Syracuse University
School of Education

PARADIM Research Experiences for Undergrads (REU)

August 2022

PARADIM: Research Experience for Undergraduates (REU)
2022

A Research and Evaluation Project of
The Office of Professional Research & Development
School of Education at Syracuse University

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Contents

Introduction

Research Experiences for Undergraduates (REU)

PARADIM, the *Platform for the Accelerated Realization, Analysis, and Discovery of Interface Materials*, is a national user facility at Cornell dedicated to the discovery and fabrication of materials with unprecedented properties that do not exist in nature. Each year PARADIM invites selected interns interested in growing new materials targeted by PARADIM users and/or improving the techniques used to grow, characterize, and provide theoretical guidance leading to their discovery and optimization.

The PARADIM REU Program is designed to give undergraduate students an introductory research experience in the growth, structural/electrical characterization, or use of first-principles theory relevant to thin films of transition metal oxides or chalcogenides currently being researched as next generation electronic materials within PARADIM.

This year's REU sought interns not only interested in growing new materials, but also those interested in optimizing and improving the equipment used to grow and characterize them. Molecular beam epitaxy (MBE) and MOCVD (metal-organic chemical vapor deposition) are state-of-the-art thin film growth techniques with atomic precision, and PARADIM offers unique systems with world class capability. Laser Pedestal and High Pressure Optical Floating Zone (FZ) are world leading bulk crystal growth capabilities. PARADIM also houses the world's highest resolution electron microscope which allows you to probe materials atom-by-atom. Electronic and structural properties are characterized at PARADIM using angle-resolved photoemission spectroscopy (ARPES) and x-ray diffraction (XRD). PARADIM is also spearheading new data-rich Artificial Intelligence/Machine Learning techniques to improve materials discovery.

Projects are scaled to be challenging yet achievable within the program's time frame, from early June through mid-August. This REU program culminates with a convocation held jointly with the REU students from Johns Hopkins University where each intern gives a final presentation. Interns also write a two-page report, due at the end of the program, that will be posted on the PARADIM website.

Methodology

The Evaluation Team employed a Developmental Evaluation Methodology (Patton, 2011) in studying the program implementation and impact. Developmental Evaluation[1] focuses on collecting both qualitative and quantitative data applied to formative and summative study. Formative evaluation examined fidelity of the program's implementation (degree to which what was done met criteria of intent and professional standards of practice); areas for continuous improvement; and practices worthy of replication in REU programs locally and more broadly. Summative evaluation sought data providing evidence of program outcomes and impact, as well as for making a case for continuing REU program sustainability.

The data collected by the Team focused on four information sources:

1. Document Review: Examination of program and demographic data from PARADIM website and REU management and operations documents
2. Mid-point Survey: Assess mentor/mentee relationship as it relates to project productivity
3. Presentation Observations: Dual evaluator observations of a sampling of intern presentations, employing a multi-criteria assessment instrument
4. Intern Survey: Post-program survey seeking intern information related to program quality (lectures, mentoring, research, presentation, virtual delivery)

After all data were compiled and analyzed, a REU Final Report is drafted to address the needs and interests of key stakeholders (funder, PARADIM leadership, REU planners) and to provide findings and recommendations to inform further program planning, i.e., what to maintain, what to revise, what to eliminate.

[1] Patton, M.Q. (2011). *Developmental Evaluation: Applying Complexity Concepts to Enhance Innovation and Use.* New York: The Guilford Press

FINDINGS (See Appendix for complete survey)

Student Perceptions

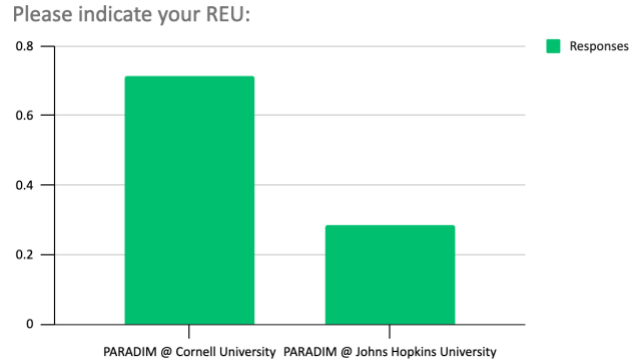
Following the conclusion of the 2022 REU program, the Evaluation Team administered a post-survey to all interns. The original cohort of 20 with 19 completing the program (13 Cornell REU completed the program - 1 Cornell REU individual did not complete the program; 6 Johns-Hopkins REU) represented (16) universities:

Cornell REU 2022	Major/College	Mentor
Jordan Brown	Chemistry, Clark-Atlanta University	Betul Pamuk
Anna Capuano	Materials Engineering, Rensselaer Polytechnic Institute	Brendan Faeth
Saisrinivas Gudivada	Physics and Math, UC Berkley	Betul Pamuk
Kevin Hernandez	Astrophysics and Math, University California Berkley	Noah Schnitzer
Evan Krysko	Physics and Math, Penn State University	NEHA
Joseph Lin	Material Science and Engineering, Cornell	Gianluca Fabi
Ciaran Mackenzie	Ceramics Engineering, Alfred State University	Jacob Steele
Reid Markland	Physics and Math, Auburn University	Maya Ramesh
Yacob Melman	Chemical Engineering, Clarkson University	Cameron Gorsak
Erdem Ozdemir	Material Science Engineering, University of Michigan	James Hwang
Ethan Ray	Materials Science Engineering, Georgia Institute of Technology	Tobias Schwaigert
Jayda Shine (PREM)	Physics and Astronomy at Spelman College	Evan Yilin Li
Xu Qing	Physics and Math, University of California Los Angeles	Qi Song
JHU REU 2022	**Major/College**	**Mentor**
Bianca Brown (PREM)	Chemistry, Clark Atlanta University	Tyrel McQueen
Sam Dawley	Chemistry and Applied Math, Johns Hopkins University	David Elbert
Morgan Dierolf	Chemistry, Penn State University	Satya Kushwaha
Abby Neill	Chemistry, University of Texas at Dallas	Thomas Whoriskey
Catherine Philips	Physics, Harvey Mudd College	David Elbert
Julia Camacho Wejbrandt	Biomedical Science, King's College, London (Johns Hopkins University year-abroad program)	David Elbert

REU Affiliation

Students were asked to indicate which REU school they worked with during the program. Based on 14 responses the data indicate that 71% of students were working with Cornell University and 29% of students worked with John Hopkins University.

Figure 1. Student REU Affiliation

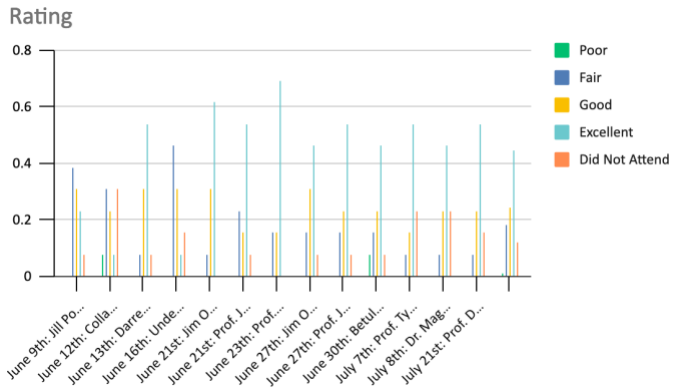


Student Experience Assessment

The survey administered asked the participants to respond to a number of questions rating their experience with the REU program and to what degree the experience will impact their choices going forward.

Participants were asked to rate their experiences with the lectures, training sessions, and activities as well as their overall REU experience as shown in Figure 2. Of the 14 respondents, data show that 1 skipped this question. The data indicate that 44% of those responding rated the experiences with the lectures, training sessions and activities and their overall REU experience as "excellent". A further 24% rated the experience as "good," with 18% rating it as "fair" and 1% rating it as "poor".

Figure 2. Student Experience Assessment



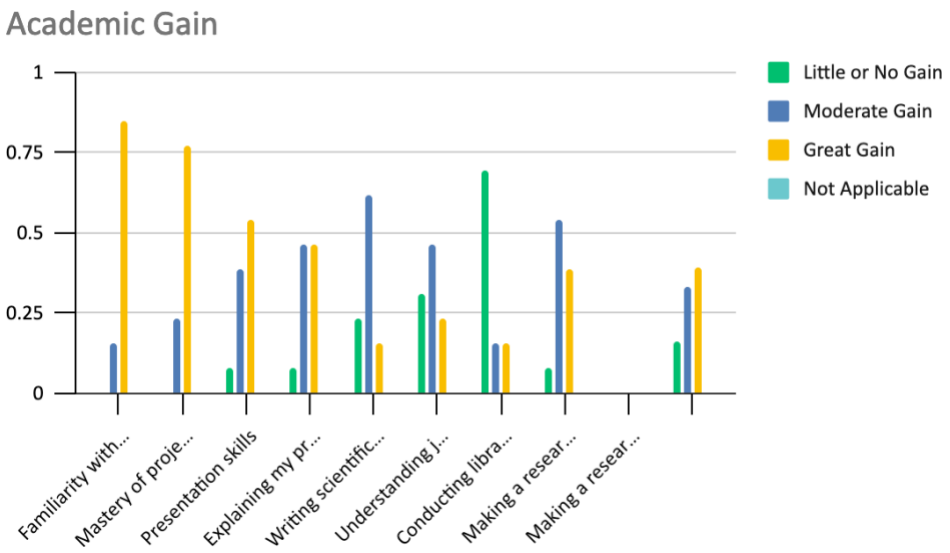
Full List of Lectures, Training Sessions, and Activities in Figure 2

June 9th: Jill Powell, Library Science
June 12th: Collaboration workshop with Lynne Vincent
June 13th: Darrell Scholom MBE Summer School Intro Lectures
June 16th: Undergraduate Workshop on Research Ethics and Responsible Conduct
June 21st: Jim Overhiser, Research Presentation Workshop (CU)
June 21st: Prof. Julie Nucci, Importance of Science Communication (CU)
June 23th: Prof. Lena Kourkoutis, Seeing with Electrons
June 27th: Jim Overhiser, Research Presentation Workshop (CU)
June 27th: Prof. Julie Nucci, Importance of Science Communication (CU)
June 30th: Betul Pamuk, Computer Experiments Using Density Functional Theory
July 7th: Prof. Tyrel McQueen, Guided Materials Discovery
July 8th: Dr. Maggie Eminizer, Data Science and Automation
July 21st: Prof. Darrell Schlom, How Wacky Oxides have Improved Transistors

Academic Gains

Additionally, participants were asked to rate the academic gains related to the research techniques, as well as the skills connected to their abilities to provide the information to people outside their specific area of focus. Of the 14 respondents to the survey, 13 responded to this question with 1 reported as "skipped". Participants rated the academic gains with an average of 43% rating their academic gains as "great gains", an additional 33% rating their gains as "moderate gain", and 16% rating "little or no gain".

Figure 3. Academic Gains Related to Research Techniques



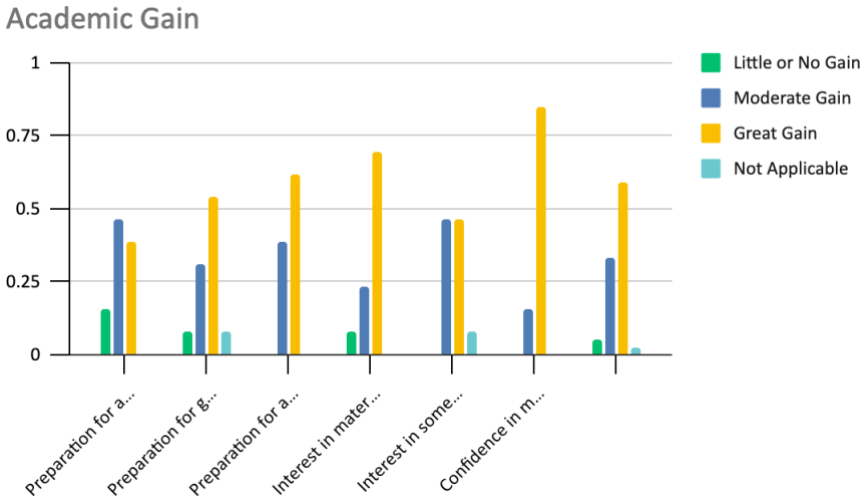
Additional Academic Gains (related to future planning)

The survey provided the participants the opportunity to rate additional academic gains in areas related to their preparation for future choices and interest in the materials they researched,

interest in other scientific research, as well as their confidence in their ability to contribute to science.

As with previous questions, of the 14 respondents, there was one who skipped this question. The data in Figure 4 indicate that roughly 3% found this question to be "not applicable", while 59% indicated "great gain", 33% responded "moderate gain", and 5% reported "little or no gain".

Figure 4. Academic Gains Related to Future Decision Making



Following up on the questions regarding gains from the program, participants were asked to provide additional information of gains that were not addressed in previous questions. The participants were particularly asked to further elaborate on any "little or no gain" responses they provided. This question was responded to by 10 of the 14 participants with 4 skipping the question.

Figure 5. Additional Information Provided Regarding Gain (Direct Student Responses & Summary)

Direct Participant Responses:

Student Provided Responses
I did not have much practice searching library databases.
Mainly because most of these preparations did not directly apply to my research. I was almost always at a computer coding, so the gain I believe I truly had was more about discipline.
Not much emphasis was put on the paper or poster, just that they were things to be done before the REU was considered complete.
It made me much more interested in going to grad school and I am much more excited about research than I was before my REU.

I feel that much of my work this summer did not emphasize a usage of past literature or looking into past literature of the field which I think would have been very beneficial, as would further instruction of writing within the research topic.
Gain in communication skills
There was not a lot of guidance given on the reading of scientific literature, which I believe would have been quite helpful. The session on library research was pretty bland and I had heard most of that information prior to the presentation.
I found that many of my learning, preliminary research, and understanding skills were already very good so that reading and finding papers was something I could do easily with access to a library database. However, the most I gained from the experience was in creating and presenting professional posters, slides, and papers to disseminate to the rest of the community. Also, I gained a lot by just meeting people!
The REU allowed me to greatly expand my research techniques. Although I am not a materials science major, the REU expanded my interest in the field.
I learned best when motivated, nothing personal

Summary of Survey Responses

Gains:

- Communication skills
- Networking
- Creating an excitement around research
    - Led to expanded interest in chosen field
    - May lead to different graduate choices
- Expanded research techniques
- Focus on support with final presentation including professional presentation slides, posters, and paper

Considerations for Improvement:

- Further experience and guidance in library research
    - Learning more about how to use previous research literature to support current research
- Further emphasis on final presentations, posters, and papers rather than just seen as requirements *(conflicting experiences with this area of program)*
- Additional motivation throughout project

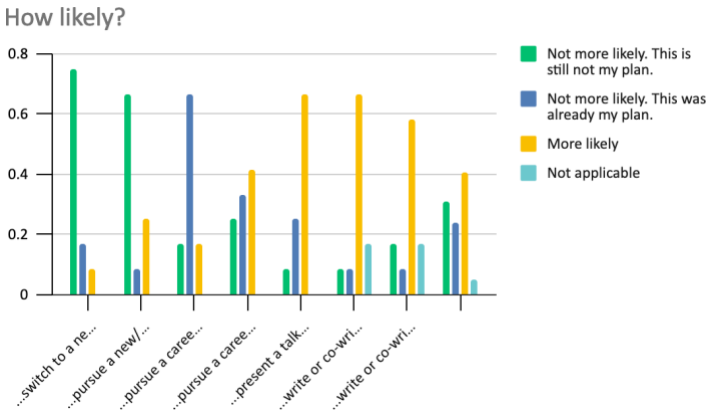
REU Impact on Possible Future Academic Choices

Following up on questions regarding gains made through the program, participants were asked to indicate how the REU research experience impacted possible considerations for future choices in areas such as college, career, conference participation, and/or publishing academic work. Of those participating in the survey, 12 responded to this question and 2 individuals skipped the question.

The data represented in Figure 6 vary within this question based on specific areas addressed but most notably indicate that roughly 71% of respondents stated that a change in major or minor in college was “Not more likely. This is still not my plan” while 64% of overall respondents

indicated that they were “more likely” to present at a conference or publish academic work in either an academic journal or undergraduate research journal.

Figure 6. REU Impact on Future Choices



Participant Likelihood to Present, Publish, or Apply for Awards/Scholarships

Figure 7 represents the data regarding the participants' responses when asked to provide additional information if they reported being likely to present, publish, or apply for awards/scholarships based on the research they conducted in the program. As with the previous question of the 14 total respondents, 12 provided responses and 2 skipped this question. However, of the 12 responses provided, 3 stated “N/A” and did not provide any additional information. Based on Figure 7, participants noted no indication of plans to apply for awards or scholarships.

Figure 7. Likelihood to Present, Publish, or Apply for Awards/Scholarships Based on REU Experience

Direct Participant Responses:

Responses
N/A
I still need more practice on presentation skills and this opportunity was an experience to modify and build my own way to present.
If I do make it onto a paper as a result of my summer work it likely will not be for some time. I will, however, use the skills acquired this summer to present research from other research projects in the future.
I am more interested in writing a paper after my experience this summer. However, I am not going to be writing a paper on what I did this summer.
N/A
Poster contest at home university
I would like to enter a science research poster competition.
Was on a publication with my mentor this summer
I have been told by my PI that he would like me to write a paper with his group regarding my research, and I am honored to be given such an opportunity.

N/A
It is possible that if the group I was a part of publishes a paper in the future, I will be included as an acknowledgement or co-author.
I am working with a professor at home university on a paper

Summary of Survey Responses

Gains:

- Increased likelihood of publishing academic work
  - Individually or with mentor
- Use of presentation skills in future
  - Poster presentations

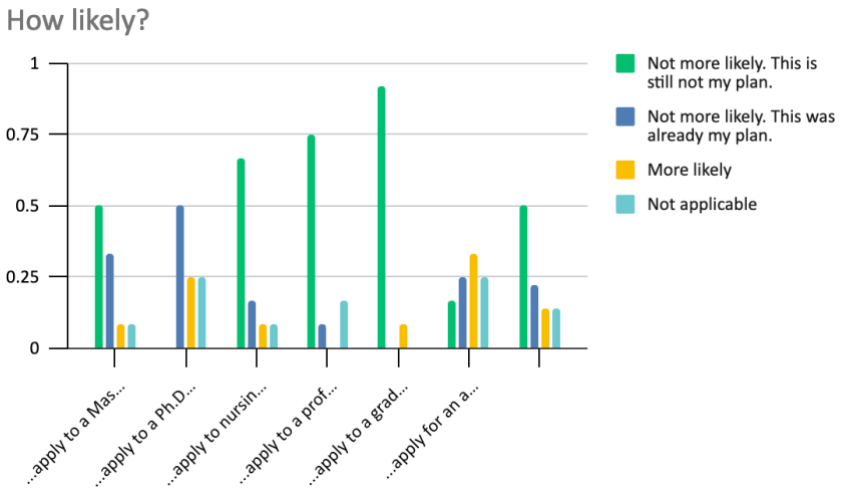
Considerations for Improvement:

- Additional Presentation Skills

Participant Plans for Advanced Degrees

Participants were asked to indicate the impact the REU research experience had on the likelihood to apply to advanced degrees in STEM fields, non-STEM fields and awards or scholarships. Of the 14 participants in the survey 12 provided responses to this question and 2 skipped the question. The data indicate that 50% of those responding indicated that they were "Not more likely. This is still not my plan", 22% responded "Not more likely. This was already my plan", and 14% responded "more likely" with an additional 14% responding "not applicable".

Figure 8. Likelihood in Applying for Advanced Degrees



REU Impact on Participant Career or Graduate School Planning

In follow up to the previous question, participants were asked to provide personal responses in their own words regarding the influence the REU experience had on their thinking about future

career or graduate school plans (or not). Of the 14 individuals participating in the survey 12 provided responses with 2 choosing not to respond.

Figure 9. Participant Responses Regarding Planning for Career or Advanced Study

Direct Participant Responses:

Responses
My REU experience just made me more hyper-focused on what I am aiming to achieve. I have a more thought-out plan as well as more experience in what I need to do to prepare for my future career.
It solidified my ambition for graduate school, but it also reminded me of my human nature and that its very important to have a life balance
I was surprised with how much I enjoyed materials science, coming from a physics background. I could see myself potentially pursuing it as a career path.
I am much less concerned about doing research and I am much more interested in doing research, in and out of school.
This REU helped me bring more focus of what field I would like to focus my graduate research on in the future. Although I had already planned to pursue materials science research, I now have a plan to focus more on the realm of solid state materials synthesis.
It made me better aware of the challenges and daily life of a grad student as well as the joys that pursuing a PhD can bring. Getting to know several grad students was a highly beneficial aspect of the program.
It has influenced me to broaden my research into my field, so that I know exactly what pathway I would like to take.
Tells me what I should care about and who to ask to learn about a group when applying to grad school
It gave me a broader view of laboratory social scapes, possible employment opportunities, and the possibilities of different work environments. All of these were very helpful when looking forward to the future.
It did not change how I think about future career planning and graduate school because I already planned on doing those things before the REU. Though, with some of the people I've been able to meet I may apply to different programs/work with different professors.
Giving me the most hands-on lab/research experience that I have had as of yet, it both increased my understanding and perception of graduate school. It has led to me taking that into consideration as a potential option.
It reinforced my thinking and gave me more confidence

Summary of Survey Responses

Gains:

- Solidified planning for future planning
    - Improved understanding of personal goals
    - Increased clarity regarding field of focus
        - Value of hands on experiences
    - What to consider in an advanced program of study
        - What to ask when evaluating a program for personal benefits
- Provided experience to support future study
    - Increased ambition within chosen fields
    - Networking
    - Broadened knowledge of overall fields
        - Laboratory variety

- Career Pathways

Considerations for Improvement:

- No areas for improvement highlighted by participants

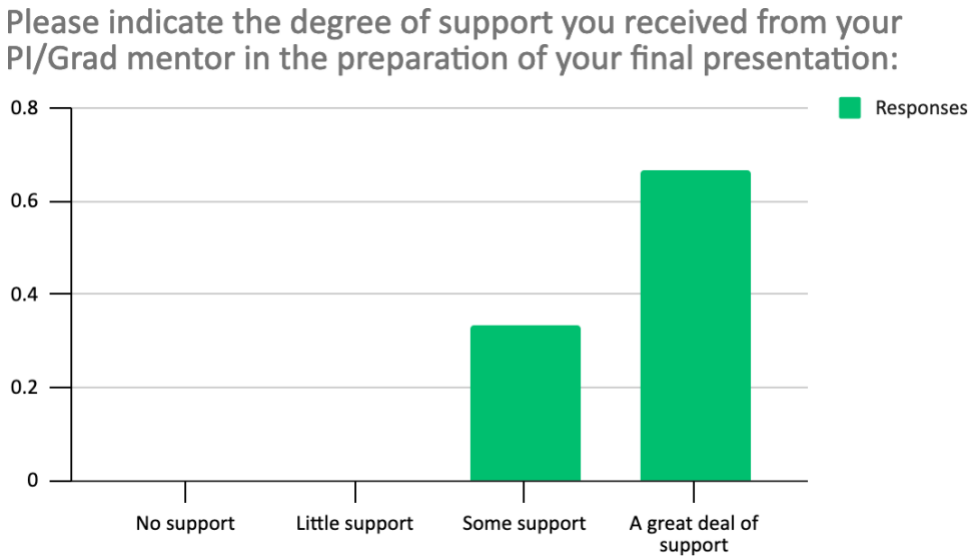
Mentorship Assessment

Students were asked to provide feedback regarding their perceptions of the experience with their mentors in the following areas as shown in Figure 10:

1. Support in preparation of final presentations
2. The importance of the mentor to the success of the REU experience
3. The degree the mentor influenced their future plans

Students reported at least some support in preparing for their final presentations, with 67% reporting "a great deal of support" and 33% reporting "some support". Of the 14 participants responding to the survey, 12 provided responses to this question with 2 skipping this question.

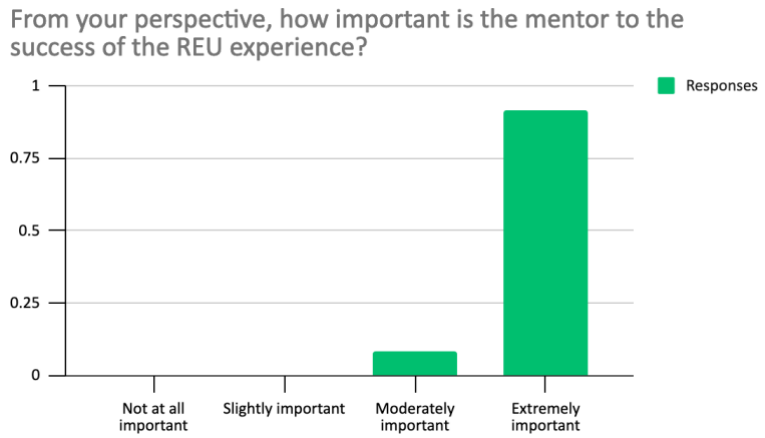
Figure 10. Mentor Support with Final Presentation



Student Perspectives Regarding Mentor Importance

In evaluating the importance of the mentor to the success of the REU experience from their own perspectives, Figure 11 shows that students reported at least a moderate importance of the mentor, with 92% responding "extremely important" and 8% responding "moderately important". Again, 12 respondents provided responses with 2 skipping the question.

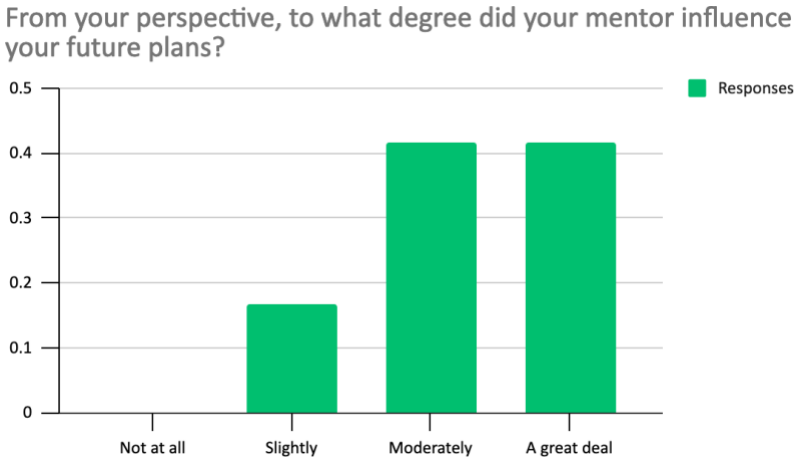
Figure 11. Importance of Mentor in REU Experience



Mentor Influence on Future Planning

Participants were then asked to rate the degree to which their mentor influenced their future plans. All respondents reported the mentor at least "slightly" influenced their future plans with 17% reporting "slightly" influenced and 42% reporting "moderately" and "a great deal" respectively. Again, 2 participants skipped this question with 12 providing responses.

Figure 12. Mentor Influence on Participant Future Planning



Participants were provided the opportunity to elaborate on the mentor experiences in their own words. 12 participants provided additional comments with 2 participants skipping the question.

Figure 13. Participant Responses Regarding Mentor Influence

Direct Participant Responses:

Responses
I had a great mentor experience. He was patient and understanding. Even when he wasn't present he still found a way to make sure I was still on the right track.
He was great, but there wasn't an instant connection, there was definitely time needed to establish a trust. The communication seemed a bit forced but overall I appreciate his time and effort for the program.
Talking with my mentor about her experience with graduate school was extremely eye opening, especially as she came from a similar background of physics.
My mentor was great at teaching me while making it fun and relaxed.
Although my mentor meant well, he was fairly hands off and did not provide me much guidance in the way of my project and seemed to not have much direction for my project when I started, leading me to communicate more with my PI. I think had he had more guidance for what my project should have been, I think I would have had a better experience.
My mentor was very helpful in teaching and guiding me through the project while still giving me a good sense of independence.
My mentor really went out of her way to make sure that I understood all of the materials and background information on the topic at hand. We need more hands-on mentors like her.
My mentor is very helpful in helping me understand concepts (always answer my question so patiently), learn how to do experiments (teach me step by step), guide me through presentations and gave a lot of helpful tips, and even out of lab life.
Although I had some bumps in the road regarding my mentor specifically, my PI was able to step in and fill all of the gaps that I was missing from my graduate mentor. I was also able to get a mentor change, and my experience was far better with my new mentor.
I had a fantastic experience with David! And Maggie! They both provided any support I could have asked for and even connected me with other scientists I would not have had the ability to work with and learn from. In addition to being very supportive, the entire Elbert group was incredibly warm and inviting
My mentor was incredibly patient and helpful throughout the course of the REU, and it is thanks to him that I was able to learn so much. Watching him also helped change my perception of graduate students and their roles in research.
Great knowledge ; fair as a teacher/coach

Summary of Survey Responses

Gains:

- Understanding of participant needs and pace of learning
- Patient and understanding throughout experience
    - Provided understanding of materials and appropriate background information
- Demonstrated knowledge to support experience
    - Provided teaching and guidance for many participants
        - Some participants noted support and guidance for graduate work and life outside the lab

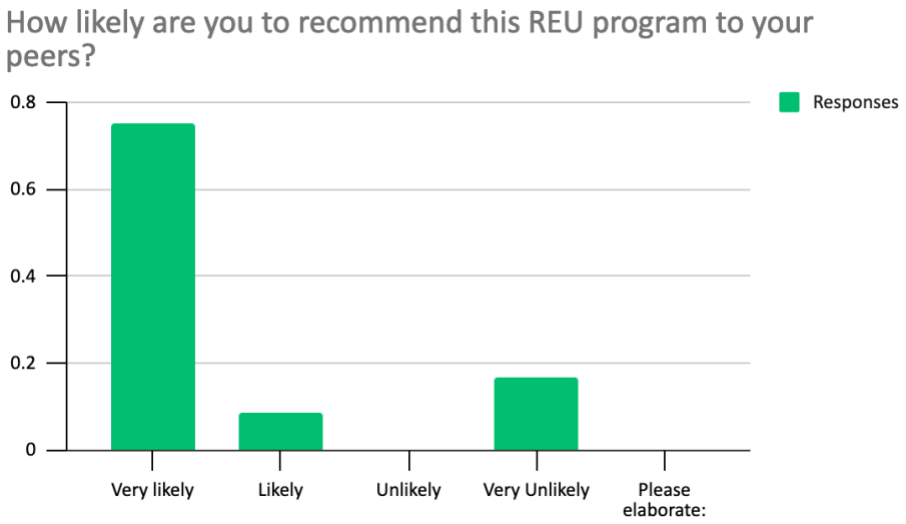
Considerations for Improvement:

- Need for greater level of teaching and coaching by mentor noted by some participants
- Building relationships with participants more effectively from start of experience

REU Recommendations to Peers

In being asked about the likelihood of recommending the REU program to their peers, Figure 14 shows 12 participants provided responses that ranged from "very unlikely" to "very likely" and 2 participants skipped the question. Of those respondents providing responses, 75% stated they are "very likely" to recommend the program, 8% stated they were "likely", and 17% stated they were "very unlikely" to recommend the program.

Figure 14. Participant Recommendation to Peers



In wrapping up the survey, participants were provided the opportunity to discuss, in their own words, the best aspects of the program and those areas that they believe are in need of improvement as well as an opportunity to provide any additional comments they wished.

Of the 14 respondents participating in the survey, 12 responded to and 2 skipped the question providing an opportunity to discuss the best aspects and those in need of improvement.

Figure 15. Participate Views on Best Aspects and Areas for Improvement

Direct Participant Responses:

Responses
Working in the lab! Getting hands-on experience and interacting with the fellows in the lab. I would say making sure that we are included in activities outside of the lab. There was a lack of communication leaving me confused about a lot of the other programs that were offered to us. Like being unaware of the bigger group of REUs that had meetings every Monday, Tuesday, and Wednesday.

Definitely there should be some sort of a meal plan included. I know there are summer ones, but they are pricey upfront. I would have liked a trip to the city rather than the corning glass museum. More interactions with other REU interns from different programs.
I enjoyed working with the Schlom group in their "natural environment". I assisted my mentor in all of the research techniques they would use throughout their time in the group, giving a very accurate idea of what graduate school would be like in materials science. However, I think initial expectations could be better managed as several of my fellow REU students and I expected to be receiving individual projects to work on throughout the summer. It is completely okay that this did not happen as I believe I learned more as a result, but in the future accurate expectations for the students on the experimental side should be given. This is to say future students should early on be told that they will be assisting mentors in long-term projects which may or may not be completed within the 10 week program.
The mentors and time in the labs was the best part for me. there was not much that should be improved upon.
The best aspects of the REU program were having access to state of the art instrumentation as well as a very supportive group of graduate students who helped improve my presentation and knowledge. I believe what is in need of improvement is organization between Cornell and JHU, as well as a better understanding of the projects and access to literature before arriving to the REU in the summer.
The best aspect was the people. I loved my fellow REU interns and the mentors I gained along the way were incredible. One thing that can be improved is the frequency of check-ins as some peers felt lost midway through their project and had to reach out.
The best aspects were the help and support of the other REU's, the hot materials talks, and the mentors. Things that can improve would be the meal plan inclusion for everyone attending the program and/or laundry inclusion.
Best aspects are everyone has their own mentor to work with and gave us the chance to interact with other REU participants a lot; improvement might be organize more activities on weekends
Best: Resources, seminars, research atmospheres, and people Improve: Mentor preparation. Myself and a couple of my colleagues who did not have a PI as a mentor experienced some difficulties regarding the project planning by some mentors. We had to push quite hard for a next step in the project, or we had to circumvent the mentor and go straight to the PI.
What I enjoyed most was being able to meet people, make connections, and gaining experience in putting together and orating a professional presentation. There were very few aspects of the experience that I did not enjoy. One thing I noticed was that some of the Mentors were more prepared than others to take on a mentee. That is, some of the mentors had projects in mind from day 1 for their students that led to a great presentation at the end of the semester. In other cases, the mentor only had a rough idea of what project would be good for their student which led to some issues. I personally didn't find this to be a huge issue, though, I definitely could have seen myself suffering from an issue such as this if I wasn't as comfortable doing independent work.
The research conducted was top-notch, and the REU allowed me to spend most of time being a part of it. However, the organization of some of the lectures could be improved. Some of the guest lectures/sessions were incredibly interesting, while others were far more repetitive, and had few research connections.
presenters, lab, students

Summary of Survey Responses

Gains:

- Direct work within labs
- Patient and understanding throughout experience
- Provided experience to support experience
    - Knowledgeable in area of study
    - Provided teaching and guidance for many participants
- PI supportive as needed by participant

Considerations for Improvement:

- Teaching and coaching by mentor (varied from other participant experiences)
    - Building relationships with participants more effectively from start of experience

When given the opportunity to provide additional comments, 3 of the 14 survey participants provided responses, however one simply responded “n/a”.

Figure 16. Further Comments

Responses
Overall an amazing experience. Thanks to everyone who put this together!
N/A
This experience was quite literally priceless. I would not have traded it for the world, and I hope that plenty of other lucky students are able to participate in this program and have their love of science reinforced and grown.

Summary of Survey Responses

Gains:

- Positive experience

Considerations for Improvement:

- Not mentioned in responses provided

FINAL PRESENTATIONS

The PARADIM Evaluation Team conducted virtual observational assessments of REU students presentations.. The assessment metrics related to each presentation included:

- Organization,
- Visuals,
- Delivery,
- Content,
- Illustrations/Examples/Metaphors

A 1-5 Likert-type scale was employed: Poor/Inadequate; Below Average; Average; Above Average; Excellent/Professional Quality. In addition, the evaluator-observer team took brief notes on the content and their perceptions of the presentations.

Following is a summary of the evaluator data:

PARADIM Presentation Evaluations

1. **Ms. Jordan Brown**
Cornell REU
Clark-Atlanta University
Mentor: Betul Pamuk

Organization	Visuals	Delivery	Content	Examples/ Metaphors/Illustration
5.0	5.0	3.0	4.5	3.5

Notes:

Organization – Clear path through content and provided next steps beyond her research
Visuals – All visuals connected to content and supported presentation
Delivery – Conveyed content knowledge. However, demonstrated a struggle speaking to groups and relied on reading from screen.
Content – Demonstrated content well as well as providing next steps as evidenced by only a few questions raised by the audience.
Examples/Metaphors/Illustrations – Provided some real-world connections early in presentation but did not continue to provide them throughout presentation.

2. **Ms. Anna Capuano**
Cornell REU
Rensselaer Polytechnic Institute
Mentor: Brendan Faeth

Organization	Visuals	Delivery	Content	Examples/Metaphors/Illustration
4.5	5.0	3.5	4.0	3.0

Notes:

Organization – Clear path through content but did not provide next steps beyond the research conducted.
Visuals – All visuals connected to content and supported presentation including a couple of videos providing additional visual representation of the topic.
Delivery – Demonstrated an initial comfort with speaking but then began to appear flustered with the content as the presentation continued. Had a grasp and understanding of content but struggled to stay focused on how to present it to others.
Content – Demonstrated content well but provided no next steps as evidenced by questions from the audience that helped complete the understanding of the content.
Examples/Metaphors/Illustrations – Technical examples provided but used few if any metaphors and illustrations beyond the data collected throughout the project as illustrated by the questions for clarity and further understanding by the audience.

3. Mr. Saisrinivas Gudivada
Cornell REU
UC Berkley
Mentor: Betul Pamuk

Organization	Visuals	Delivery	Content	Examples/ Metaphors/Illustration
5.0	5.0	4.0	5.0	2.0

Notes:

Organization – Extremely well organized with use of slides and transitions to indicate the steps taken in the project.
Visuals – Visuals all connected to content and were well chosen as evidenced by the connections the presenter made to the content based on the visual.
Delivery – Fast speaker. Stumbled occasionally, but self-corrected when necessary and didn't just continue. Made sure his content was addressed.
Content – Goals defined from the beginning of presentation. Definitions provided where the speaker felt necessary regardless of the knowledge base of the audience which supported the overall understanding of the project. Results clearly addressed. Side note: not only thanked those that supported the project but acknowledged the contribution the entity or person made to support him.
Examples/Metaphors/Illustrations – Very limited examples/metaphors/illustrations beyond the content of the presentation.

4. Mr. Kevin Hernandez
Cornell REU
UC Berkley
Mentor: Noah Schnitzer

Organization	Visuals	Delivery	Content	Examples/ Metaphors/Illustration
5.0	5.0	5.0	5.0	3.0

Notes:

Organization – Extremely clear organization with transitions through the project provided.
Visuals – All visuals connected to content and were not only discussed, but even discussed by specific portions of the visual so the audience could focus where the presenter wanted them to focus.
Delivery – Stood in front of a screen facing the audience and moved around only looking at the screen to ensure the content provided was what it should have been or to help elaborate on a particular portion of screen to support the audience. Extremely clear and high level of knowledge of the presentation.
Content – Very clear content and provided the WHY the project was important from the start. Discussed limitations of the project and next steps. Conclusions clearly shown on screen as were next steps. Also acknowledged that his own research could be flawed in response to a question by stating that he "couldn't be 100% sure it was the material". High level response.
Examples/Metaphors/Illustrations – Started with some outside connections supporting the WHY of the project but did not continue to use any examples/metaphors/illustrations beyond content directly.

5. Mr. Evan Krysko
Cornell REU
Penn State University
Mentor: NEHA

Organization	Visuals	Delivery	Content	Examples/ Metaphors/Illustration
4.0	5.0	4.5	4.5	2.75

Notes:

Organization – No initial outline for presentation but moved in a logical order despite not setting it up in the beginning of presentation. Conclusions of the project were very clear.
Visuals – Clear and well used especially as the presenter used the visuals and drew audience attention to portions being discussed to help highlight content.
Delivery – Facing screen and the visuals but did make eye contact with the audience. Rushed to respond to questions from the audience.
Content – Gave background and current flaws as related to current experiment and was clear in how the current project addressed those flaws discussed. Did not provide any next steps or how there could be extensions of the project.
Examples/Metaphors/Illustrations – Some introduced early on but then did not use any further throughout the presentation.

6. Mr. Joey Lin
Cornell REU
Cornell
Mentor: Gianluca Fabi

Organization	Visuals	Delivery	Content	Examples/ Metaphors/Illustration
5.0	5.0	4.5	5.0	2.0

Notes:

Organization – Clear outline for presentation provided and then discussed project based on the steps used in the project. Very clearly organized throughout.
Visuals – Used visuals to support the presentation and drew audience attention to portions being discussed and explained.
Delivery – Set up the audience to know that definitions would be provided to support understanding. Stumbled occasionally but did not impede understanding. Looked at the screen much of the time.
Content – Provided background information, shared the ideal and limitations of previous models and supported audience understanding with next steps beyond the project. Handled questions from the audience well.
Examples/Metaphors/Illustrations – Almost none used during presentation.

7. Mr. Ciaran MacKenzie
Cornell REU
Alfred State University
Mentor: Jacob Steele

Organization	Visuals	Delivery	Content	Examples/ Metaphors/Illustration
4.5	5.0	4.5	4.0	2.5

Notes:

Organization – No initial outline for presentation provided but most of the presentation was organized. However, it seems that the results were provided twice.
Visuals – Well presented and drew audience attention to portions as needed.
Delivery – Started out tentatively but spoke quickly as he became more confident. Eye contact with the audience but used the computer as a guide rather than screen so eyes were down from the audience.
Content – Started out defining how "normal" within the procedure would be then laid out what the current project did. Provided impacts of project content. Seemed unsure or unclear on how some of the processes worked. Audience had lots of questions – could be due to lack of information provided or extensions of the current project.
Examples/Metaphors/Illustrations – Very few used to help illustrate project.

8. Mr. Reid Markland
Cornell REU
Auburn University
Mentor: Maya Ramesh

Organization	Visuals	Delivery	Content	Examples/ Metaphors/Illustration
5.0	5.0	4.5	5.0	2.5

Notes:

Organization – Laid out presentation plan and followed it clearly throughout one step at a time.
Visuals – Clear and well used by drawing attention to portions being discussed.
Delivery – Some struggles with delivery but not for lack of knowledge. Nerves seemed to be a small issue. Not much eye contact with the audience, rather focused on screen or one portion of the audience – may have been the mentor.
Content – Very extensive and clear. Made sure to refer to parts in future parts of the presentation. Explained how things may be understood as well as how error impacted and informed the project moving forward.
Examples/Metaphors/Illustrations – Lacked throughout but did show some images to support this area.

9. Mr. Yacob Melman
Cornell REU
Clarkson University
Mentor: Cameron Gorsak

Organization	Visuals	Delivery	Content	Examples/ Metaphors/Illustration
5.0	5.0	4.0	5.0	2.0

Notes:

Organization – Laid out what was examined immediately, and the pathway presentation would follow. Well organized.
Visuals – Clear and well used by drawing attention to portions being discussed.
Delivery – Looked at screen much of the time and was a fast speaker which made the presentation seem scripted although not.
Content – Very extensive and clear. Handled questions very well and offered connections to what was used.
Examples/Metaphors/Illustrations – Lacked throughout with only a brief mention.

10. Mr. Erdem Ozdemir
Cornell REU
University of Michigan
Mentor: James Hwang

Organization	Visuals	Delivery	Content	Examples/ Metaphors/Illustration
5.0	5.0	4.5	5.0	2.5

Notes:

Organization – Clearly organized but did not lay out that organization at the beginning. Did not impact the organization overall.
Visuals – Well discussed and explained and drew attention to portions as needed.
Delivery – Eye contact between screen and audience. Handled disruptions in personal delivery well. A bit of a fast speaker which caused the trip-ups but did not impact understanding.
Content – Offered the WHY – advantages and disadvantages for parts offered throughout the presentation. Provided clear conclusions and future work.
Examples/Metaphors/Illustrations – Attempts made but did not extend much past direct content.

11. Mr. Ethan Ray
Cornell REU
Georgia Institute of Technology
Mentor: Tobias Schwaigert

Organization	Visuals	Delivery	Content	Examples/ Metaphors/Illustration
5.0	5.0	5.0	5.0	3.0

Notes:

Organization – Clear organization although no layout for presentation provided at beginning.
Visuals – Very clear and connected to the project and used visuals to enhance presentation.
Delivery – Moved eye contact from audience to screen to computer as needed to provide best content.
Content – Started with background and connections to previous research. Provided why and why nots that impacted the strengths of content and reliability. Connection to previous literature and next steps.
Examples/Metaphors/Illustrations – Provided some use of project connections.

12. Ms. Jayda Shine (PREM)
Cornell REU
Spelman College
Mentor: Evan Yilin Li

Organization	Visuals	Delivery	Content	Examples/ Metaphors/Illustration
5.0	5.0	4.5	5.0	3.5

Notes:

Organization – Although no initial layout of presentation provided, very well organized as presented.
Visuals – Well connected and explained throughout.
Delivery – Provided her information but repetitively used "umm". Eyes on the screen or computer.
Content – Definitions needed and provided. Expressed her own lack of prior experience in a way that enhanced content. Discussed failures prior to current project and the goals of project.
Examples/Metaphors/Illustrations – Provided how this project was used in everyday life.

13. Ms. Qing Xu
Cornell REU
University of California Los Angeles
Mentor: Qi Song

Organization	Visuals	Delivery	Content	Examples/ Metaphors/Illustration
5.0	4.75	4.5	5.0	2.5

Notes:

Organization – Started with materials and then had a clear order and provided procedure well.
Visuals – Explained clearly and brought attention to visuals as being discussed. Used images of herself working helping audience connect with her and the project. Some fonts used in visuals felt less than professional but seemed to be used to provide variation throughout the presentation.
Delivery – Eyes on the audience most of the time. Stumbled over words a tiny bit but did not impede understanding. Seemed too rehearsed and may have been reading notes directly on the computer as presented.
Content – Gave the WHY and applications for the project. Offer problems that support content.
Examples/Metaphors/Illustrations – Provided some loose applications of the project.

14. Ms. Bianca Brown (PREM)
JHU REU
Clark Atlanta University
Mentor: Tyrel McQueen

Organization	Visuals	Delivery	Content	Examples/ Metaphors/Illustration
5.0	5.0	3.5	5.0	2.0

Notes:

Organization – Clearly organized from background to project research. Spent a substantial time on background.
Visuals – Connected well to what was being discussed and brought attention to specific portions of visuals as needed.
Delivery – Nerves showing. Lots of pauses, fast speaking. Fidgeting (hand wringing and one behind back a lot). Almost confused at points but seemed related to nerves rather than content. Seemed to have notes on presentation on the computer as a guide.
Content – Gave background needed regarding the content and why the materials were chosen. Continued clarity as discussed the current project. Some next steps provided.
Examples/Metaphors/Illustrations – Only very few slight connections beyond direct content.

15. Mr. Sam Dawley
JHU REU
Johns Hopkins University
Mentor: David Elbert

Organization	Visuals	Delivery	Content	Examples/ Metaphors/Illustration
5.0	5.0	5.0	5.0	2.5

Notes:

Organization – Laid out the order of the presentation verbally and then maintained a very clear order throughout.
Visuals – Very clearly connected to content and point in presentation while focusing attention to portions as needed.
Delivery – Engaged with audience "we can all agree" based on simple concept so didn't come off as a risk in some not being engaged by it. Repetition of some phrases however allowed him to show more tech related to the project. Used humor well which allowed his personality to be infused deeply. Mainly looked at the screen but some time spent with eyes on the audience – the time spent looking at the screen seemed to be supportive of the visual.
Content – Definitions provided immediately (focus for presentation) and then provided the why, what and how of the project.
Examples/Metaphors/Illustrations – Few provided in presentation.

16. Ms. Morgan Dierolf
JHU REU
Penn State University
Mentor: Satya Kushwaha

Organization	Visuals	Delivery	Content	Examples/ Metaphors/Illustration
5.0	5.0	4.75	5.0	4.0

Notes:

Organization – Started with applications of the project beyond the research which allowed the content to be connected back to those applications with the audience mind. Well organized.
Visuals – Kept visuals simple allowing for explanations of what the project did and not just a retelling of what the visual was.
Delivery – Needed to project voice a bit more and some stumbling early on. Both improved as confidence grew.
Content – Defined as needed – clear and detailed and even discussed ideal outcomes. Conclusions clear and discussed successes of project and next steps.
Examples/Metaphors/Illustrations – Led with good connections to companies and home computer users – very good setup for the presentation to provide a context for the project.

17. Ms. Abby Neill
JHU REU
University of Texas at Dallas
Mentor: Thomas Whoriskey

Organization	Visuals	Delivery	Content	Examples/ Metaphors/Illustration
5.0	5.0	5.0	5.0	2.0

Notes:

Organization – Didn't lay out the project until a bit in but very well organized from beginning to end.
Visuals – Clear and explained throughout.
Delivery – Mic seemed low but was adjusted. Fast speaker but seemed to stem from excitement about the project and not nerves. Used gestures to help illustrate what was being said. Some extended eye contact in one direction, but mostly varied.
Content – Definitions provided to support understanding of content and visuals used. Offered what they found and how it could be improved going forward. Referred to some confusion about some results but made comments about how the professor helped with her understanding during the project and how to move on with exploration. Overall, very clear content.
Examples/Metaphors/Illustrations – Almost none provided not related directly to content.

18. Ms. Catherine Phillips
JHU REU
Harvey Mudd College
Mentor: David Elbert

Organization	Visuals	Delivery	Content	Examples/ Metaphors/Illustration
5.0	5.0	4.0	5.0	3.5

Notes:

Organization – Clear organization of content and research conducted and used transitions well to support the organization.
Visuals – Connect to content and focused audience attention as needed. Even showed one image of the note cards she used during the research which made it feel more personal.
Delivery – Stood facing the screen and would look back over shoulder at the audience – but found a way to connect to the audience. Body movements and a bit of humor assisted in the building of that connection. Although nerves could not be noticed in her voice or speaking, she seemed to use the sleeves of her sweater as a comfort to hide the nerves – seemed to be a good way to hide her nerves during presentation as she maintained audience connection to screen and content.
Content – Very knowledgeable and made sure to make the more difficult content accessible through presentation style.
Examples/Metaphors/Illustrations – Provided connections to ice cream sandwiches to support understanding during one portion of the presentation.

19. Ms. Julia Saga Viktoria Camacho Wejbrandt
JHU REU
King's College, London (Johns Hopkins University year-abroad program)
Mentor: David Elbert

Organization	Visuals	Delivery	Content	Examples/ Metaphors/Illustration
5.0	5.0	5.0	5.0	2.0

Notes:

Organization – Background provided and explained clearly where she was going throughout the presentation which was very supportive to the audience. During the presentation she explained when one section was wrapped up and what the next portion would cover.
Visuals – Minimalistic visuals used in the beginning but became more detailed as needed regarding the current project.
Delivery – Moved instantly from behind the computer helping to connect her to the audience. She moved throughout the presentation which was good except it led to occasionally too much swaying. Began to speak fast (normally a negative in presenting) but it was clear it wasn't nerves but rather excitement regarding the project. Spoke with a blank slide at one point but used it well

as a connecting time with the audience as their focus was on her rather than screen. Smile and facial expressions supported her overall excitement.
Content – Provided the background and then the WHY of the project. Very clearly knowledgeable with deep understanding and explanations provided.
Examples/Metaphors/Illustrations – There were few if any connections in this area provided.

Student Presentations: Conclusions/Considerations

As both the numerical metrics and the observation narratives demonstrate, there was a high degree of quality in the presentations by the 19 presenters (1 student did not present). In nearly all the five variables studied by the evaluation team, students across the board scored at and above 4.0 (above average), with many receiving top grades of 5.0 (excellent/professional quality). The evaluator was highly impressed that these undergraduate college students could combine the technical content with the ability to communicate so well and clearly. In the metrics for Illustrations/Examples/Metaphors – there was an observable lack of these connections being made in most presentations. The evaluator suggests that to ensure that students - in college and in career - are able to communicate well to both science- and non-science- publics, helping audiences "see" the unfamiliar in familiar ways is a strength. There were some signs of this in some of the presentations, and it is recommended that continued direct instruction in this variable be considered for future REU iterations.

Appendix

Complete Survey Details

Question 1

Please indicate your REU:		
Answer Choices	Responses	
PARADIM @ Cornell University	71.43%	10
PARADIM @ Johns Hopkins University	28.57%	4
	Answered	**14**
	Skipped	**0**

Question 2

Please rate the following lecture, training session, and activities, as well as your overall REU experience:											
Rating											
	Poor		Fair		Good		Excellent		Did Not Attend		Total
June 9th: Jill Powell, Library Science	0.00%	0	38.46%	5	30.77%	4	23.08%	3	7.69%	1	13
June 12th: Collaboration workshop with Lynne Vincent	7.69%	1	30.77%	4	23.08%	3	7.69%	1	30.77%	4	13
June 13th: Darrell Scholom MBE Summer School Intro Lectures	0.00%	0	7.69%	1	30.77%	4	53.85%	7	7.69%	1	13
June 16th: Undergraduate Workshop on Research Ethics and Responsible Conduct	0.00%	0	46.15%	6	30.77%	4	7.69%	1	15.38%	2	13
June 21st: Jim Overhiser, Research Presentation Workshop (CU)	0.00%	0	7.69%	1	30.77%	4	61.54%	8	0.00%	0	13
June 21st: Prof. Julie Nucci, Importance of Science Communication (CU)	0.00%	0	23.08%	3	15.38%	2	53.85%	7	7.69%	1	13
June 23th: Prof. Lena Kourkoutis, Seeing with Electrons	0.00%	0	15.38%	2	15.38%	2	69.23%	9	0.00%	0	13
June 27th: Jim Overhiser, Research Presentation Workshop (CU)	0.00%	0	15.38%	2	30.77%	4	46.15%	6	7.69%	1	13
June 27th: Prof. Julie Nucci, Importance of Science Communication (CU)	0.00%	0	15.38%	2	23.08%	3	53.85%	7	7.69%	1	13
June 30th: Betul Pamuk, Computer Experiments Using Density Functional Theory	7.69%	1	15.38%	2	23.08%	3	46.15%	6	7.69%	1	13
July 7th: Prof. Tyrel McQueen, Guided Materials Discovery	0.00%	0	7.69%	1	15.38%	2	53.85%	7	23.08%	3	13

July 8th: Dr. Maggie Eminizer, Data Science and Automation	0.00%	0	7.69%	1	23.08 %	3	46.15 %	6	23.08 %	3	13
July 21st: Prof. Darrell Schlom, How Wacky Oxides have Improved Transistors	0.00%	0	7.69%	1	23.08 %	3	53.85 %	7	15.38 %	2	13
	1.18%		**18.34 %**		**24.26 %**		**44.38 %**		**11.83 %**	Answered	**13**
										Skipped	**1**

Question 3

How much did you gain in the following areas as a result of this REU research experience?									
Academic Gain									
	Little or No Gain		Moderate Gain		Great Gain		Not Applicable		Total
Familiarity with a range of research techniques	0.00%	0	15.38%	2	84.62%	11	0.00%	0	13
Mastery of project-specific research techniques	0.00%	0	23.08%	3	76.92%	10	0.00%	0	13
Presentation skills	7.69%	1	38.46%	5	53.85%	7	0.00%	0	13
Explaining my project to people outside my field	7.69%	1	46.15%	6	46.15%	6	0.00%	0	13
Writing scientific reports or papers	23.08%	3	61.54%	8	15.38%	2	0.00%	0	13
Understanding journal articles	30.77%	4	46.15%	6	23.08%	3	0.00%	0	13
Conducting library database searches	69.23%	9	15.38%	2	15.38%	2	0.00%	0	13
Making a research poster	7.69%	1	53.85%	7	38.46%	5	0.00%	0	13
Making a research poster	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0
	16.24%		**33.33%**		**39.32%**			Answered	**13**
								Skipped	**1**

Question 4

How much did you GAIN in the following areas as a result of this REU research experience?									
Academic Gain									
	Little or No Gain		Moderate Gain		Great Gain		Not Applicable		Total
Preparation for advanced course/thesis work	15.38%	2	46.15%	6	38.46%	5	0.00%	0	13
Preparation for graduate school	7.69%	1	30.77%	4	53.85%	7	7.69%	1	13
Preparation for an academic or industrial career	0.00%	0	38.46%	5	61.54%	8	0.00%	0	13
Interest in materials science research	7.69%	1	23.08%	3	69.23%	9	0.00%	0	13
Interest in some other scientific research/career	0.00%	0	46.15%	6	46.15%	6	7.69%	1	13

Confidence in my ability to contribute to science	0.00%	0	15.38%	2	84.62%	11	0.00%	0	13
	5.13%		**33.33%**		**58.98%**		**2.56%**	Answered	**13**
								Skipped	**1**

Question 5

Please provide further explanation of your responses, particularly any "little or no gain" responses. Also, did you make any other gains that we didn't mention?	
Answered	
Skipped	
	Responses
	I did not have much practice searching library databases.
	Mainly because most of these preparations did not directly apply to my research. I was almost always at a computer coding, so the gain I believe I truly had was more about discipline.
	Not much emphasis was put on the paper or poster, just that they were things to be done before the REU was considered complete. Other moderate gain responses are a result of prior knowledge and comfort levels.
	It made me much more interested in going to grad school and I am much more excited about research than I was before my REU.
	I feel that much of my work this summer did not emphasize a usage of past literature or looking into past literature of the field which I think would have been very beneficial, as would further instruction of writing within the research topic.
	Gain in communication skills
	There was not a lot of guidance given on the reading of scientific literature, which I believe would have been quite helpful. The session on library research was pretty bland and I had heard most of that information prior to the presentation.
	I found that many of my learning, preliminary research, and understanding skills were already very good so that reading and finding papers was something I could do easily with access to a library database. However, the most I gained from the experience was in creating a presenting professional posters, slides, and papers to disseminate to the rest of the community. Also, I gained a lot by just meeting people!
	The REU allowed me to greatly expand my research techniques. Although I am not a materials science major, the REU expanded my interest in the field.
	I learned best when motivated, nothing personal

Question 6

As a result of this REU research experience, how likely you are to:									
How likely?									
	Not more likely. This is still not my plan.		Not more likely. This was already my plan.		More likely		Not applicable		Total
...switch to a new/different major in college?	75.00%	9	16.67%	2	8.33%	1	0.00%	0	12
...pursue a new/different minor in college?	66.67%	8	8.33%	1	25.00%	3	0.00%	0	12
...pursue a career in science or engineering? (industry and/or academic)	16.67%	2	66.67%	8	16.67%	2	0.00%	0	12
...pursue a career in materials science, specifically? (industry and/or academic)	25.00%	3	33.33%	4	41.67%	5	0.00%	0	12
...present a talk or poster at a conference?	8.33%	1	25.00%	3	66.67%	8	0.00%	0	12
...write or co-write a paper to be published in an academic journal?	8.33%	1	8.33%	1	66.67%	8	16.67%	2	12
...write or co-write a paper to be published in an undergraduate research journal?	16.67%	2	8.33%	1	58.33%	7	16.67%	2	12
	30.95%		**23.81%**		**40.48%**		**4.76%**	Answered	**12**
								Skipped	**2**

Question 7

If you indicated that you are likely to present, publish, or apply for an award/scholarship based on your research this summer, please tell us more:		
Answered	**12**	
Skipped	**2**	
		Responses
		N/A
		I still need more practice on presentation skills and this opportunity was an experience to modify and build my own way to present.
		If I do make it onto a paper as a result of my summer work it likely will not be for some time. I will, however, use the skills acquired this summer to present research from other research projects in the future.

		I am more interested in writing a paper after my experience this summer. However, I am not going to be writing a paper on what I did this summer.
		N/A
		Poster contest at home university
		I would like to enter a science research poster competition.
		Was on a publication with my mentor this summer
		I have been told by my PI that he would like me to write a paper with his group regarding my research, and I am honored to be given such an oportunity.
		N/A
		It is possible that if the group I was a part of publishes a paper in the future, I will be included as an acknowledgement or co-author.
		i am working with a professor at home university on a paper

Question 8

As a result of this REU research experience, how likely you are to:									
How likely?									
	Not more likely. This is still not my plan.		Not more likely. This was already my plan.		More likely		Not applicable		Total
...apply to a Master's program in science, math, or engineering?	50.00%	6	33.33%	4	8.33%	1	8.33%	1	12
...apply to a Ph.D. program in science, math, or engineering?	0.00%	0	50.00%	6	25.00%	3	25.00%	3	12
...apply to nursing, medical, dental, pharmaceutical, or veterinary school?	66.67%	8	16.67%	2	8.33%	1	8.33%	1	12
...apply to a professional program not already mentioned? (e.g., law, library science, business, social work, journalism, etc.)	75.00%	9	8.33%	1	0.00%	0	16.67%	2	12
...apply to a graduate program in a non-STEM field? (e.g., social science, humanities, fine arts, etc.)	91.67%	11	0.00%	0	8.33%	1	0.00%	0	12
...apply for an award or scholarship based on your research?	16.67%	2	25.00%	3	33.33%	4	25.00%	3	12
	50.00%		**22.22%**		**13.89%**		**13.89%**	Answered	**12**
								Skipped	**2**

Question 9

In your own words, how did your REU experience influence your thinking about future career and graduate school plans (or not)? Please explain.		
Answered	**12**	
Skipped	**2**	
		Responses
		My REU experience just made me more hyper-focused on what I am aiming to achieve. I have a more thought-out plan as well as more experience in what I need to do to prepare for my future career.
		It solidified my ambition for graduate school, but it also reminded me of my human nature and that its very important to have a life balance
		I was surprised with how much I enjoyed materials science, coming from a physics background. I could see myself potentially pursuing it as a career path.
		I am much less concerned about doing research and I am much more interested in doing research, in and out of school.
		This REU helped me bring more focus of what I field I would like to focus my graduate research on in the future. Although I had already planned to pursue materials science research, I now have a plan to focus more on the realm of solid state materials synthesis.
		It made me better aware of the challenges and daily life of a grad student as well as the joys that pursuing a PhD can bring. Getting to know several grad students was a highly beneficial aspect of the program.
		It has influenced me to broaden my research into my field, so that I know exactly what pathway I would like to take.
		Tells me what I should care about and who to ask to learn about a group when applying to grad school
		It gave me a broader view of laboratory social scapes, possible employment opportunities, and the possibilities of different work environments. All of these were very helpful when looking forward to the future.
		It did not change how I think about future career planning and graduate school because I already planned on doing those things before the REU. Though, with some of the people I've been able to meet I may apply to different programs/work with different professors.
		Giving me the most hands-on lab/research experience that I have had as of yet, it both increased my understanding and perception of graduate school. It has led to me taking that into consideration as a potential option.
		It reinforced my thinking and gave me more confidence

Question 10

Please indicate the degree of support you received from your PI/Grad mentor in the preparation of your final presentation:		
Answer Choices	Responses	
No support	0.00%	0
Little support	0.00%	0
Some support	33.33%	4
A great deal of support	66.67%	8
	Answered	**12**
	Skipped	**2**

Question 11

From your perspective, how important is the mentor to the success of the REU experience?		
Answer Choices	Responses	
Not at all important	0.00%	0
Slightly important	0.00%	0
Moderately important	8.33%	1
Extremely important	91.67%	11
	Answered	**12**
	Skipped	**2**

Question 12

From your perspective, to what degree did your mentor influence your future plans?		
Answer Choices	Responses	
Not at all	0.00%	0
Slightly	16.67%	2
Moderately	41.67%	5
A great deal	41.67%	5
	Answered	**12**
	Skipped	**2**

Question 13

Please elaborate on your mentor experience:		
Answered	**12**	
Skipped	**2**	

		Responses
		I had a great mentor experience. He was patient and understanding. Even when he wasn't present still found a way to make sure I was still on the right track.
		He was great, but there wasn't an instant connection, there was definitely time needed to establish a trust. The communication seemed a bit forced but overall I appreciate hi9s time and effort for the program.
		Talking with my mentor about her experience with graduate school was extremely eye opening, especially as she came from a similar background of physics.
		My mentor was great at teaching me while making in fun and relaxed.
		Although my mentor meant well, he was fairly hands off and did not provide me much guidance in the way of my project and seemed to not have much direction for my project when I started, leading me to communicate more with my PI. I think had he had more guidance for what my project should have been, I think I would have had a better experience.
		My mentor was very helpful in teaching and guiding me through the project while still giving me a good sense of independence.
		My mentor really went out of her way to make sure that I understood all of the materials and background information on the topic at hand. We need more hands-on mentors like her.
		My mentor is very helpful on helping me understand concepts (always answer my question so patiently), learn how to do experiments (teach me step by step), guide me through presentations and gave a lot of helpful tips, and even out of lab life.
		Although I had some bumps in the road regarding my mentor specifically, my PI was able to step in and fill all of the gaps that I was missing from my graduate mentor. I was also able to get a mentor change, and my experience was far better with my new mentor.
		I had a fantastic experience with David! And Maggie! They both provided any support I could have asked for and even connected me with other scientists I would not have had the ability to work with and learn from. In addition to being very supportive, the entire Elbert group was incredibly warm and inviting
		My mentor was incredibly patient and helpful throughout the course of the REU, and it is thanks to him that I was able to learn so much. Watching him also helped change my perception of graduate students and their roles in research.
		great knowledge ; fair as a teacher/coach

Question 14

How likely are you to recommend this REU program to your peers?		
Answer Choices	Responses	
Very likely	75.00%	9
Likely	8.33%	1

Unlikely	0.00%	0
Very Unlikely	16.67%	2
Please elaborate:	0.00%	0
	Answered	**12**
	Skipped	**2**

Question 15

What were the best aspects of the REU program? What aspects are most need of improvement? Please take time to reflect and elaborate		
Answered	**12**	
Skipped	**2**	
		Responses
		Working in the lab! Getting hands-on experience and interacting with the fellows in the lab. I would say making sure that we are included in activities outside of the lab. There was a lack of communication leaving me confused about a lot of the other programs that were offered to us. Like being unaware of the bigger group of REUs that had meetings every Monday, Tuesday, and Wednesday.
		Definitely there should be some sort of a meal plan included. I know there are summer ones, but they are pricey upfront. I would have liked a trip to the city rather than the corning glass museum. More interactions with other REU interns from different programs.
		I enjoyed working with the Schlom group in their "natural environment". I assisted my mentor in all of the research techniques they would use throughout their time in the group, giving a very accurate idea of what graduate school would be like in materials science. However, I think initial expectations could be better manages as several of my fellow REU students and I expected to be receiving individual projects to work on throughout the summer. It is completely okay that this did not happen as I believe I learned more as a result, but in the future accurate expectations for the students on the experimental side should be given. This is to say future students should early on be told that they will be assisting mentors in long-term projects which may or may not be completed within the 10 week program.
		the mentors and time in the labs was the best part for me. there was not much that should be improved upon.
		The best aspects of the REU program were having access to state of the art instrumentation as well as a very supportive group of graduate students who helped improve my presentation and knowledge. I believe what is in need of improvement is organization between Cornell and JHU, as well as a better understanding of the projects and access to literature before arriving to the REU in the summer.

		The best aspect was the people. I loved my fellow reu interns and the mentors I gained along the way were incredible. One thing that can be improved is the frequency of check-ins as some peers felt lost midway through their project and had to reach out.
		The best aspects was the help and support of the other REU's, the hot materials talks, and the mentors. Things that can improve would be the meal plan inclusion for everyone attending the program and/or laundry inclusion.
		Best aspects are everyone has their own mentor to work with and gave us the chance to interact with other REU participants a lot; improvement might be organize more activities on weekends
		Best: Resources, seminars, research atmoshperes, and people Improve: Mentor preperation. Myself and a couple of my colleagues who did not have a PI as a mentor experienced some difficulties regarding the project planning by some mentors. We had to push quite hard for a next step in the project, or we had to circumvent the mentor and go straight to the PI.
		What I enjoyed most was being able to meet people, make connections, and gaining experience in putting together and orating a professional presentation. There were very few aspects of the experience that I did not enjoy. One thing I noticed was that some of the Mentors were more prepared than others to take on a mentee. That is, some of the mentors had projects in mind from day 1 for their students that led to a great presentation at the end of the semester. In other cases, the mentor only had a rough idea of what project would be good for their student which led to some issues. I personally didn't find this to be a huge issue, though, I definitely could have seen myself suffering from an issue such as this if I wasn't as comfortable doing independent work.
		The research conducted was top-notch, and the REU allowed me to spend most of time being a part of it. However, the organization of some of the lectures could be improved. Some of the guest lectures/sessions were incredibly interesting, while others were far more repetitive, and had few research connections.
		presenters, lab, students

Question 16

Please use the space below for any further comments you would like to add:		
Answered	**3**	
Skipped	**11**	
		Responses
		Overall an amazing experience. Thanks to everyone who put this together!
		N/A
		This experience was quite literally priceless. I would not have traded it for the world, and I hope that plenty of other lucky students are able to particcipate in this program and have their love of science reinforced and grown.