

A Comparative, Longitudinal Case Study of Two International Research Experiences for Students Programs

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Introduction

In this qualitative case study, we share our experiences and lessons learned in starting and leading two National Science Foundation (NSF) funded International Research Experiences for Students (IRES) programs during the summers of 2023 to 2025; one taking place in Germany, and one in Australia. We first present background information for each IRES program, its topics of study, etc. Next we describe our research methods and types of assessment practices. We used data from independent, semi-structured student interviews that were conducted as part of an annual program assessment after each trip. Then we share the results of the assessment for each program and program year and show a comparison table of the emergent themes for each program. Finally, we share our overall lessons learned from starting and leading the programs over the three-year span in an effort to support others' efforts in successfully starting and leading their own IRES programs.

Areas for assessment included motivations for participating in the IRES programs; cultural competencies gained; experiences abroad; conceptions of research; program impact on future career and educational goals; perceived gains from the IRES; experiences with workshops/seminars; experiences with their research communities, peers, and mentors; and possible improvements for the IRES. The assessment yielded much beneficial information about the positive experiences and areas for improvement for the IRES programs year to year. There were many similarities in student experiences across programs and also some differences. Program PIs made a point of integrating student assessment feedback and adapting their programs year to year to address the student feedback in real time.

In line with current study abroad literature, there were many benefits students experienced from the IRES programs [1 & 2]. As found in the Jaiswal & colleagues (2024) study, our students reported gaining cultural competencies such as open-mindedness and the ability to take on global perspectives and critically think about own cultures, as well as increased communication skills [1]. A similarity in our findings to the Katz (2025) was the students' willingness to consider working/attending school abroad after their IRES experience [2]. Another recent study on an IRES program in China had similar outcomes, sharing that some challenges students faced included wanting improved pre-departure preparation and project clarity [3]. Niehaus et al. (2022) also found that student mental health needs to be a focus during study abroad programs [4]. Additionally, much like our study, Kinginger (2011) highlights the complexities of trying to learn a foreign language and using that language while abroad [5].

IRES Programs Background Information

Below we provide an overview and background information for each of the two IRES programs.

Germany Living Materials iPRISM Program Background Information

The living materials "iPRISM" program (International Partnership for Responsive Infrastructure using Sustainable Multifunctional Materials), was an eight-week international research opportunity for

undergraduate and graduate students that built on a strong, multi-year partnership between [R1 University] (U.S.) and the University of [deidentified] (Germany) capitalizing on recent critical discoveries in engineered synthetic living materials at [deidentified], to accelerate research in this emerging area with a particular focus on adaptive and responsive architecture. The program boasted six on-going projects on enabling technologies for engineered synthetic living materials – a new paradigm where responsive material systems are developed in concert with the application they are advancing.

The projects involved fundamental studies on triboelectricity, responsive cement chemistries, hygrothermal actuators, and social science research on living materials acceptance across Germany and global audiences. The projects were hosted by senior faculty in the LivMats Research center at the University of [deidentified], particularly in the Cluster of Excellence in Living, Adaptive, and Energy-autonomous Materials Systems.

The program ran for eight-weeks from June to July, and involved pre-departure preparation of research proposals, cultural humility, and basic German language training. To support the cohort's research and professional development, the program hosted a graduate program mentor with an active research collaboration in the LivMats Center. The graduate program mentor hosted weekly learning sessions, dedicated to various skills development in research, such as elevator pitches, scientific posters, and oral communication. The students through daily research tasks with in-lab Ph.D. and Post-doctoral researchers developed practical research skills in an international research context, where English was primarily used in daily communication. With regular meetings with [R1 University] and [Partner University] PIs, the students, [deidentified]-faculty host, and mentors were aligned in research tasks, plans, and timelines to disseminate the research findings, through journal and conference proceedings as well as an end-of-program research presentation. The iPRISM program covered all costs to students associated with travel, lodging, and meals.

Australia Water Quality IRES Program Background Information

The water quality IRES program was a four-week collaboration between [R1 University] (U.S.) and [Deidentified] University (Australia) that ran between mid-July to mid-August. Program leaders initiated these collaborations as part of a [Deidentified] seed grant intended to support collaborations between these two institutions. From having this prior connection that allowed the PIs to learn more about each other's work in the water quality management space at these two institutions, they were well-prepared to initiate the IRES proposal to further expand on their initial connection.

For the IRES program, members worked to determine sources and transport of nonpoint source pollution in a multi-use watershed, evaluate function of existing Best Management Practices (BMPs) and propose new BMP locations and/or designs, develop transferable knowledge and new insights for managing nonpoint source pollution challenges in the U.S., and grow the [Deidentified] connection for continued collaboration.

Pre-trip training for students included meetings which allowed students to meet the mentors, discuss basic concerns and travel preparation, and provided some background on the research plans. There was also an asynchronous training via Canvas during the latter part of the spring semester related to international travel safety, logistics, and Australian culture.

The first week of the trip entailed orientation to campus, and planning for and conducting field sampling. The second week entailed conducting field sampling and starting sample analysis. The third week entailed laboratory analysis of samples. The fourth week entailed final laboratory analysis and data analysis, along with a final presentation to [Deidentified] University collaborators in Australia. Over the course of the four-weeks, students were trained in general hydrology and water quality field and lab methods as part of this experience, as well as exposed to watershed management practices, and Australian culture. IRES leaders facilitated student engagement in intensive independent research projects that tested hypotheses, targeted gaps in current knowledge, and trained them in state-of-the art water quality assessment methods. While [Deidentified] faculty and staff led the research experience in Australia, each student was co-mentored by faculty at [Deidentified]. Students gained experience in the difficulties of watershed management, with multiple stakeholders, sources, and types of nonpoint source pollution, while they tested feasible and effective solutions. Following completion of independent research projects, students communicated findings to their fellow IRES researchers, [Deidentified] students, and other stakeholders. Each student gained experience with the open-ended nature of research and the challenges of deciphering pollution dynamics and determining appropriate solutions in a multi-use watershed. For each student participant, travel and housing costs were covered, and an additional stipend was provided to cover additional costs such as food.

Methods

Methodology

For the study's methodology, we used Stake's (1995, 2006) take on case study [6 & 7]. His take on case study describes a more qualitative approach to case study than Yin (2003), and he offers guidance on how to compare programs [8]. In line with his methodological advisement, to assess and compare the programs we use qualitative interviews with students as well as capture faculty impressions in the form of "lessons learned" for each program and program year. We focus on qualitative data because of the small number of students who participated in each program each year, which averages 6 students per program per year, given that the small number would not yield a high strength and power if we were to employ quantitative measures. The qualitative data we collected gave us rich and deep impressions of the students' experiences. While for this study we focus on the qualitative data, we did collect quantitative data as well that we plan to use in a more high-level future study comparing additional programs with overall student numbers, rather than the more in-depth comparison we conducted for this study. In addition to utilizing the qualitative data, we compare the programs in a fixed timeline (Summer 2023-2025), which Stake (1995) recommends to properly "bound" our study [6]. We also consider the unique cultural contexts of each program and the program backgrounds when developing program conclusions.

Participants

There were approximately 6 student participants per program each summer. Table 1 (below) shows the total number of participants per program by year. The living materials program had slightly more student participants over the years with 18 total participants, versus the water quality program which had 16 total participants over the years.

Table 1: Number of Student Participants per Program by Year

Program Year:	Germany Living Materials iPRISM Program	Australia Water Quality Program:
2023	5 Participants	5 Participants
2024	6 Participants	5 Participants
2025	7 Participants	6 Participants
Total:	18 Participants	16 Participants

Data Collection & Analysis

To collect study data, two graduate students from the assessment team conducted individual post-trip semi-structured interviews with each student participant. The graduate students received the same training and interview protocols. Interview protocols were developed in partnership between the assessment team and the project PIs. Each IRES program had a unique interview protocol; however, the content of each protocol was largely the same. Interviews were conducted via Zoom and lasted approximately 45 minutes. The interview protocols are available in Appendix A.

The same two graduate students analyzed the interview data using a deductive thematic coding approach. Categories for investigation were developed by the assessment team and correlated with the areas being assessed for the projects. The eight categories for each year of reporting included: 1) Motivations for participating in the IRES program, 2) Cultural competencies gained, 3) Experiences abroad, 4) Conceptions of research, 5) Impact the IRES program had on future career and educational goals, 6) Perceived gains from the IRES, 7) Experience with the workshops/seminars, 8) Experiences with their research community, peers and mentors, and 9) Possible areas for IRES Improvement. From the interview transcript data, the graduate students shared the themes that emerged for each category.

Qualitative Assessment Results

In the sections below we describe the emergent themes for each category of investigation from the student interview data for each program by year and also give a comparison of the overall program results.

Germany Living Materials iPRISM IRES Program Student Interview Results Year to Year

Table 2, below, shows the main categories investigated from the student interviews along with the emergent themes discovered each year from the student interviews. Throughout the years there were both areas highlighting program successes and areas for improvement. Program successes were many and similar year to year. Examples include increases in student cultural competencies, including gaining a global perspective; excellent research experiences; new friends/connections; leadership skills; communication skills; and a positive impact informing future educational and career goals, including pursuing graduate school. Areas for improvement varied year to year and are highlighted in the paragraphs below by year.

For the 2023 program year, of the five students who participated, four were undergraduate students and one was a graduate student mentor. While the many program strengths are represented in the 2023

Emergent Themes column, such as the cultural competencies gained, the impact on future career and educational goals, and the students' conceptions of research; the main student feedback for program improvement centered on travel logistics and improving foreign language barriers.

Regarding travel visas, one student reported *"I was not a citizen of America. I had to get the German visa. And we did that after finishing the semester. We had only 20 days to apply for the visa. I got my visa two days before traveling, another [student] got theirs 12 hours before the flight."*

Another student talked about the importance of foreign language competency when ordering food for students with food allergies, sharing *"we struggled when we ordered food. One of the students had [food] allergies. [A PI] took us to dinner so we'd have an idea of how to order food. In the first restaurant [the server] didn't understand her [food] allergy part. So, we figured that out and that was very beneficial."*

During the 2024 program year, all six students interviewed were undergraduate students. Along with the many positive aspects of the program represented in the table, the main areas of feedback concerned lack of mental health training/discussion/support both pre-trip and during the trip, the need for mental health disability accommodations to be arranged pre-trip, and the need for additional cohort relationship building/diversity trainings pre-trip to address exclusion of students holding diverse personal identities.

One student shared *"we didn't talk about mental health stuff at all, even though I had a conversation with another guy about mental health, he shared that he also struggled with a [mental health disability], too, and was having a really difficult time. I don't know what it was like for him, but I can imagine that if I didn't have that support system of other people I had met [outside of my cohort] to say, like, 'Hey, can I come over like, to your room right now, because I can't be alone. Like, it just could be dangerous.' That would have been really challenging, and we didn't talk about that really at all before leaving."*

For the 2025 program year, all six undergraduate students and one graduate student mentor participated in the individual interviews. There were many benefits students discussed from participating in the program. Students also described experiences of being racially minoritized/racism outside of the university in Germany and homesickness/loneliness at the beginning of their trip, and difficulty setting work/life boundaries, sometime skipping meals or sleep at night to be in the lab.

In regards to experiences of racial minoritization/racism, one student reported *"Germany... very White country. There were moments where I did feel looked at or kind of stared at. I was very aware of not being White at certain times. This one time I was at a train stop; there's a lot of people, not a single other soul was [my racial/ethnic background], and this one [White] guy walks up to me and [greets me in a language he assumes I know], and walks away, you know? And it's like, sure, everyone gets their one, I guess, right? It wasn't anything that stuck with me. But, I don't know, I've never had that happen to me in America. I think that the differences that I've noticed in terms of racism, was, think in Europe, in Germany, it comes from more of an ignorance thing, whereas in America, it can be sometimes more linked to knowledge. So if anything, you know, that's fine. I had a handful of times people are like, 'Oh, are you [a certain ethnic group],' you know, it's like, I mean, [sarcasm] nice,*

nice icebreaker,’ I guess, it was my first time meeting them. It wasn’t anyone that I worked with. It was just kind of random people, the random cashier or the random person on the street.”

Another student described their experience of homesickness as *“I definitely felt a bit lonely, you know, going in and constantly being more alone and stuff. And when I say more alone, I mean than typically how I am in the US, maybe during a semester. Being with the other students helped a lot, because they also felt the same way I did. They were very homesick. So many times we arranged plans to hang out with each other, and that helped a lot. And so my time there in the beginning was good. The transition was a bit lonely, but I still enjoyed it. The transition and the sleep schedule was probably the hardest part for me. But other than that, everything else was really nice and very streamlined. Yeah, it was great. I loved it.”*

The student who stayed in the lab over meal times and in lieu of sleep at night reported *“in the beginning, when [one PhD mentor] wasn't around, [another PhD mentor] would kick me out of the lab [by 5:30 or 6:00pm] because it's not safe for someone who's not lab trained in this lab to be in there alone. In the beginning, when [a PhD mentor] would enforce these rules, I would be in the lab from like 9:00am till like 5:30pm or 6:00pm, and then when [the other PhD mentor] came back and [PhD mentor one] was no longer on my case about staying late, I'd be there very late, from 9:00am till, I don't know, like, 7:00pm, 8:00pm, or 9:00pm; sometimes until 12:00am, and then in the last two to three weeks, when I had to compress all of that research into this short period of time, I just lived in the lab. My life was, 'I do research all day until 2:00am, 3:00am, 4:00am;' until I got tired, and then my experiments would take 30 minutes to an hour to run. I would do that until like 7:00am, 8:00am, 9:00am; and then I would go back to my apartment to shower, and I'd come back [to the lab], and I would do it all over again. And that was my life for two to three weeks. So you know, it was a little rough.”*

The student with feedback for the pre-trip training shared *“pre-trip to Germany I think was a great idea of having us all for two days interacting with each other, working on our research project. I did like that, but I did feel like maybe one extra day together [would have been beneficial] in more of an informal settings to be with the other iPRISMers, because it felt like we were constantly focusing on the research.”*

Table 2: Germany Living Materials iPRISM 2023 – 2025 Emergent Themes

Categories:	2023 Emergent Themes:	2024 Emergent Themes:	2025 Emergent Themes:
1) Motivations for participating in the IRES program	Research Experience, Graduate School, Going abroad, Mentor	Research Experience, Going abroad, Mentor, Getting Paid, Student Club	Going abroad, Research Experience, Growing personally and professionally, Wanting a future career in academia, Programing funding, Mentor, Climate change, Feel more included in the field of engineering as a woman
2) Cultural competencies gained	Different Work Atmosphere/ Culture, Language, Different Schedule/ Mealtimes, Cross-cultural communication	Learning a new Language, Cross-Cultural Interactions, Global Perspective, Critiquing their own culture	Foreign language competence, Desire to learn more about international history and international current events, Cross-cultural communication
3) Experiences abroad	Building Confidence, Guidance Learning Daily Tasks/ Logistics,	Language Barrier, Lack of “cultural support” during and pre-trip, Liked being “shown	Loved being in [Deidentified]M, Enjoyed additional travel opportunities, Liked experiencing a new language,

	Excellent Research Experience, Food Allergies Abroad, Language Barrier	around,” Feeling of exclusion from peer group, Lack of mental health disability accommodation during the trip, Enjoyed traveling to other countries	Developed friendships, Enjoyed working abroad/ experiencing a different work culture, Experienced racial minoritization/racism in Germany, Homesickness/ loneliness at the beginning, Time change was difficult
4) Conceptions of research	Better Conception of Research: Timing and Collaboration; Stayed the Same	Stayed the Same, Improved their Conceptions of Research	Positive conceptions of research, including being more open to research and feeling supported; Stayed the same
5) Impact the IRES program had on future career and educational goals	Desire to Work Internationally, Desire to Pursue Graduate School	Desire to Pursue Graduate School	Desire to pursue graduate school and future research opportunities
6) Perceived gains from the IRES	Communication Skills, Foreign Language Skills, Teamwork, Presentation Skills, Science Communication, Confidence, Life Skills	Communication Skills, Life Skills, Confidence, Research Experience, Relationships, Travel, Leadership Skills	Communication skills, Confidence in themselves and with lab work, Research skills, Friendships, International work experience, International travel experiences, Cultural experiences
7) Experience with workshops/seminars	<u>Pre-Trip Workshops:</u> Need Team Building/ Ice Breaker w/ Cohort Prior to Travel <u>Seminars:</u> Useful to Learn about Projects going on around them, Difficult to Understand.	<u>Pre-Trip Workshops:</u> Enjoyed meeting the other students, Some information given could have been more clear and descriptive <u>Seminars:</u> Helpful to see where other students were in their research, Difficult to Understand	<u>Pre-Trip Workshops:</u> Enjoyed workshops, Would have liked additional time to informally bond with cohort <u>Seminars:</u> Enjoyed the research talks, Difficult to understand
8) Experiences with their research community, peers and mentors	Developed Feelings of Belongingness, Enjoyed working with PhD Students, Positive Experience w/ Peers & Mentors, Wanted More Social Outings	Feelings of both inclusion and exclusion were reported in their cohort, lab groups, and in Germany	Group chat called “The North Americans”, One student had difficulty setting lab work boundaries, Importance of the initial orientation upon arrival in [Deidentified], Feeling welcomed, Feeling supported, One student felt their lab mentor excluded them socially, which led to feelings of isolation.
9) Possible areas for IRES Improvement	Student Travel, Applying Earlier for Visas, Receiving Flight Itinerary Earlier, Carry Offer Letter During Travel, Earlier Information on Research pre-trip	Improved language learning tool, Additional cultural support, Diversity training to help prevent exclusion from peer group, Pre-trip: address student disability accommodations, Provide a mental health crisis hotline, Mental health discussion and trainings	Include informal peer time prior to the trip, Include weekly or bi-weekly student check-ins with the graduate student mentor to ensure students are not skipping meals and spending evenings/overnights in the lab alone, Clarify expectations of leaving the lab at the end of the working day, Ensure every iPRISM student is paired with someone else from their cohort in their lab group to help prevent isolation.

Australia Water Quality IRES Program Student Interview Results Year to Year

Table 3, below, compares the main emergent themes for each category from the student interview data for the length of the Australia Water Quality IRES program, years 2023-2025. There were many benefits from the program that students reported over the years, the daily “coffee breaks” with their lab groups that allowed for both increased learning and relationship building, traveling abroad, gaining research experience, building relationships with friends and mentors, etc. The areas for improvement varied year to year, so those different areas are highlighted by year below.

In the 2023 program year four undergraduate students and one graduate student participated in the interviews. In addition to the benefits students reported from participating in the program, one student noted areas of difficulty were experiences with racism through finding racist items at an outdoor market, microaggressions by peers, and feelings excluded by peers and the graduate mentor. Other students noted having more direction from mentors and more information about research projects in advance of the trip would be helpful, as well as having an itinerary or schedule for the trip prior to departure.

In regard to the experiences of racism and feelings of exclusion, one student shared *“It was like outside, like a flea market, and there were a lot of racist objects. I know, Australia has a deep-rooted history with indigenous people and things like that. But it was just discouraging to see people selling golly which are just like dolls, and they're like black faced. And you know, when you're trying to connect to one of your peers about how you're feeling upset, and you're trying to explain to someone what it is. They say, ‘what is blackface?’ You're kind of like, ‘you're older than me. You're a junior in college, and you don't know what that is.’ It's just I feel like I had no one to connect to or to talk to on this trip, you know, if that makes sense... It was just a culture shock, I guess maybe, is the word that I want to use. But I really did enjoy the abroad experience overall.”*

The 2024 program year included interview data from five undergraduate students. Students reported having excellent experiences all around, from peer and mentor relationships to cultural experiences to research opportunities. The only area of feedback concerned offering students a packing list because some students did not know how to correctly pack for their projects/fieldwork.

The 2025 program year included interview data from four undergraduate students and two graduate students. In addition to the many benefits from participating in the program, student feedback focused on travel issues, showing the need for flights to be booked with longer layover times.

One student reported *“we sat on the tarmac for two hours, which instantly meant we missed our plane from LAX to DC. So we had to panic figure it out, by that point, one of our PhD students was gone. Our professor was gone. So it was just one of our PhD students, and then four undergrads. So me and [another student], we were on the same plane with the one master student, so that was nice. We got home, but two [undergrad students] couldn't rebook their plane ticket like we did, so they had to go to a different help office and, completely rebook so they didn't end up having anyone with them. It was just those two.”*

Table 3: Australia Water Quality 2023 – 2025 Themes

Categories:	2023 Emergent Themes:	2024 Emergent Themes:	2025 Emergent Themes:
1) Motivations for participating in the IRES program	Travel; Mentors; Agriculture, natural resource, and water quality research; Environmental engineering	Research Experience, Going abroad, Program alumnus, Advisors, Clarification of academic major and future career	Research Experience, Environmental Research, International collaboration/connections, Program funding, Personal/ professional growth, Cultural experience/ travel abroad
2) Cultural competencies gained	Experiencing new places/culture, Cross-cultural exploration, Open-mindedness, Acknowledgment of indigenous people through land acknowledgements	Experiencing a different work culture, Cross-cultural interactions and global conversations, Learning about indigenous culture, Australia's unique sustainability focus	Open-mindedness, New cultural experiences, New food and public transit experiences, Cross-cultural relationships, Different work culture
3) Experiences abroad	Daily "coffee breaks" with lab group, Grateful they were not in student housing for the whole trip, Finding racist items at an outdoor market, A student mentioned difficulty connecting with peers on the trip and a lack of a sense of belonging among peers on the trip	Enjoyed additional travel on the weekends, Good work/life balance, Enjoyed exploring the nature there	Having new cultural experiences, Enjoying the different types of food, Having new experiences with public transport, Enjoying the relationships and work they did abroad, and adopting a different work culture. Flight delay leading to missed layover flights
4) Conceptions of research	Learned more about how people become researchers. One student was surprised at how little the farmers were brought into the research projects. One student shared that a graduate mentor told them they might not be cut-out for fieldwork. However, after a conversation with a trusted mentor, their conception of research ultimately was not affected by this adverse experience. Instead, it motivated them to become an even better researcher.	Improved their conceptions of research, Solidified for students that they want to do research in the future	Helped clarify what research was like, Conception had not changed. Learned different research methods, Affirmed their belief that anyone can be a scientist
5) Impact the IRES program had on future career and educational goals	Desire to attend graduate school, Helped clarify future goals	Want to pursue graduate school, Helped clarify research interests	Clarification on pursuing graduate school and what to study
6) Perceived gains from the IRES	Communication and teamwork skills	Improved engineering communication skills as well as general communication skills such as how to ask questions, Teamwork skills, Leadership confidence	Flexibility/adaptability, Open-mindedness, Gaining research skills, Community support at [Deidentified], New friendships, Problem-solving skills
7) Experience with workshops/seminars	Pre-trip training was helpful, Liked the real-time feedback they received	Would like more information about the research projects	Would like additional information about research

	for their presentation at the end of the trip	pre-trip and a trip schedule prior to departure	projects and a packing list added to pre-trip workshops
8) Experiences with their research community, peers and mentors	All students reported a welcoming research community from the [Deidentified] group and also requested more structure from mentors, Working in a student pair increased their learning, Mixed experiences regarding their relationships with their peers, A report of negative peer interactions/ microaggressions and feeling excluded and unworthy of being on the trip because of the different types of knowledge they shared. The graduate student expressed having difficulties interfacing with the undergraduate cohort.	Sense of community both in and outside of the labs, Feelings of support and connectedness, Mentioned coffee breaks and other community building events with lab mates	Students enthusiastically reported positive experiences with their research community, peers, and mentors. One student mentioned they wished they had more interactions with students from [Deidentified], but they did not have a [Deidentified] student working on their project.
9) Possible areas for IRES Improvement	Provide students with a schedule/itinerary for their time abroad prior to departure, including suggestions for weekend excursions. Increased communication with [Deidentified] faculty pre-trip and knowledge of their research projects pre-trip, More peer interaction and team-building activities before the trip, Diversity training prior to departure specific to Australia related to race to help prepare students for any racist objects they may encounter as well as a plan for how to support students who encounter these objects	Giving the students a packing list is recommended as one student mentioned they would have packed differently/better if they knew what type of fieldwork they would be doing. The 2024 experience shows a significant improvement from the 2023 program. This significant improvement shows the PI and the Co-PI's commitments to keep improving the program.	Students mentioned scheduling flights with longer layovers as an area for improvement so that flights are not missed in the case of unexpected delays

Comparison of Germany Living Materials iPRISM & Australia Water Quality Programs

In Table 4, below, we compare the main emergent themes between 2023 and 2025 from each IRES program for each assessment category. The similar themes are listed as well as the differing themes, which are **highlighted in gray** to indicate that they are differing.

There were many similarities between the programs, including the students' motivations for participating in the IRES program of gaining research experience and traveling abroad, conceptions of research either improving or staying the same after the programs, and the IRES program inspiring future goals to attend graduate school and participate in future research. Other similar experiences students had across programs included mental health issues abroad and experiences with racism abroad. Additional similar experiences included some students having feelings of exclusion from their cohorts based on their personal identities, while other students in the same cohort having feelings of inclusion and belongingness. Many students in both programs had an excellent research experience. These similarities are further highlighted in the table below.

Some of the main differences in the programs included experiences with language. Students from the Germany IRES program expressed many thoughts and feelings around being in a country where they do not speak the language. Students expressed both the challenges and rewards of being in a place where they needed to learn the language. Another difference was in the Australia IRES, one of the graduate students expressed struggles interfacing with the undergraduate cohort, while this experience was not reported for the Germany IRES graduate students. The difficulty experienced by the grad student seemed to emerge from trying to manage students during the fieldwork done in Australia and a need for pre-trip training on how to manage student groups and clarify expectations. Another different specific to Australia was the “coffee breaks” students described. This unique cultural experience was described and recounted by all of the students as a main and essential experience to both their learning and community building within their lab groups. During the coffee breaks, which happened daily a couple hours after beginning work, everyone in the lab would sit down together and have coffee and talk about both work and non-work related topics.

Table 4: Comparison of Main Themes by Assessment Category for each Program

Category	Germany IRES Main Themes 2023-2025	Australia IRES Main Themes 2023-2025
1) Motivations for participating in the IRES program	Research experience, Travel abroad, Mentor	Research experience, Travel abroad, Mentors/Advisors/Program alumnus, Environmental/water quality/agricultural research theme
2) Cultural competences gained	Different work culture/atmosphere, Foreign Language, Cross cultural communication / interactions, Global Perspective	Open-mindedness, Cross-cultural exploration, Different work culture, Indigenous relations in Australia, Global conversations/ Relationships
3) Experiences abroad	New language, Building Confidence, Excellent research experience, Mental health difficulties/loneliness, Enjoyed additional travel experiences, Experiences with racism abroad	Coffee breaks, Building confidence, mental health difficulties, Experiences with racism abroad, Enjoyed additional travel, Research experience, Travel delays and missed flights
4) Conceptions of research	Improved conceptions of research, Conceptions stayed the same	Improved conceptions of research, Conceptions stayed the same
5) Impact the IRES program had on future career and educational	Desire to attend graduate school/ pursue future research experiences, Desire to work/ to school internationally	Desire to attend graduate school, Clarified research interests/ future goals/ what to study in grad school
6) Perceived gains from the IRES	Foreign language skills, Communication skill, Teamwork, Presentation skills, Science communication, Relationships, Research experience	Teamwork skills, Communication and Science communication skills, Adaptability, Relationships, Research skills, Problem-solving skills
7) Experience with workshops/ seminars	Pre-trip workshops: Additional time to bond cohort/ teambuilding Seminars: Helpful to see other projects but difficult to understand	For pre-trip: Would like more information about research projects and a packing list
8) Experiences with their research community, peers and mentors	Both feelings of inclusion and exclusion were reported; most students felt a sense of belongingness, but some students did not. Students who did not reported it was due to their differing social/ personal identities	Welcoming research community from the [Deidentified] group. Most experiences with peers and grad mentors were positive, though one student shared a bad experience with a graduate mentor and feelings of exclusion from cohort peers based on a social identity
9) Possible areas for IRES Improvement	Improved language learning tool, Address needed accommodations for student disabilities pre-trip, Mental health training/support, Team building for students	Pre-trip schedule, flight itinerary given earlier, packing list, and additional information about research projects; Longer flight layovers, To prevent feelings of

	with a diversity/inclusion focus, Preparation support for students focused on encountering racism abroad	isolation, ensure each student is paired with another from their cohort, Inclusion training support for students with an inclusion focus, Graduate student training, Preparation and support for students focused on encountering racism abroad
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Lessons Learned/ Discussion

Below we offer overall themes of Lessons Learned during the programs informed by both the student interview data/perspectives and the experiences of the PIs. These lessons learned may prove helpful to others looking to start IRES programs for students.

1. Better foreign language training. The team moved to auditory training based on feedback from student participants.
2. Better proposal development and information about the research projects pre-trip to students was identified to minimize idle time in the short research abroad.
3. Give students a packing list so they are better prepared for any potential field work.
4. Students with food allergies need additional language/cultural training to ensure they can order food safely abroad.
5. Give students, especially international students, the opportunity to apply for their visas earlier. Encourage each student to travel with a printed acceptance letter to the IRES program to aid in passing security checkpoints.
6. Development of cohort teambuilding and inclusion was important to mitigate issues far from home, such as home sickness, disconnection from cohort, and others. The Germany PI Team implemented an in-person on-boarding process in 2025, which was successful in forming a stronger cohort connection.
7. Training on diversity, equity, and inclusion, particularly for the IRES country contexts, needs to be more comprehensive. Feedback was provided by students in the cohort that the diversity of experiences may not be well represented in the existing training, including experiences of racism abroad. Create a plan for support when students experience racism abroad.
8. Ensure every student is paired with someone else from their cohort in their lab group to help prevent feelings of isolation
9. Ask students to report any needed disability accommodations pre-trip and work with their campus disability specialist to develop an accommodation plan while abroad.
10. Homesickness and mental-health issues abroad were a recurring theme. Have mental health training and practices built-in to support students, such as counselors accessible to students while abroad, reiterating the importance of team-building and community building among the student group, and PIs/graduate student mentors checking-in regularly. Provide an on-call number that students can use in case of emergency day or night.
11. During a project year all students worked on projects under a common umbrella (one big field site, with several types of analyses). This led to a lot of collaboration and the centralized goals and shared experience seemed positive.
12. One year, a program did not have a graduate student as part of the cohort. It was clear by comparing to the other years with grad student(s) participating that they also offer important formal and informal mentorship with the students. In some cases, the undergraduate students are more comfortable discussing certain issues/ challenges than they are with faculty mentors.

13. A few students took excursions to other parts of the country/countries on weekends that cost money. With a relatively small group of students, it left some students feeling left out who did not want to (or could not) spend money to do these excursions. In response to this, as much as possible, the accompanying faculty tried to offer options for low cost/free local exploration options on time off from research.
14. One year a program had paired graduate + undergraduate students on some projects. It was a really effective model, where the graduate student still was mentored by faculty and gained new experiences and knowledge, but also got to help mentor the undergraduate researcher. The undergraduate students in these pairings seemed to get more out of their experiences.
 - a. One IRES students' graduate student partner was unable to work with them. This created difficulties for that undergraduate student. Having an alternate graduate student available in case of emergency is necessary to ensure all undergraduate students end up with a graduate student partner.
15. For the Australia IRES, with only one month for the program, the entire timeline was tight. The reason for this timeline was the high cost of travel and housing to/in Australia. While we did the most we could in this time and had successful efforts, it was particularly tough and stressful at times to troubleshoot issues or deal with unexpected health issues with little time buffer. To deal with this, we did the best we could to plan in advance and get field sampling started as soon as we got there to leave the maximum time for analysis and any associated troubleshooting. On the upside, with having our program only last one month, students also had other jobs/ internships/took a course in the rest of the summer.
16. Request flights with long layovers when having to go through customs and re-check through security in a major airport. Because of flight delays students missed their connecting flight and this caused a lot of stress to wrap-up the trip.

Conclusion

Both IRES programs had many successes and reached their goals of providing excellent research experiences abroad for students. Through the annual program assessments, PIs were able to adjust their programs in real time to address student feedback. The PIs diligence in adapting their programs to address student feedback helped them provide an even better student experience. We cannot emphasize enough the importance of annual program assessments and the efforts to address student feedback year to year in creating the best programs possible and an excellent student experience.

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Appendix A: Interview Protocols

Germany Living Materials iPRISM Program Interview Protocol:

1. What motivated you to participate in the IRES program?
2. What types of projects have you been working on?
 - a. As part of those projects, what types of tasks have you been doing?
3. Tell me about the mentor or mentors that you worked with.
 - a. What was it like working with them?
4. Tell me about your experience abroad.
5. How did working with your research team (i.e., faculty mentors, graduate students, student pair/partner, if applicable) impact your research experiences?
 - a. Did it impact your plans for future research?
6. How has your conception of research changed because of participating in the IRES?
7. What did you gain from participating in the IRES program?
 - a. Can you give an example of how the exchange between [Deidentified] and the University of [Deidentified] accelerated your discoveries in engineered synthetic living materials?
 - b. Tell me about your research on Living Materials (if they don't know what that means - structure-performance intersection in achieving unprecedented control over materials functions for use in materials for adaptive buildings).
8. Describe how the IRES program impacted your
 - a. Leadership confidence.
 - b. Communication and teamwork skills.
 - c. Cultural competence.
9. What are your educational and career goals?
 - a. Do you have an interest in pursuing graduate school?
 - i. If yes, in what discipline/area?
10. How has participating in the IRES program impacted your educational and career goals?
11. Did you feel you were part of a research community when you arrived in Friberg? Why or why not?
12. Were you able to establish a peer group and make friends through the program?
 - a. Did you feel like you had a community of peers in the IRES program? Explain.

13. What was helpful about the seminars you participated in during the IRES?
 - a. Do you have any specific suggestions for improving the seminars?
14. Describe the social outings that you had.
 - a. Did you find them beneficial? If so, how?
 - b. How can social outings be improved for the future?
15. How could the IRES program be improved? What suggestions do you have for improving the IRES experiences for future students?

Australia Water Quality Student Interview Protocol:

1. What motivated you to participate in the IRES program?
2. What types of projects have you been working on?
 - a. As part of those projects, what types of tasks have you been working on?
3. Tell me about the mentor or mentors that you worked with.
 - a. What was it like working with them?
4. Tell me about your experience abroad.
5. Did you work as part of a student pair during your IRES experience?
 - a. If so, describe your experiences working in your student pair.
 - b. How has working in a student pair impacted your IRES experience?
6. How did working with your research team (i.e., faculty mentors, graduate students, student pair/partner, if applicable) impact your research experiences?
 - a. Did it impact your plans for future research?
7. How has your conception of research changed because of participating in the IRES?
8. What did you gain from participating in the IRES program?
9. What state-of-the-art water quality assessment methods did you utilize?
 - a. Can you give an example of a project where you utilized this?
10. What is your evaluation of the best management practices design you found during the IRES experience?
 - a. What best management practices design and/or location would you propose based on your experience?
11. Describe how the IRES experience impacted your
 - a. Leadership confidence.
 - b. Communication and teamwork skills.
 - c. Cultural competence.

12. What are your educational and career goals?
 - a. Do you have an interest in pursuing graduate school?
 - i.If yes, in what discipline/area?
13. How has participating in the IRES program impacted your educational and career goals?
14. Did you feel you were part of a research community when you arrived at [Deidentified] University? Why or why not?
15. Were you able to establish a peer group and make friends while at [Deidentified] University?
 - a. Did you feel like you had a community of peers in the IRES program? Explain.
16. What was helpful about the workshops you participated in during the IRES?
 - a. Do you have any specific suggestions for improving the workshops?
17. Describe the social outings that you had.
 - a. Did you find them beneficial? If so, how?
 - b. How can social outings be improved for the future?
18. How could the IRES program be improved? What suggestions do you have for improving the IRES experiences for future students?