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CIDER II Synthesis Center: Cooperative Institute for Dynamic Earth Research

Final Evaluation Report

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Introduction

CIDER-II Synthesis Center (CIDER-II) is a project that uses a multi-disciplinary approach to engage researchers at all career levels to “identify key cross-disciplinary problems to tackle, foster the development of integrative ideas and address a broad range of cutting edge questions around the overarching general theme of ‘how the earth works?’” (Romanowicz et al., NSF Proposal 1135452). Through a multi-week summer program, CIDER brings together graduate students, post-doctorates, junior and senior scientists to collectively learn about key issues related the “the deeper earth, the upper boundary layer and integrative themes across multiple lateral and depth scales”.

The Research Group of the Lawrence Hall of Science at the University of California served as the external evaluator for this project, from 2012-2016. The following report focuses on the key findings from the evaluation study.

Evaluation Design and Methods

Evaluation Purpose

The Research Group of the Lawrence Hall of Science is currently conducting an evaluation of the CIDER-II program, through which it aims to 1) provide formative feedback to the CIDER-II program staff, Steering Committee and Advisory Committee; and 2) learn how CIDER-II is situated in the field and its perceived impact on participants. By providing ongoing feedback to the CIDER-II program developers, the external evaluation will help the program evolve and improve the structure and the offerings of the program. In addition, the evaluation will be able to gauge the impact of CIDER-II within the larger context of the Deep Earth research field. The evaluation was guided by the following questions:

1. What are the overall perceived benefits of bringing together researchers from multiple disciplines and with different levels of experience for more extended periods than afforded in traditional conferences or workshops?
2. To what extent and in what ways did participating in CIDER-II influence participants’ career pathways?
3. In what ways, if any, has participation in CIDER influenced participants’ research?

Design and Methods

In an effort to answer the aforementioned questions, this study primarily utilized qualitative methods to provide ongoing feedback to inform the refinement of the CIDER-II project and to examine the extent and ways in which the project influenced program participants. The design of the evaluation focused on two units of analyses: 1) current CIDER-II participants and 2) alumni of the 2010-2015 CIDER summer programs. The alumni of CIDER-I (i.e., 2010-2011) were included in this study due to expressed interest of the PI to learn more about what participants perceived to be some of the longer-term impacts to help inform their long-term planning.

The evaluation study primarily used two sources of data collection to answer the key evaluation questions: 1) summer program feedback survey and 2) alumni survey. The

research team also conducted periodic observations to gain contextual information about the program, which focused on what types of activities were included in the summer program, though the bulk of this summary will focus on the survey data collected.

Summer Program Feedback Survey

At the end of each summer program, from 2012-2016, participants were invited to complete an online feedback survey about their experiences in the program. The purpose of this survey was primarily formative and was designed through an iterative process with the CIDER-II program staff to ensure that data collected would be most useful in helping to further develop and refine the summer program experience. The survey consisted of 30 open-ended questions that asked participants about their reasons for being part of CIDER and to share their impressions about the lectures, tutorials and research groups, including what worked well and what improvements, if any, they might suggest. In addition, survey participants shared any immediate benefits or drawbacks to participating in the summer program.

CIDER-II program staff and/or the research team administered the survey on the last day of the summer program, from 2012 through 2016. The research team then obtained the email listserv through which an invitation to the survey was sent out to all remaining participants who may not have been present on the final day.

After each administration, the evaluation team provided a deidentified, aggregate summary of survey to the CIDER-II leadership team. The leadership team primarily used the data in two ways: 1) to share with CIDER participants in an effort to be transparent about how the group collectively described its experience in the summer program and 2) to identify ways in which it can improve the summer program experience for subsequent participants. The evaluation team was not involved in planning meetings and so did not document changes that the leadership team made; though the evaluation team was available to the leadership team if there were any questions related to the survey. The leadership team also used the data to provide feedback about how to refine the feedback survey for the following summer.

Alumni Survey

In an effort to gain insight into the perceived impact of CIDER on participants, the evaluation team, in coordination with the CIDER-II leadership team, developed an alumni survey. The purpose of this survey was to gain insight into participants' perspectives about how participation in CIDER influenced their career and/or research paths.

To gather perspectives from participants who have had some time to reflect on the longer-term benefits and challenges of participating in the program, the evaluation team invited alumni two years after participating in the summer program. During the first administration, in 2014, the survey was sent to all alumni from CIDER-I (i.e., 2004- 2011 cohorts) and CIDER-II (i.e., 2012 cohort). The survey was sent to remaining alumni in subsequent years (e.g., 2013 cohort completed in the survey in 2015; 2014 and 2015 alumni completed the survey in 2016). For the purpose of this report, analysis focused on

respondents of the 2010 through 2015 cohorts primarily due to a low response rate from the 2004-2009 cohorts (n=7 across all cohorts).

The Research Group collected several existing records of alumni from CIDER program staff, which included participants from 2004 through 2015. The Research Group then reconciled all of the records into a single database, which included participants' names, emails, institution affiliation, and year(s) of participation in the CIDER program. The final database consisted of 507 alumni participants, including graduate students, post-doctorate researchers, and senior participants.

Alumni were invited to participate in the survey via email, using Survey Monkey, with the initial invitation describing in detail the purpose and goal of the survey. Over the three administrations, 507 invitations to participate in the survey were sent out. 66 of those email addresses bounced which may have been due to an outdated email address or the domain security settings may have detected the email invitation as spam. Three of those emails addresses had opted out of receiving survey invitations. The final sample size was 441, excluding the non-working email addresses.

In each administration researchers made due diligence to ensure that the survey was open for a minimum of four weeks and sent weekly reminders to encourage higher participation. Nevertheless, we acknowledge the limitations associated to administering online surveys to participants, which in some cases occurred 3-5 years following participation in CIDER. By the close of the survey 131 alumni from the 2010-2015 cohorts had completed the survey, as illustrated in the table below, for a response rate of 29.7%. While the response rate may appear low, Duncan Nulty (2008) notes the average response rate for online survey is 33 percent compared to 56 percent for paper-based surveys.

The final survey data set was downloaded and analyzed through which items were coded to identify emergent themes.

Description of Participants

The following summarizes CIDER participants who completed the (1) summer program feedback survey during the CIDER-II grant cycle (e.g., 2012-2016) and (2) CIDER alumni survey, which includes CIDER-I and CIDER-II alumni.

CIDER-II Summer Program Survey Participants, 2012-2016 Cohorts

Over the duration of CIDER-II, 316 participants completed the summer feedback survey. A breakdown of each cohort is illustrated in the table to the right. It is important to note that survey respondents may not be representative of all CIDER participants due to some participants not staying the entire duration of the program.

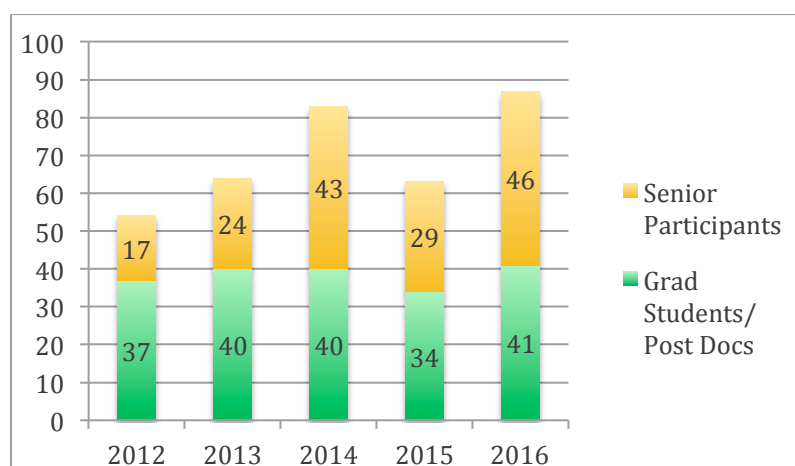
Table 1 . Summer Feedback Survey Participants, 2012-2016

Program Year	Total Survey Participants
2012	54
2013	64
2014	68
2015	53
2016	77

Nonetheless diligent efforts were made to include all participants in the survey.

CIDER-II participants can be divided into two groups: 1) advanced graduate students and post-doctorates and 2) senior participants that included lecturers, faculty and researchers. Senior participants were asked to lead research talks, lectures and tutorials. Given that the goal of CIDER-II was to bring together researchers at all career levels, senior participants were also invited to participate alongside the graduate students and post-doctorates in program activities. Therefore, they were included in the final sample. As illustrated in Figure 1, graduate students and post doctorate researchers typically comprised the majority of participants with exception in 2014 and 2016. Though, it is important to note that senior participants shared that during some summers, they held multiple roles and/or attended multiple summer programs, so they may be slightly overrepresented in the figure below. For instance, some respondents shared that they participated as a graduate student, and in a subsequent summer returned as a senior participant or in a particular summer, they may have identified as leading a lecture and tutorial.

Figure 1. Distribution of Participant Types, Program Year



CIDER Alumni Participants from 2010-2015

A total of 131 alumni responded the survey. As illustrated in Figure 2 on the next page, the number of respondents among participants from CIDER-I (i.e., 2010-2011 cohorts) was particularly low with only 11 and 10 alumni responding to the survey. A higher proportion of alumni from the 2012-2015 cohorts responded to the alumni survey, which could be expected given their more recent participation in the CIDER-II summer program. Moreover, a number of participants had shared they attended multiple summer programs which could be indicative of having a more personal stake in wanting to contribute to the ongoing development of the program by providing feedback.

Figure 2. Number of CIDER Alumni Survey Participants by Program Year, (N=131)

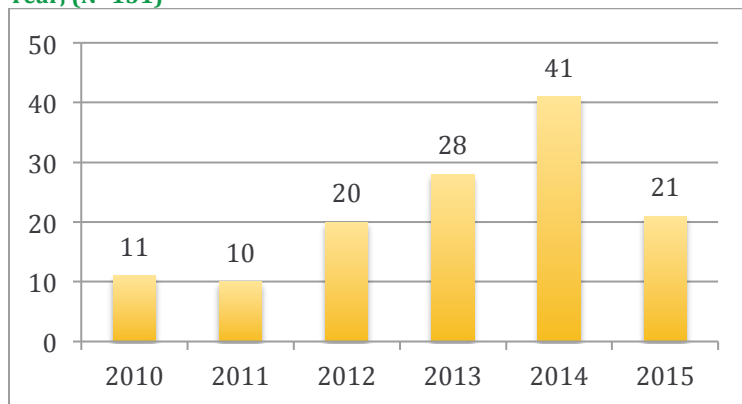
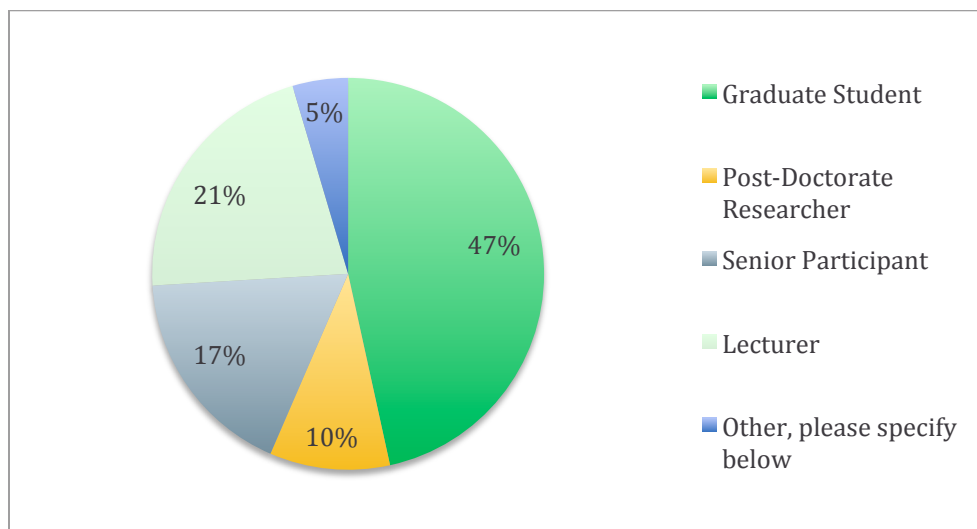


Figure 3 illustrates the breakdown of roles that alumni held during the CIDER Summer Program as reported on the alumni survey. Among alumni who responded to the survey, graduate students and post-doctorate researchers represented a slightly higher proportion of respondents (n=75). Yet, lecturers and senior participants remained well represented among alumni who responded to the survey (n=56). Similar to the feedback survey, senior participants may be overrepresented in the figure below due to having multiple roles and/or attending multiple summer programs.

Figure 3. CIDER Participant Roles, Alumni Survey, 2010-2015 (N=131)



Summary of Evaluation Findings

CIDER is a 6-week summer program that engaged scientists in lectures, tutorials and research working groups to deepen participants' knowledge and provide opportunities for collaboration around issues related to the deep earth.

As described, CIDER is a multi-week summer program that runs five or six weeks depending on the location. The CIDER summer program brings together scientists to learn about issues related to the deep earth. Centered around a particular theme, the goal of each summer program is to engage participants in multi-disciplinary learning and dialogue through a series of lecture and tutorials designed to deepen participants' working knowledge. These sessions provide a contextual framework for participants to think about key issues and problems that they would want to address in research groups, which are formed during the summer program. In the research groups, participants design and formulate a plan to develop an inter-disciplinary collaboration to address an identified key issue. Acknowledging that not all participants may be able to commit to the full summer program due to other professional and academic obligations, senior participants are required to commit to attending a minimum of two weeks. Graduate students and post-doctorate researchers are required to attend three of the four-week tutorial program, though participants who indicate they can attend all four weeks are given priority in the application and selection process.

As noted, CIDER participants can be divided in two overarching categories: (1) graduate students and post-doctorate researchers whom participate in the lectures and tutorials as “learners” and (2) senior participants and lecturers, which includes junior and senior scientists and community members who lead, facilitate, and teach lectures and tutorials. While graduate students and post-doctorate researchers are the primary “learners”, senior participants are encouraged to participate alongside the graduate students and post-doctorates when they are not leading a workshop or lecture.

Lectures and Research Talks

Senior participants were invited to present and lead lectures, research talks and tutorials with the goal of presenting current research and background content related to understanding the deep earth. Senior participants were intentionally invited to present a range of perspectives across multiple disciplines, including high pressure material science, geodynamics, seismology, geochemistry and geomagnetism (CIDER website, deep-earth.org).

Overall participants felt that the lectures were well designed and appreciated that the content was multidisciplinary. Each year there was a small subset of participants that commented wanting more lectures that included perspectives related to their specific field. For example, in the most recent 2016 summer program, participants noted wanting lectures that covered topics such as petrology, geochemistry, and other planets aside from Earth. In addition, over the years, some participants noted that at times lecturers assumed all participants had a certain amount of background knowledge, which made it challenging

to follow when the content was outside of their field of expertise. Though, the CIDER leadership team has always posted on the CIDER website videos of the presentations along with the presentation slides within 24 hours of the lecture so that participants could go back to the lectures on their own time. Nevertheless, participants overwhelmingly shared that they found the lectures useful and valued having the opportunity to hear about cutting-edge research and issues from leading experts in the field.

The lectures were very helpful. As a grad student, I have limited experience outside of my field, so the lectures and tutorials were crucial to bringing me up to speed. The research project solidified the quick education with trial by fire. Very helpful.

Outstanding lectures/presentations overall. The paleoclimate presentations gave me a new context to view of ongoing climate changes.

I thought that the balance between disciplines worked well, and made going to the next lecture interesting. The lectures were more geared as background for current cutting edge research, i.e. to make cutting edge research topics and presentations outside of one's own field accessible. This worked very well overall.

Tutorials

Senior participants were also invited to lead tutorials through which they present current research and tools use to examine various issues in the deep earth sciences. For example, in the 2015 CIDER Summer Program, Fred Pollitz led a tutorial on VISC02.5D, a software program “to calculate quasi-static deformation resulting from imposed earthquake sources in a spherical geometry” (Pollitz, 2015). In 2014, Ian Rose presented a tutorial on using BurnMan, “open source mineral physics toolbox written in Python to determine seismic velocities for the lower mantle” (Rose, 2014; Burnman.com, 2012-2016). In these tutorials, participants are presented with relevant research as context for learning new tools that expands the potential toolbox they may tap into for their own research. Participants noted that they really valued the tutorials because it introduced them to new tools in an application-based setting that they may not have otherwise been exposed to in their own academic and professional settings.

The breadth and depth of topics and research expertise was great! The tutorials was helpful to understand how other fields do their research etc.

I really enjoyed some tutorials. It is a good opportunity to learn the actual tools that are used by researcher that are not particularly in my field.

Though, it is important to note that participants, over several summer programs, commented on not having the appropriate software or programs that were used in the

tutorials which made some of the tutorials feel more abstract. Participants noted having advance notice of what software programs would be used during the summer program would be helpful. To address this issue, since 2014 the CIDER leadership team sought the support from the Computational Infrastructure for Geodynamics to embed all software used in tutorials in the “VirtualBox” environment. In addition, some participants also noted that the tutorials felt fast-paced, so suggested having smaller groups work together with a senior participant to allow more opportunities for questions and to move at different paces depending on the groups’ level of familiarity with the program would be a good addition to the program.

Research Working Groups

A substantial portion of the summer program was dedicated to participants forming small working groups through which they would collaborate on a research project that addressed a key issue in the deep earth sciences. The goal of the working groups was to provide opportunities for participants to examine key issues in the deep earth sciences from a multi-disciplinary approach. Participants generally noted that this was a positive process to go through; though graduate students and post-doctorate participants did indicate that that it would have been helpful to have more guidance by senior participants. Participants noted that groups often encountered difficulties in trying to identify what topic their group would collectively work on. The CIDER leadership team appeared to have tried to address this issue by adjusting the ways in which topics were determined. For example in the first two summer programs, comments seemed to indicate that each participant would propose topics, which they would then collectively narrow down. Yet, in 2014, comments indicated that the CIDER leadership team facilitated this process through which all participants brainstormed ideas early on in the summer program and then voted, using Doodle Poll, to narrow down the topics to a select few. Topics were then agreed upon after a plenary discussion through which the CIDER leadership team ensured that the groups were balanced in terms of disciplines and senior/junior participation. One participant shared that this process seemed to encourage participants to branch out into research areas that they may normally not have considered and seemed to deal with some of issues around groups taking a long time to decide on a topic:

I think coming down to a set of few research topics by voting was a neat idea. I had no experience working with the moon before CIDER and I decided to join the lunar research group just so that I will get an opportunity to learn more and diversify my area of interest.

While generally, it seems that the research working groups component has supported participants’ professional growth, it is also important to note that some alumni shared that it was challenging to continue working on research projects after the summer program because of constraints related to time, distance and funding. For example, some alumni shared that when they return to their home institutions, it was difficult to find time and funding to work on research outside of their own projects, which is further strained by some participants returning to institutions internationally.

My barrier was, probably, because of me living [out of the country]. The time difference and the fact I was towards the end of my Ph.D. left me little time to collaborate properly. Travelling to an occasional group meeting was also expensive/difficult to make.

It was difficult to keep contact, because of the distance. We met at conferences, but we are all focused on our own research.

It is important to note that starting in 2012, CIDER did provide participants with the opportunity to apply for additional funds which was contingent on submitting a mini-proposal which could be used to fund travel for working groups. Though it appears that this funding may not have been available for international travel. Moreover, existing grant funds are primarily intended to support work during the summer program and to help initiate working collaborations, with the understanding that groups may continue their research on their own accord. However, it may be worthwhile for CIDER to consider in what ways it may be able to further support this process in the future. For example, perhaps supplemental funds could be sought to support working groups that have international collaborations, or the pool of mini-grants could be expanded to support a larger number of working groups.

Other CIDER Activities

In addition, CIDER has made great effort to create opportunities to sustain this community beyond the summer program. For example, CIDER hosts a one-day workshop at the Annual Geophysical Union Annual Meeting during which participants are invited to present their research to the CIDER and broader community. Alumni (96.2% of respondents) were well aware of this annual meeting, with a number (n=61) of alumni respondents reported having participated. Alumni who attended noted that they appreciate having the opportunity to reconnect with the CIDER community as it provides a way to sustain professional relationships and stay up to date about current research.

I think that the AGU CIDER workshops are a great way to regularly get the community together and bridge connections between CIDER [cohorts]. I think that the CIDER working groups could be extended to a virtual audience. This way a larger number of more junior members could participate.

Among those who have not attended (n=32), alumni shared that it was primarily due to the timing of the conference during the year, conflicts with other professional obligations, and the limited capacity to attend pre- and post- AGU events and activities:

I would have liked to participate but the timing has around AGU has made it difficult due to preparation of AGU presentations, and particularly because of teaching obligations as AGU almost always coincides with the end of the fall semester and finals.

I have considered attending such initiatives. However, often travel to/from AGU restricts the time I can stay in the city pre/post meeting (international travel).

I'm not terribly interested in a post-AGU workshop given how busy the AGU period is. The pre-AGU workshop (as was done in 2014) conflicts with GeoPRISMS activities.

I have not participated. I have looked at the emails with some interest but usually feel that AGU is busy enough and adding another activity at that time of year is difficult.

In addition, CIDER has also invested resources into developing a website and wiki that provides alumni and current participants with information about the CIDER program and additional resources. A number of respondents (n=82) reported using the website at some point; though a number of alumni share that they primarily to access lectures and resources and summer program information (i.e., logistics and agenda). Many comments seemed to infer that most alumni use the site during the summer program, however a few alumni did note that they appreciate being able to access the website following the summer program for resources and presentations. Five alumni also noted that they use the website as a teaching tool, using lectures and slides as resources in their own lectures and directing her/his students to the lectures and resources on the website.

CIDER cultivated a scientific community through which scientists across multiple disciplines and career levels had opportunities to share knowledge and expertise; foster professional networks; and develop collaborative research projects. This appeared to be a unique opportunity within the field that participants noted they would not have had without CIDER.

As described, CIDER-II was designed intentionally to bring together scientists across disciplines and career levels to participate in the CIDER Summer Program, which was a primary incentive for many participants to participate in CIDER:

I wanted to see and experience the breadth of research being conducted on the Earth's deep interior. I also wanted to acquire a better understanding of the tools used by mineral physics, geodynamics and seismology to understand the inner workings of the planet, in order to complement my own geochemical background.

A workshop devoted to a multidisciplinary assessment of the early Earth seemed very useful for my research (early Earth geochemistry) and for making connections for future collaborations.

[I] wanted to broaden my understanding of deep Earth processes and connect with influential people in the field as well as my peers.

Alumni noted that the multidisciplinary approach of CIDER, particularly, through the research working groups, exposed them to areas outside of their own research and deepened their understanding of how to take an interdisciplinary approach in research.

... the multi-disciplinary nature of the lectures forced me to think about different ways to answer the same question.

CIDER was an amazing experience to get new ideas and motivation as well as meeting people for further research. This kind of experience is very rare. Furthermore the group project [provides] a chance to learn to work in a very multidisciplinary group and learn new skills. It is a very valuable experience that we can only recommend.

Overall, the quality of CIDER is excellent. This is a great opportunity to learn about and integrate multidisciplinary techniques and approaches to research that is much-needed in the geosciences.

Participants further noted that opportunities to interact with scientists and experts across multiple scientific fields are rare. For example, typically conferences are a way for scientists to network with persons outside of their field. Yet, the structure and format of conferences do not tend to lend themselves as an environment conducive for fostering professional relationships due to rather large numbers of attendees and multiple sessions occurring at once. Moreover, there are often limited opportunities at conferences to develop collaborations.

Yet the structure and format of CIDER provided multiple forums for participants to cultivate relationships that supported participants' professional development. For example, CIDER, in comparison to other conferences and programs is a smaller program, typically attended by 60-80 participants, with programming that stretches across five to six weeks. In addition, senior participants are asked to take on multiple roles through the summer program as instructors, mentors and co-participants. CIDER also provided other networking opportunities throughout the summer program, such as informal gatherings, group lodging and meals, lectures, research groups, field trips, and poster presentations, which enabled participants to get to know each other on a more personal basis.

Collectively, these opportunities seemed to be an integral in fostering a community of knowledge sharing among peers resulting in participants feeling more versed in their respective fields and fostered professional collaborations that led to academic and professional opportunities.

[I made] many more connections. If I don't know something, I now know who to ask, and feel confident saying so. I've learned a lot by closely working with others, and it has also been a very motivating experience for my regular research.

Attending CIDER has greatly expanded my network of colleagues spanning a number of disciplines. Although currently this hasn't directly resulted in publications or collaborations, I'm confident that it will provide for valuable opportunities in the near future.

I became much better at talking with other geophysicists, partly from the language I learned in summer 2014 and partly from the learning-resources I accumulated (especially friends and a few key review articles).

In addition, participants noted that CIDER contributed to their growth as scientists, including: learning new scientific tools; providing multiple lens through which they would look at their own research; and leading to new research ideas and collaborations.

CIDER has given me a more interdisciplinary network, helped develop more substantive relationships with other scientists beyond my home institution, and has made me generally more integrated into the geologic community.

CIDER has made me appreciate the debates within other communities (e.g., mineral physics, seismology); it has given me the ability to read papers in other fields critically i.e., I can evaluate the arguments and logic presented on my own.

Based on some of the discussions during and after talks, I have a few questions of my own which I'm hoping to pursue to help explore other related fields to my current research. It was nice to generate some new ideas, which allow for collaboration with other fields rather than just focusing on a single approach (say in geodynamics).

Given that participants have noted that collaborations and networking outside of their scientific fields are atypical, the fact that CIDER has been successful in fostering these connections is an important model for other fields that may have similar experiences.

Participants shared that their participation in CIDER contributed to their own academic and professional growth through the development of research collaborations that resulted in publications, new research ideas and proposals. Further, some participants credited the professional advancements to their experience in CIDER.

Participants, overall, shared that CIDER provided a positive experience to engage in multi-disciplinary research, particularly through the research working groups. Through the research process, participants gained experience in designing a collaborative research project that aimed to contribute to understanding key issues in the deep earth sciences. The summer program set a foundation for groups to ground their projects in the literature and set a plan for the group to continue working over the year. Participants shared that without this experience, they may not have gained valuable skills and knowledge that would have supported their professional careers.

It was great exposure to current investigations outside my specialty, which are very relevant to my research questions. I appreciate the education and the ability to work with top researchers outside my home institution who I otherwise would not have had the chance to work with.

It gave me an appreciation for other subfields and skepticism about some methods in other subfields, helping me figure out what kinds of experiments I want to do in the future.

The range of things I learned and researched is not possible outside of CIDER—I am a much more well rounded scientist for attending.

I am more aware of important research questions and issues in other fields. This helps me aim my own research to include those issues, whenever possible.

While some alumni participants noted that they did not complete the research projects due to reasons pointed out earlier in this report, a large number of alumni reported that the work they started during the summer program had in fact resulted in presentations, publications or new directions in research. For example, of the 98 alumni who indicated they had participated in the research working groups, nearly 60 percent (n=58) reported that they had presented a poster at the American Geophysical Union Annual (AGU) Conference or other conferences, such as the Gordon Research Conference, European Geosciences Union conference, or Study of the Earth's Deep Interior conference. Beyond presenting at conferences, 35 alumni shared that their research had resulted in the submission of manuscript and/or publication; 14 reported that the research had resulted in new directions in his/her own research; and four shared that their research resulted in a new proposal.

...I established contacts with people and then followed up on research [projects] outside of CIDER; if I hadn't gone to [CIDER], I wouldn't have gotten involved in [those research projects].

Following CIDER, we proposed for additional funds through CIDER. Using this money, we met as a group twice. This collaboration resulted in a paper published in [a scientific journal]. I am also a participating scientist on a grant that stemmed from the research group collaboration at CIDER. My research has also been influenced by the topics taught and conversations at CIDER.

The research I was involved in during my first CIDER participation (in 2010) resulted in one publication, and the research accomplished during my second participation resulted in several new research projects, one of which is about to get submitted, as well as an NSF proposal for a postdoctoral project.

I have established a few collaborations, one with a project group, and one or two outside it, based on conversations at CIDER. One potentially will become an NSF proposal after I complete the first paper from this project, started 2 weeks ago and outlined on the plane during my return trip.

Moreover, participants shared CIDER greatly contributed to their professional networks, which they credited to supporting their professional advancements:

CIDER has been vital for building my professional network. I genuinely cannot imagine what my career would look like if I hadn't attended. I don't think I would have been able to [be] a postdoc or secure a permanent academic (teaching) position if I had not attended [CIDER].

Participating to CIDER has greatly helped me to develop my network. I spent a month at another institution to work on the project with another student and senior member, which was a fantastic experience. I also developed, later on, a close collaboration with another senior participant, who I am currently writing a research proposal with for the NSF. CIDER has been wonderful for my career development. It hasn't directly helped me to get a job yet, but that's the only thing that it could do better in that respect.

Senior participants similarly shared that CIDER provided them with the opportunity to work with and identify junior scientists that could potentially lead to professional collaborations in the future.

As a senior participant I enjoyed and benefitted from the interactions among colleagues, which I would not get otherwise. I also enjoyed getting a feel for some of the young talent outside of my home institution.

This is the best part of CIDER. Although I did this less than in previous years, I always find it valuable. My department will likely be hiring in solid Earth geophysics next year, and my contact with young geophysicists definitely gives me a head start in known the great young talent in our field.

I recruited and trained several new users of the software that I maintain ... this will directly result in collaborations, citations and co-authorships for me. I met a number of strong young researchers that I might consider for future appointments. I had a number of conversations that I've been meaning to have for years but never quite managed by e-mail or at short meetings ... live is better!

Conclusion

CIDER-II is a multi-week summer program that convenes scientists across multiple disciplines and career levels learn about issues related to the deep earth. One byproduct of this project has demonstrated is its contribution to the collective knowledge of fields within the deep earth sciences, including high pressure material science, geodynamics, seismology, geochemistry and geomagnetism through the development of research that has resulted in numerous publications, presentations, and research proposals as shared in the body of this report. In addition, one noteworthy contribution that CIDER has accomplished through this project is the development of a multi-disciplinary scientific community. Through its project activities (i.e., lectures, tutorials, research working groups, meetings at the Annual Geophysical Union Meeting), CIDER has provided opportunities for scientists to share knowledge and expertise; developed multidisciplinary collaborations; fostered professional networks; and has provided a foundation for the academic and professional advancement of participants. As participants have shared, CIDER is a unique opportunity that has greatly enhanced the deep earth science community.

[CIDER is a] unique opportunity to network and gain a wider perspective on cutting edge Earth Science developments. In many ways, the CIDER model is how science should be more often, where experienced experts and early career scientists from various fields are actively encouraged to talk to each other, share knowledge, challenge preconceptions and tackle the next generation of science questions

CIDER is unparalleled in this regard, in both that you can interact with potential postdocs, and top minds in their fields from geophysics and other disciplines. If anything, this program has me now corresponding with several folks that I typically would have only spoken with at conferences.

Provides a forum for the next generation of scholars to dynamically learn from and interact with world scientific leaders as well as their student/postdoc peers in tutorials and group research. Connections formed that will likely last a lifetime.

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