treating security as an afterthought****"*

Alumni Professional Accomplishments

Technology Artifacts

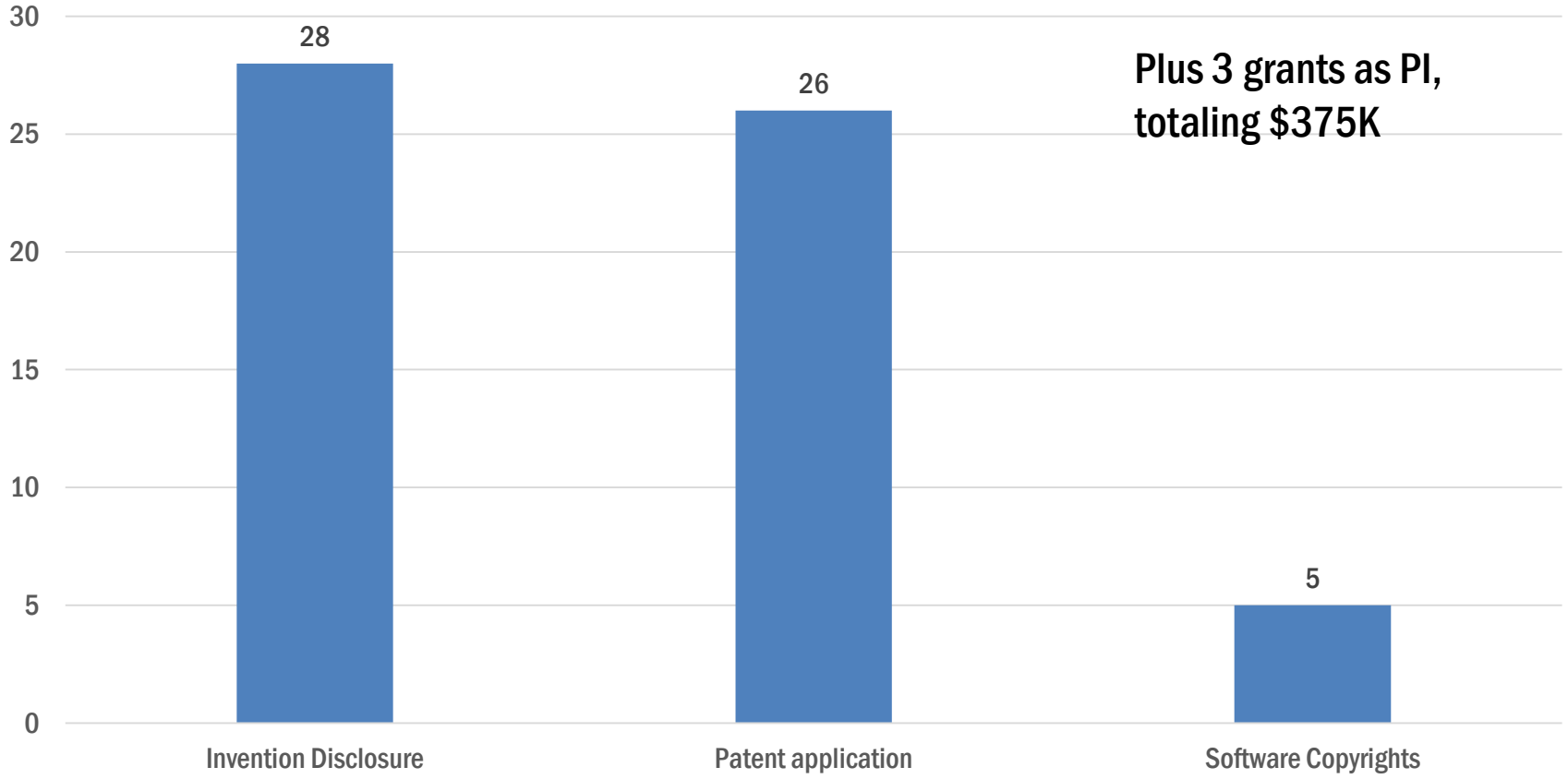


Alumni Professional Accomplishments



Alumni Professional Accomplishments

Intellectual Property Events



Plus 3 grants as PI, totaling $375K

CO-AUTHORSHIP ANALYSIS

Co-authorship Analysis: Background

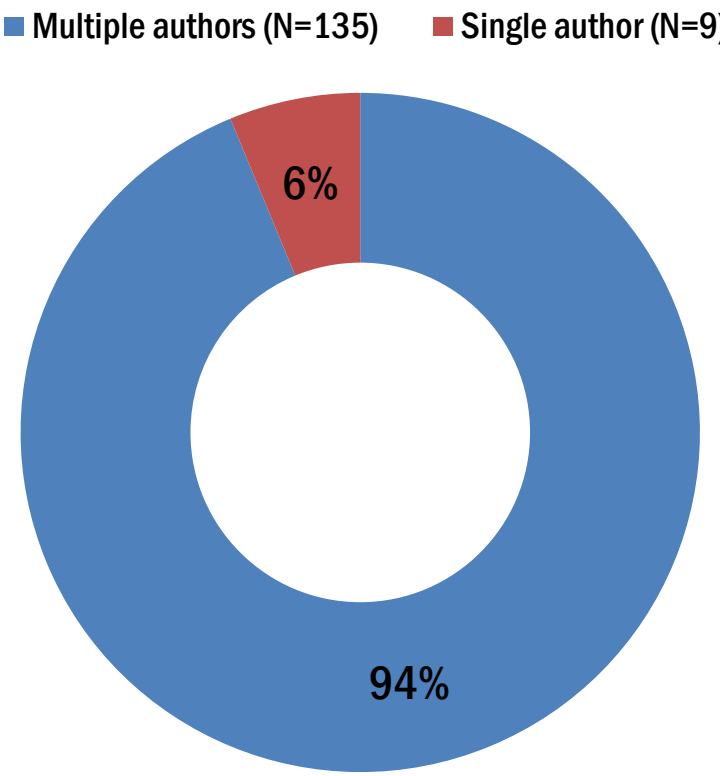
- Goal: To understand how our collaborations are growing the community of practice for a science of security.
- To what extent has NCSU Lablet research involved:
  - Collaboration with external researchers?
  - Multidisciplinary collaboration?
  - Cross-sector collaboration?
  - International collaboration?
  - Collaboration with other Lablets?

Co-authorship Analysis: Methodology

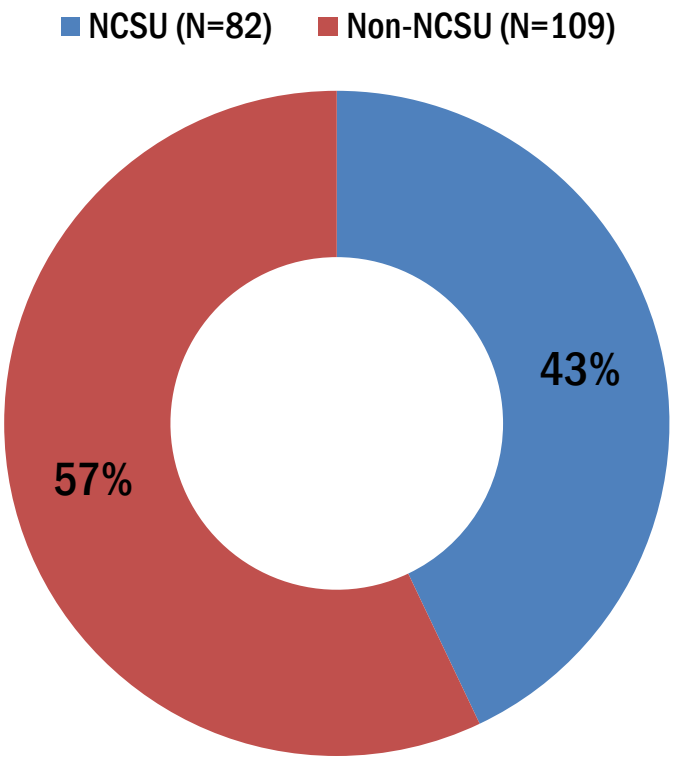
- Collect all Lablet publications since 2014
  - N = 144 as of last quarterly report
- Create unduplicated list of all authors
  - N = 191
- Identify author affiliations
- Identify collaborative patterns

Co-authorship Analysis: Results

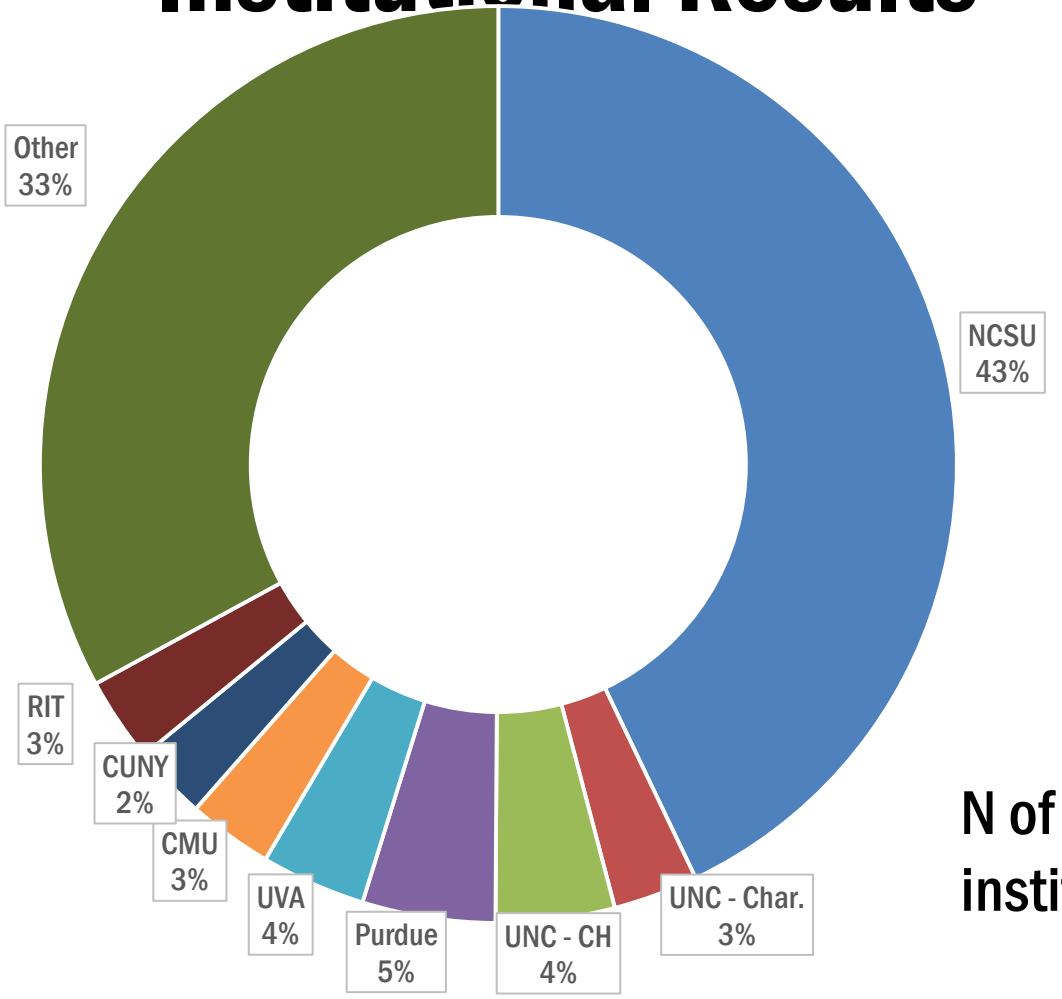
Publications (N=144)



Unique co-authors (N=191)

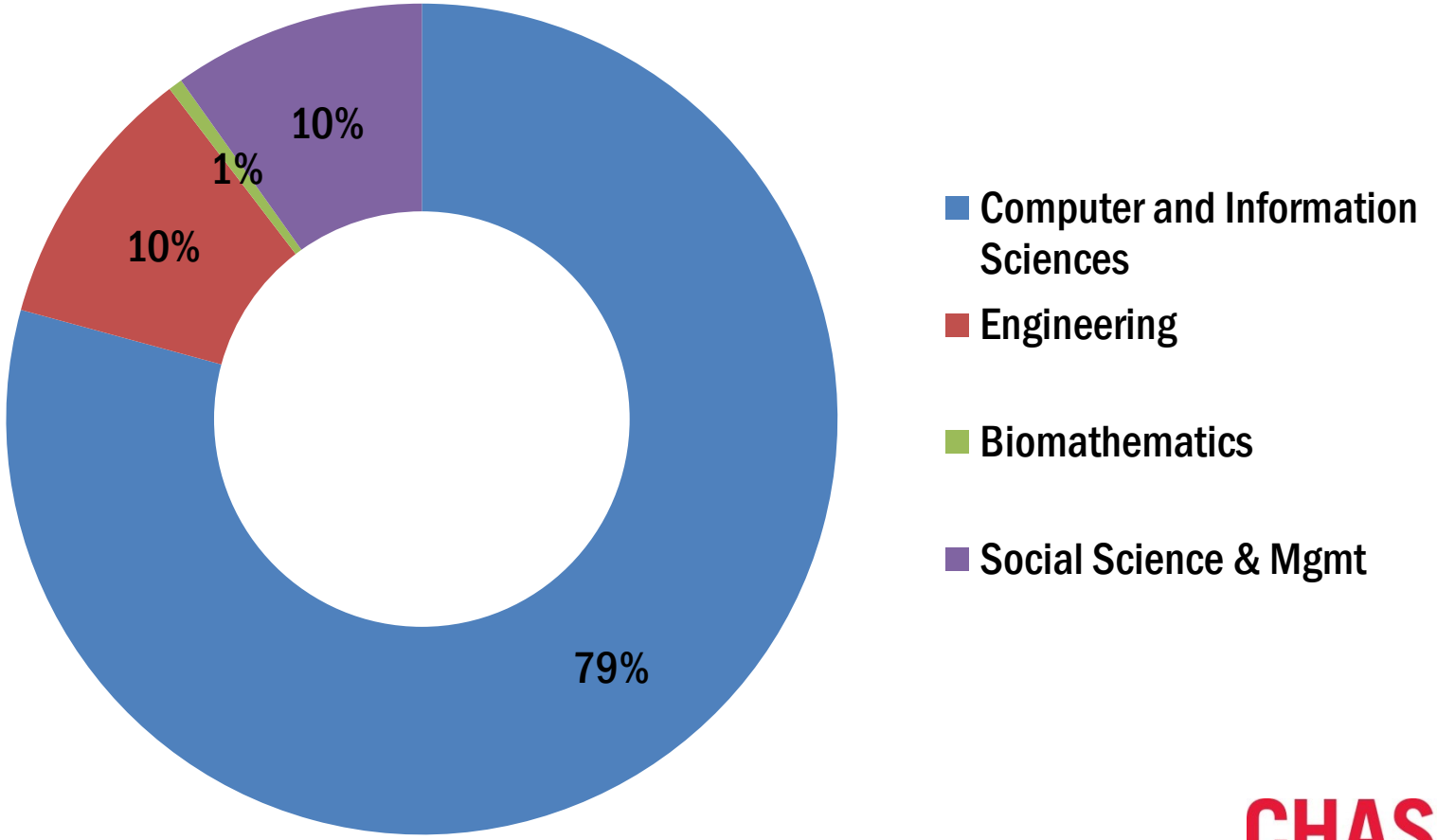


Co-authorship Analysis: Multi-Institutional Results

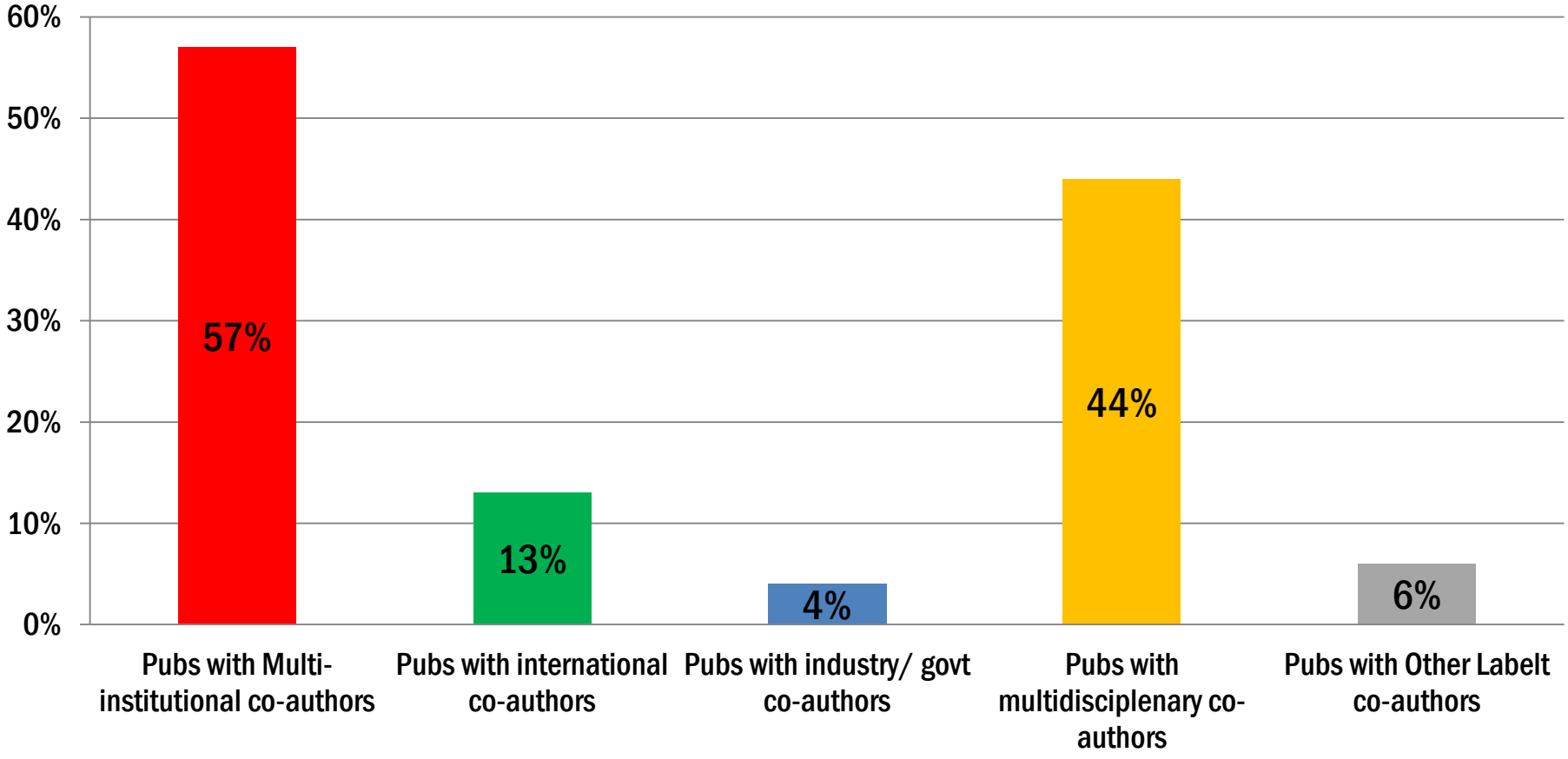


N of co-author institutions = 45

Co-authorship Analysis: Multidisciplinarity



Co-authorship Analysis: Results



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QUESTIONS?