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## Designing inclusive community-based geography research experiences across the spectrum of ability

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### ABSTRACT

Through the voices of both faculty and student authors, we discuss the intentional integration of neurodiversity in an undergraduate, community geography research program. This exploratory case study takes conversations about diversity, equity, and inclusion from theory to practice presenting the development of an inclusive learning community through the lens of education and geoscience education frameworks. Through multiple perspectives advocating for systemic change for inclusive community geography, this paper presents actionable recommendations others in geography can draw from in their own efforts to broaden participation within geography field programs.

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## Introduction

Working at the intersection of physical and social science disciplines, geographers have long aimed to promote creative and inclusive teaching and research practices that broaden the perspectives of the discipline and its students. Yet, past studies on diversity, equity, and inclusion in the field of geography offer limited discussion of intellectual and developmental disabilities with a few notable exceptions (Hall, 2004; Hall & Kearns, 2001; Judge, 2018; Philo & Metzel, 2005). Geographers working in broadening participation most often focus on race (Adams et al., 2014; Kobayashi et al., 2014; Wright et al., 2014), gender (Sanders, 2006), and ethnicity (Torres & Wicks-Asbun, 2014; Villenas, 1996). While these efforts are important for expanding the talent within all geographic disciplines (Solis et al., 2014; Solis and Miyares, 2014; Oyana et al., 2015), accessible and inclusive practices that encourage the participation of students and practitioners with disabilities warrant greater attention in the discussion of diversity in geographic contexts. Health geographers have noted that there is an ethical obligation to place more prominence on examining the geographies of disability, the social production and “othering” of

those with disabling conditions, and the role space and place play in ableism within society (e.g., Gleeson, 1996; Park et al., 1998; Chouinard, 2000; Kitchin & Wilton, 2000; Laurier & Parr, 2000; Hall & Kearns, 2001; Valentine, 2003; Hansen & Philo, 2007; Imrie & Edwards, 2007; Crooks et al., 2008; Castrodale & Crooks, 2010; Allegri, 2015; Pini et al., 2017).

Davidson and Henderson (2010b), Davidson and Smith (2009), Judge (2018), and Kingsbury et al., (2020) make clear that the voices of neurodiverse scholars must be more clearly present and articulated in disciplinary dialogues. Judge further argues that such published work should especially focus on reflexive accounts of personal experience. Judge notes this importance “to demonstrate the ways in which neurological-differences commonly understood as limitations can act as strengths, insights, and challenges to the ways in which we produce knowledge and do research, and the ways in which we consider neurological-difference generally” (Judge, 2018, p. 1102). Like these authors, we aim to amplify the voice of neurodiversity through personal experience and social engagement of doing collaborative research. This article focuses on the qualitative interactions of all students in the learning community as an exploratory case study on inclusive design in a field-based community geography program.

Traditionally, courses and research experiences in field-focused science disciplines, including those in geography, are designed according to a normalized student population and often place an inherent prerequisite on physical and social ability (Atchison, Marshall et al., 2019). As such, the successful completion of an undergraduate field program relies primarily on the students’ perseverance and physical, social, and emotional ability to navigate the field course culture and activities (Hall et al., 2002). The true barrier preventing student participation in field-based teaching and learning is the culture of inherent exclusion, which marginalizes students with physical, sensory, or developmental disabilities, such as autism (Hall et al., 2002; Atchison, Marshall, et al., 2019). Even when provided with an opportunity to participate, students with apparent and non-apparent disabilities often remain unable to complete basic program requirements due to rigid instructional practices and unwavering program requirements.

Exclusionary practice in field-intensive science disciplines is often exacerbated by the lack of flexibility in instructional planning and design, inaccessible site selection, and bias and stereotype towards student ability (Carabajal et al., 2017; Stokes et al., 2019). However, recent field research has shown that the barrier to participation in the natural environment can be mitigated with intentional selection of more accessible field sites, including the students’ perspective in collaborative planning, and the integration of universally designed pedagogical strategies that enable active participation across the learning community (Atchison, et al., 2019). Program activities that are asset-minded – designed to focus on the strengths and abilities of each individual student – enable the engagement and active participation of students with physical, sensory, and developmental disabilities, and in most cases, will strengthen the learning outcomes within the entire program.

A developing subfield of inclusive geoscience education is working to enhance accessibility across the various geoscience learning environments for students with disabilities (e.g., Gilley et al., 2015; Carabajal et al., 2017; Atchison, Marshall et.al., 2019; Atchison, Parker, et al., 2019) yet notably very few studies on accessibility appear in geography education journals. Such an omission in the literature significantly limits the

conversations for a more accessible and inclusive discipline. The benefits of integrating inclusive pedagogical practices are advancing through research that focuses on the entire student learning community (Atchison & Carnahan, 2018; Atchison et al., 2019). Studies addressing issues of accessibility for students and practitioners with physical (e.g., mobility; Atchison & Gilley, 2015; Gilley et al., 2015; Houghton et al., 2020; Feig et al., 2019; Stokes et al., 2019), sensory (e.g., vision/hearing; Hendricks et al., 2017), and other non-apparent disabilities (e.g., color vision deficiency; De Paor et al., 2017) are becoming more prominent across the geosciences. These studies advocate for the development of courses and programs that focus on the strengths and abilities of all students, and contradict common bias within the geoscience community that individuals with physical and sensory disabilities have limited opportunities for careers in the geosciences (Atchison & Libarkin, 2016). Instead, these recent studies provide evidence that not only can the field sciences be made accessible, but that scientific innovation across all science disciplines can be strengthened by a diverse talent pool of practitioners across a spectrum of ability (Carabajal et al., 2017; Atchison et al., 2019). Field-focused program directors and course instructors should therefore be knowledgeable and prepared to address potentially exclusionary practices (Carabajal & Atchison, 2020) through universal instructional design, development of inclusive learning communities (Fink & Hummel, 2015), and the implementation of multiple pedagogical strategies across all science contexts, including field experiences (Atchison, Marshall, et al., 2019; Atchison, Parker, et al., 2019).

In this article, we utilize outcomes from foundational geoscience education studies to create an inclusive community of research and learning that specifically supported the integration and active participation of a student with Autism Spectrum Disorder (ASD). We share our outcomes as an exploratory case study by purposely amplifying the voices of our student participants, and discussing how we integrated their personal expertise and experiences into the process of designing an inclusive geography research community. Through both faculty and student perspectives (Kingsbury et al., 2020) drawn from reflexive individual and group reflection (Judge, 2018), we discuss how the intentional integration of neurodiversity strengthened our learning and research community. It is important to note that our student participants are also co-authors in this publication.

## Methods

This exploratory case study outlines a seven-week summer National Science Foundation (NSF) Research Experiences for Undergraduates (REU) Site focused on community geography, citizen science, and geographic information systems (GIS) in Belize. This summer field research program brings together students from multiple American universities and the University of Belize. It is necessary to note that our reflections within this exploratory case study are focused on collaborative research experiences and field-work rather than a conventional course intervention. Furthermore, this case study is unique as it deliberately designs and accommodates a student with a developmental disability into an inclusive, international learning experience. Given the perceived social challenges inherent in conducting research in communities (i.e. interviewing, social interaction, collaboration and conversing with strangers), let alone the cultural

differences in international research, integrating a neurodiverse student into this type of research might seem impractical for instructors and program directors. This exploratory case study presents practical evidence for the benefit of such an inclusive program, and provides recommendations for how to design and implement one.

The examination of this inclusive summer geography program focuses on a team of five students as a single exploratory case study within a learning community of 15. Our work is grounded in theories similar to those outlined by Rees et al., (2020) that suggest a key element of community geography education practice should focus on active, intentional, and reflexive dialogue and critical reflection of all project participants – both at the individual and group levels.

### ***Exploratory case study and approach***

This exploratory case study of inclusion is grounded in the developing community geography literature. Community geography – a type of participatory field-based research – is a growing subfield in geography centered on developing university-community partnerships to both enhance access to geospatial technologies and approaches, and acknowledge the importance of representation of diverse voices and multiple forms of knowledge in geographic problem-solving (Robinson, 2010; Hawthorne et al., 2014, 2015; Hawthorne & Jarrett, 2018; Robinson & Hawthorne, 2018; Robinson et al., 2017; Shannon et al., 2020; Rees et al., 2020). Because of its emphasis on reciprocal knowledge sharing and collaborative processes, community geography projects often employ participatory research methods, like Participatory GIS (PGIS) to improve responsiveness to community priorities (McDonald & Stack, 2016). As outlined in Rees et al., (2020), a key element of community geography education practice is focused on active, intentional, and reflexive dialogue and critical reflection of all project participants (both at the individual and group level).

To focus on creating a more inclusive research program for undergraduates, the goals of this exploratory case were to: 1) create responsive research practices that integrated Geographic Information Systems (GIS) and drone technologies along with interviews to highlight community voices to tell the stories of the changing coastal landscapes of Belize; 2) focus on the opportunities to purposefully include the strengths within a diverse group of students in our learning community, rather than focusing on disability as a deficit; 3) explain how community-based research strategies and principles of learning communities could be combined to develop inclusive field research programs that accommodate and include the participation of students with disabilities, and 4) demonstrate how these combined practices create transformative learning experiences for the entire community of learning – including all faculty, staff, students, and community partners. To provide evidence for these questions, data were collected in the form of student reflection journals; informal one-on-one conversations between students and program faculty and staff; formal program evaluation; group interviews with the program evaluator; and writing retreat discussions and reflections. These data were then analyzed holistically to provide the recommendations presented in this paper.

### ***Transformative & experiential learning***

Study abroad and other international research programs require students to be culturally flexible, socially inclusive, and collaboratively reflective, and can provide the strongest learning outcomes through concrete experiences in a global context (Strange & Gibson, 2017; Tarrant, 2010). Conceptually, our international community geography research program is framed at the intersection of Experiential (ELT; Kolb, 1984) and Transformative (TLT; Mezirow, 1991) Learning Theories. Integrating these two theories into practice challenges students' inherent cultural assumptions, stereotypes, and world-views by engaging with a diverse and inclusive, international community of practice.

Practical experience often drives authentic, relevant, and meaningful learning (Bell, 1995). However, a major difference exists between experience and learning. To some, an experiential activity has the potential to provide cognitive, affective, or psychomotor outcomes. For others, experience is merely living one's life (Mezirow, 1991); a relationship between the individual and their environment, or a replicable interaction in which understanding becomes concrete (Dewey, 1938). Cognition that occurs during or after an experience is the embodiment of experiential learning. This processing, which can be done through individual reflection or group debriefing, offers the opportunity to transfer and apply the learning from the experience, and facilitate changes in interpretations, understandings, attitudes, and behaviors (Luckner & Nadler, 1997). Debriefing also enhances the experience (Frank, 2004) by providing multiple, voluntary opportunities for students to share their different perspectives of an experience with peers. When students need or prefer an anonymous outlet to frame what they have learned, journaling can provide another reflective outlet. Without the opportunity to reflect and debrief on the experience, the intellectual potential of an experience can be lost.

Transformative Learning Theory (TLT) suggests that individuals learn through cognitive dissonance created as a result of the conflict between existing cognitive schema and beliefs and the integration of new information (Mezirow, 1997), and the construction of meaning through a new experience (Mezirow, 1991), or maybe even a common experience with new perspectives. Thus, a transformative experience is achieved through concrete examples of practical application, active experimentation, and critical reflection (Frank, 2004; Kolb & Kolb, 2005). Critical self-reflection enables an individual to challenge their prior knowledge and transform their understanding through personal and collaborative interpretation of an experience (Hawthorne et al., 2015; Mezirow, 2000). “[T]hrough reflection, active learning, and placing ourselves in an uncomfortable situation we [are] fully able to develop our understanding of the work and of ourselves” (Mezirow, 1991 as cited in Strange & Gibson, 2017, p. 87). Further, critical discussion, trust, and the open sharing of information across a collaborative experience is an essential factor in a transformation across an entire community of learning (Taylor, 1998).

### ***Belize undergraduate research program***

Since 2016, the Citizen Science GIS REU Site at University of Central Florida (UCF) has supported 34 U.S. undergraduates across a variety of disciplines including geography, sociology, political science, biology, environmental studies, engineering, geology, and others. Our program has also supported six University of Belize undergraduates during this time. Over 70% of the student participation in this REU includes members from

groups commonly focused on in broadening participation efforts (e.g., race, sex, gender, ethnicity, military veterans, persons with disabilities, and first-generation college students). Faculty mentors comprise both men and women including some who were first-generation college students. While other aspects of diversity are not represented by the faculty, all have worked to gain an understanding of issues regarding diversity, equity, and inclusion including trainings specifically focused on supporting students in acknowledgment of intersectional identities. In addition, we specifically sought guidance from scholars (including the lead author) with expertise in making field science experiences more accessible for students with disabilities. Students from previous years are also invited back to serve as research support staff in part to expand representation among the leadership team. As a community-based research training program, our REU heavily relies on the collective interdisciplinary knowledge, guidance, and support of faculty and staff from multiple institutions including University of Central Florida, Georgia State University, University of Cincinnati, George Mason University, and University of Belize, as well as local residents and community organizations in Belize. As a summer field research training program sponsored by the NSF, American student participants are provided with travel, lodging and meals, and compensated with a 500 USD weekly stipend. Students are also provided financial support to attend a post-program conference, and in the case of our three student co-authors support for follow-up activities such as a post-program writing retreat. Students work nearly 40–50 hours each week during the program, and have a high level of access to faculty mentors, including most faculty mentors living on site in the fieldwork location where they interact both formally and informally during the program.

From the moment of recruitment into our program, we intentionally focus our applicants' attention on our commitment to working in a diverse and inclusive environment. When students are invited to interview for the funded research training program, they are sent an email with the following statement demonstrating our commitment to an inclusive learning community as well as our expectation that students must be willing to work collaboratively in an environment designed to be inclusive and accessible.

Our group (and those we work with in the study sites) will have all sorts of unique abilities, personalities, challenges, and backgrounds. We value diversity in every sense of the word and want our team members to be respectful, flexible, understanding, and inclusive of all abilities. If you find working with people with unique abilities and skill sets challenging, then this program might not be the best fit for you. As we have mentioned from the beginning, we want to be transparent about our REU Site, prepare folks as best we can to have an incredible, life-changing experience, and ensure we choose a team that can work together as a unit.

Upon acceptance into the program, students sign a memo of collaboration indicating their commitment to collaboration while valuing everyone's talents, abilities, and experiences. Students then engage with faculty and staff in a series of pre-program video calls to meet, discuss program objectives, and introduce assignments and expectations. Part of these meetings include one-on-one conversations with individual students to explore their interests and address their questions, concerns, and ideas for building a more inclusive and student-centered program. The program's first week is held at UCF and includes a set of detailed introductory team building activities and research method

training sessions. The program then moves to Belize for 3–4 weeks depending on the summer field schedule to conduct community-based fieldwork. After the fieldwork, students return to the UCF lab for 10–14 days to complete their analyses and prepare final presentations and reports.

During the program, students typically participate in one of three interdisciplinary research tracks. Research Track 1 focuses on participatory mapping and analyzing disparities related to flooding and disaster management strategies. Research Track 2 focuses on participatory mapping and analyzing the composition and distribution of coastal marine debris. Research Track 3, the most recent to be added, focuses on enhancing existing geospatial resources with more high-resolution data using drone mapping and spatial storytelling to examine coastal and island resiliency. As part of this track we worked to design an experience to further broaden participation with the inclusion of students with disabilities. Within the track, students learn how to fly drones for mapping changes in the mainland Belize village of Hopkins and on cayes along the nearby Belize Barrier Reef. The drone imagery replaces outdated and poor resolution satellite imagery of some of the most environmentally vulnerable places in Belize. The mapping was requested by village members, tour guides, and local fishermen to provide aerial perspectives of these changes and to showcase the beauty of the natural landscape to encourage conservation and responsible tourism. Additionally, as part of the community engagement and participation component of the program, REU students, faculty and staff work with local stakeholders in basic drone mapping operations and provide a multi-day K-12 informal STEM education program for local children at local community centers. Students also interview community members about coastal changes and about human adaptations to these historical changes. The drone imagery combined with the interviews are tied together to offer spatial stories of the changing landscapes of Belize.

To foster an inclusive learning community from the onset of the program, formal and informal strategies are utilized to enable flexibility for unanticipated events throughout the program. The faculty and staff had pre-program planning meetings to discuss inclusion, especially as it related to best supporting the needs of all students. With respect to the student with autism, program faculty met with the student and their personal advocate to discuss a previous experience in which the student was being excluded in a fieldwork program. We also discussed the implications of disclosing, or not, the student's previous experience (e.g., personal communication and social interaction challenges in the field) to the team given the unique, collaborative structure of our research program. The student decided that they would discuss their abilities and experiences early in the program's first week and share their personal ideas about inclusivity. After addressing an initial list of their questions and concerns, the lead author, a geoscience education researcher with expertise in creating inclusive field experiences, encouraged the faculty and staff to meet with the student and their advocate and discuss how to best support and accommodate the student's needs and abilities throughout the program. This was the first attempt at recognizing the student as an expert who brings a wealth of experience and knowledge to the program, rather than making decisions and creating assumed accommodations without the student being involved in the decision-making process. Including student perspectives became a central tenet throughout daily program planning and

implementation. This ultimately strengthened the entire research community as all students began to consider their own abilities and needs, especially with respect to communication, social interaction, work styles, as well as their respect and compassion for each other.

## **Toward more inclusive undergraduate research programs**

From its inception, the program's specific research objectives were designed to study how community geography and GIS could be used to solve real-world problems in an international setting. Although focused on including the participation of a diverse group of undergraduate student scholars, the research objectives of the program were not originally designed to empirically study inclusion. However, the strategic and reflective program design enables the collection of multiple datasets that allow us to assess our outcomes, including efforts to bolster inclusivity. This case study analysis is based on observational and reflective data created before, during, and after the 2018 summer research program in Belize. We recognize that our reflections and qualitative data are limited to the experiences of our research program, nevertheless, we believe that the outcomes of this exploratory study provide recommendations that can be broadly contextualized, and begin to push for a more inclusive and accessible geographic education community.

Based on our experiences and using the outcomes from this exploratory study, we developed recommendations for enhancing inclusion in community-based research programs during a post-program writing retreat and many subsequent discussions. In offering the following recommendations, we emphasize that all programs are unique and some recommendations may not be as relevant given individual contexts and circumstances. Our recommendations are designed to be positive and forward thinking, while challenging the notion that disability is considered a deficiency or problem that needs to be fixed, rather than an opportunity to improve the status quo of a normative-designed instructional environment (Dinishak, 2016; Judge, 2018). Instead, we work toward building and implementing a program where empathy, compassion, and inclusivity become the hallmarks for a research community. We provide our recommendations as a starting point for program leaders to consider adopting or adapting strategies to create collaborative and inclusive field research experiences.

### ***Recommendation 1: acknowledge individual students as experts of their unique educational needs and abilities***

We encourage faculty to create an inclusive and supportive program structure where each individual student is listened to, valued, and encouraged to contribute to the research design and overall experience of the learning community. When developing inclusive research programs, learning from students' expertise is particularly important, since faculty and staff may be unfamiliar with supporting students from groups commonly underrepresented in STEM disciplines, especially students with disabilities. For example, none of our program faculty had extensive experience working with neurodiverse students. Yet, when a student with autism applied for the program, instead of assuming we lacked the ability to meet their needs, we acknowledged that they brought



a new level of expertise to share. During the program, the student communicated openly about their unique abilities and challenges, and how we – as classmates, colleagues, mentors – could provide the most supportive community for them to be successful.

To be clear, we recommend all students, not only students with disabilities be acknowledged as experts in their intellectual, physical, and social strengths and abilities. To ensure every student has an opportunity to be heard as an expert, we suggest faculty provide an overarching research framework that provides natural supports and opportunities for students to take ownership of the co-creation of their research experience. In this way, programs can benefit from the creativity and unique assets each person brings – rather than focusing on individual student limitations as a deficit – to the community of learning. The balance to consider, however, is maintaining flexibility in program objectives that encourage students to build on their strengths while also providing opportunities to step outside of their comfort zones and learn new skills. One strategy for achieving this balance is to have students integrate peer-mentoring plans into their co-created research experience. In our program, we emphasize that the team is greater than its individual parts. Each student had a specific and unique skill set that contributed to the team goals, and we worked to provide time for students to reflect on how their individual strengths contributed to the group's collaborative objectives. During a post-program group writing retreat, one student reflected in writing: "Some tasks are not good for everyone. I had come in assuming that as a team everyone should work together on every task, but that did not end up being the case. Instead, every team member should have a task, but not everyone can or should be working on the same task at the same time." The student added, "... it taught me how to trust better. I have always kind of micro-managed group projects, but this experience taught me to let that go and to trust others' capabilities and strengths because at the end of the day we can all learn from each other." This "everyone is an expert" mindset helped the group persevere when faced with challenges. For example, near the end of the summer program, frustrations were high with looming deadlines and finalizing group projects. Team dynamics started to break down as individuals became overwhelmed and irritated by what seemed like a lack of progress because they had different opinions on where and how to focus their efforts on the remaining work. One faculty mentor met with the students, first individually and later as a group, to ensure everyone's concerns were heard. She reminded the students of how far they had come, and that they were all working towards a shared vision and goal. She refocused the conversation on how best they could *each* individually make progress toward a collective goal given their unique skills and abilities. The students were then able to effectively come up with a plan to move forward in multiple aspects of their project work and once more feel united in making progress.

#### ***Recommendation 2: create spaces for intentional and honest communication and reflection (even if it is uncomfortable in the moment)***

In residential fieldwork programs, issues will likely arise in multiple facets of daily routines, including concerns about living conditions, interpersonal and team conflicts, work styles, and fieldwork pacing and workloads. We suggest that from the moment a program begins, there should be open, honest discussions about personal concerns and

challenges, in an attempt to prevent them from becoming larger interpersonal problems that can undermine the focus on collaboration and productivity. Trust and transparency across full group, small team, and one-on-one conversations should be expected of all staff and students throughout the program to maintain a supportive and constructive research community.

Reflection and post-program evaluation data suggest that team dynamics played a huge role in project success and student well-being in the program. In their program evaluation responses, all but one student focused explicitly on interpersonal and team skills when answering the question: *What do you consider important elements of the research process?* Additionally, written reflection assignments before, during and after the Belize field experience further emphasized the importance of team building to promote inclusive communities of learning. One student noted: “I truly feel like my team has good ‘dynamics.’ I think that we work well together, and we can get work done pretty effectively. We haven’t had any interpersonal issues, and we’ve talked about our pet peeves and what annoys us. I think we can all appreciate what each other has to offer and we’ve had enough time interacting to see that in action” (student written reflection assignment from first week in Belize).

We recognize that field-based programs with an intensive schedule of activities that include community engagement can be exhausting for students, yet our reflection data from students suggest that strong team dynamics and communication played a prominent role in easing these tensions. Even in the fourth week of fieldwork, after some highs and lows, the team maintained their appreciation for one another. This can be seen in a student reflection written during a time when the team split to work with different community stakeholder groups: “I miss them already and am sad that we have to be split up because we all bring something different and useful.” Such comments are representative of the team dynamics necessary for successful fieldwork, but also speak to the importance of empathy and understanding that must occur in collaboration. This empathy is evident from other student reflections, as well: “I am glad that my teammates are willing to go out of their way to ask me daily how I feel. Knowing that my teammates do care about me makes me feel pretty good and reminds me that this team is probably one of the best ones that I have ever been on. It’s also helpful that they are willing to embrace the challenges with me” (student written reflection assignment from second week in Belize).

In addition to holding space for individual and group discussions, we also encourage program directors to require students, faculty, and staff to reflect critically through personal journaling (Rees et al., 2020). Reflective journaling provides a creative outlet for all participants to confront and grow from positive and negative experiences, and can be done daily or a few times a week. In our experience, students appreciated this informal activity as a way to organize their thoughts and emotions. These reflections can be shared by students with faculty when appropriate, but the process of reflective writing is more important to the individual and does not have to be shared with others. In addition to assigned journaling, one of the student co-authors reflected on their own to organize their thoughts and to prioritize important daily activities: “I wrote up a list of things that I should make sure to do every day for the rest of the time that I am here. I need to make sure I stick to this list to minimize the probability of me getting sick, because if that happens, I will be unable to participate in the things my teammates are doing, and my

teammates are counting on me to not let them down and do my part" (student written reflection assignment from first week in Belize). Additionally, another one of the student co-authors used journaling as a way to think through issues they wanted to bring up with teammates in order to have more productive and focused conversations. Students were also able to engage in additional guided reflection through mid-program interviews with the evaluator. One of the students commented (in response to a question about how others were helpful to them) that their peers gave them "reminders to just be flexible and be positive . . ." and to "do your best not to lose your temper" even when that student acknowledged that they were being frustrating to the group. The reflection activities overall helped students recognize problems as they arose, preventing the escalation of such problems to an impasse, and gave them a way to work through challenges either individually or as a group. Throughout the program, recommendations made to students in support of their success such as the practice of reflection, setting and following routines, maintaining a strong field notebook, open communication, and more are acknowledged as helpful to all students both as individuals – whether neurotypical or neurodiverse – and collectively for group dynamics.

### ***Recommendation 3: develop a program focusing on student abilities and opportunities rather than individual limitations or challenges***

One of the misconceptions we had about establishing inclusivity in this field program, particularly involving students with disabilities, was that it would require exponentially more time and effort to plan and implement the program activities. This bias demonstrated that the faculty initially viewed the student's disability as a deficit within the learning community rather than the potential of having a more innovative learning community by focusing on diverse strengths, abilities, experiences and worldviews. During the process of designing this new accessible and inclusive research track, we realized that the greatest difference in planning was not the amount or difficulty of the preparation, but rather the intentionality of it. All students and program faculty and staff would directly benefit from a stronger focus on how the learning community, as a whole, would create spaces for inclusion.

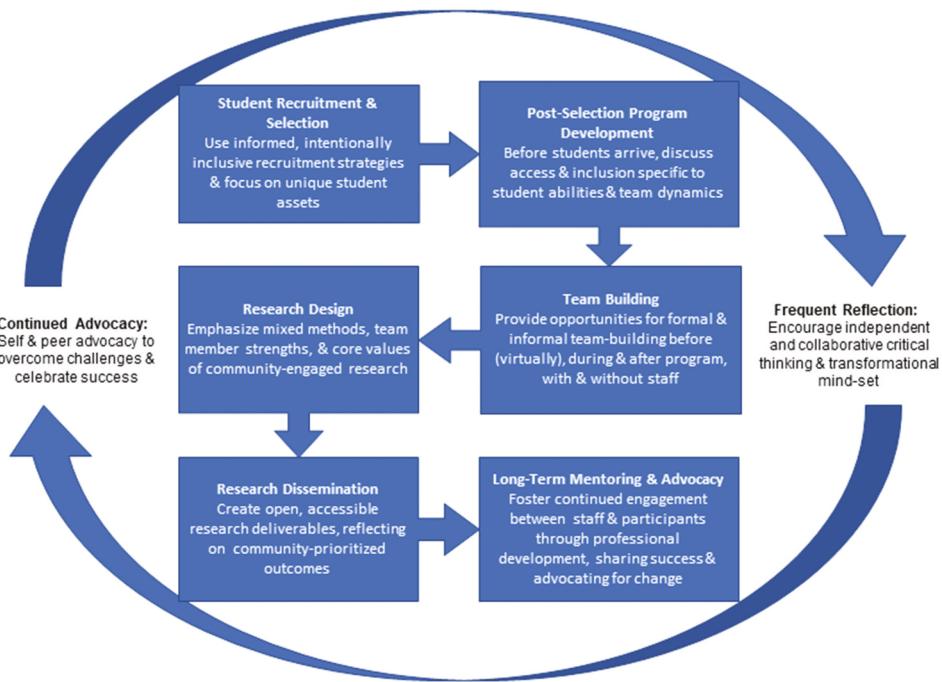
Building from our first recommendation of acknowledging students as experts of their personal abilities, experiences, and strengths, students should be provided space and structured time to have conversations about the challenges they anticipate facing in a collaborative program, and conversely, what they believe they can contribute to the team. For example, the benefits of inclusion were readily apparent from discussions held with the student team. "All of us really grew from this experience and I think I would go as far to say that having [a student on the autism spectrum] actually brought us closer together and allowed us to have an even stronger and healthier team dynamic compared to the other groups who might not have been reflecting as much or who might not have had to really focus on each other's strengths in the way that our team had to" (student post-program reflection). Such opportunities for discussion could also provide space for students with disabilities to share how this type of personal empowerment influences their sense of belonging (Huntoon et al., 2015) and contributions within the learning community (Atchison et al., 2019). Students on the autism spectrum in higher education have reported very low levels of belonging relative to their neurotypical peers (McLeod

et al., 2019; Pesonen et al., 2020). Yet, in order to support and retain students with disabilities in STEM fields, fostering a sense of belonging is critical (Fisher et al., 2019; Wilson et al., 2015). This can be done in part through collaborative activities that are intentionally designed to be inclusive by simply recognizing and valuing all individual contributions. In doing so, be sure that students' personal strengths, rather than any limitations of knowledge, experience, or ability, are recognized as assets at the core of such conversations. One of the student co-authors explained, “[t]here should not be more conversations about disabilities than there are about strengths. Students also need to learn how to think, ‘What does this person excel at?’ instead of, ‘Well, this person cannot do this, so I guess they could do that instead’” (post-program student reflection). While the students recognized that playing to their strengths was a valuable way to collaborate, group conversations revealed that they appreciated how everyone was willing to participate in all aspects of the work, and how important it was that all should have the opportunity to contribute to each task in the project activities. “[E]verybody was willing to do everything even though some may have felt a little more comfortable doing some things than others” (mid-program student interview). Cultivating a program in which individuals have the opportunity to not only shine where they are strong, but also to grow in new ways is essential. Members within the research team should not be consigned to only providing specific contributions. Therefore, early in the program, faculty should discuss with the students their experiences and skills related to the project activities, and the types of accommodations that would help them develop new skills and succeed in the program. Being intentional about developing students as budding research practitioners demonstrates to them that their contributions are valued as members of the community of learning and vital to the success of the program.

#### ***Recommendation 4: create a roadmap for enhancing inclusion within a program***

Throughout this exploratory case study, we provide a roadmap for enhancing inclusion within a program (Figure 1). Thorough planning and research, well before students are selected to participate, are vital to the success of an inclusive program. To reach a diverse pool of applicants, we purposefully targeted our program advertisements and recruitment materials to various specialty groups in geography, geology, sociology, biology and other related fields, including groups focused on diversity, equity, and inclusion. Marketing materials were also carefully designed to encourage applications from students of all backgrounds and with all types of abilities. An excellent first step to examine the preparation of a program before even interacting with students is to review the chapter on *Creating an Inclusive REU Application* (Atchison et al., 2020) in the NSF Geoscience Directorate (GEO) REU Handbook. Their recommendations include asking insightful essay questions as part of the application process related to experiences navigating adversity. This can provide an opportunity for students to open the conversation regarding challenges they may have faced and how they were able to succeed. Inclusivity requires us to empower students to lead and recognizes and values the autonomy they bring as individuals.

Our outcomes show that subsequent program design, once students are selected, must be intentional and focused on their individual strengths, abilities, and experiences. Programs should be designed with flexibility to support individual needs rather than



**Figure 1.** Roadmap for intentional integration of inclusive practices into various stages of our undergraduate student research program. Ongoing reflection and advocacy demonstrate an emphasis on transformative learning.

being so rigid that interested students are turned away if they do not hold the skills that align to every aspect of the program.

During our program planning, we considered how accessible our study site would be for students across a spectrum of physical, sensory, and developmental abilities, and had conversations with leaders in the diversity, inclusion, and accessibility subfields of geoscience education. Program Directors should consider identifying an external network of scholars that program faculty and staff can connect with should the need arise during the field activities. This network could include communicating with colleagues who are well versed in inclusive field experiences, or disability studies, or even representatives from a university office of accessibility support services. In this case, our program relied on the assistance and guidance of the International Association for Geoscience Diversity ([www.theiagd.org](http://www.theiagd.org)), a global network working to foster inclusive scientific communities of teaching, learning, and research. These conversations pushed us to shift our focus away from viewing students with limited skill sets as deficient, and instead focusing on empowering students as the experts of the skills, abilities, and experiences they brought with them. This intentionality afforded us the opportunity to strategize with experts about how to foster an inclusive and open dialogue with students to recognize and value each team member's strengths and abilities.

Once the students were selected, we were purposeful in creating both formal and informal spaces for individuals and teams to reflect on their own strengths and skillsets, and collaboratively develop strategies for working together as an inclusive learning

community (see Recommendation 2). Student feedback confirmed that this constant reflection throughout the program strengthened the team dynamic and the research products. Aligned to the nature of community geography research, such reflective conversations also facilitated the development of accessible, inclusive, and participatory research designs and conscious, collaborative dissemination of research outcomes.

Highlighted in the final box of the figure, the learning community does not dissolve at the close of the summer research program. Mentoring and working relationships between faculty, students, and staff continue through writing retreats, informal gatherings during conferences, and video conference calls to discuss career goals. Through this paper specifically, we have worked to share our inclusive research fieldwork experiences. At the end of our program, we had open discussions about how the geography literature would benefit from the outcomes of this collaborative experience, presented through both faculty and student voices as a way of modeling the inclusive nature of shared expertise and experience. This dialogue in part stimulated an interest in our team to add our reflexive programmatic recommendations to an article in the geographic education literature, with the recognition from our students that such articles are difficult to find in geography specific journals. Those that include student perspectives are even more rare.

In an effort to advocate for change, we encourage others to share knowledge by publishing on these types of programs and experiences; presenting at national, regional, and local conferences; or hosting informal discussions on campus through offices of diversity and inclusion. We also encourage others to share the successes and challenges of their programs in social media, popular press periodicals, blogs, and other cross-disciplinary formats that are of interest, especially to students. Publicity and advocacy can break the negative cycle of social bias and stereotype, and encourage others to develop and offer more inclusive experiences. Advocacy may also include encouraging professional societies to initiate policies and expectations for community-wide access and accommodation. Heightened advocacy that is inclusive of diverse voices are certainly needed in geography education.

### ***Limitations and implications for future research***

This case study focuses solely on the benefits of fostering inclusion in participatory geography research. Although we strongly advocate for the strengths and benefits inclusive learning communities provide, we also acknowledge that the outcomes of our program may not reflect the unique challenges others may face when working to enhance inclusion. This is especially important in our case, where this is a residential summer research program in an international setting, rather than a research intervention designed for a formal classroom. Our team spent seven weeks living and working together which allowed for a level of reflection, interaction, and dialogue to occur that is not possible in a university course. Furthermore, our qualitative approach does not allow us to generalize our specific findings to other programs. Future studies could explore lessons learned from similar qualitative approaches to enhance a programmatic design that intentionally evaluates inclusion. These limitations offer implications for future research, but should not diminish the novelty of our outcomes as we share these findings to spark reflection, create awareness, and drive innovation of inclusive program design across the broader geographic education research community.

## Conclusions

This exploratory case study presents outcomes of an inclusively designed community of learning in a participatory, community-based undergraduate geography research program. Not only does this paper discuss the necessity of collaborative planning and implementation to support an inclusive field research program, but we also model this collaborative nature in the dissemination of the work, by including the voice to those most impacted by the outcomes of this approach: the students themselves (in this case, as co-authors). By demonstrating this model of practice, we hope to empower geography educators and researchers to consider, accommodate, and include the spectrum of student ability and experience in program design and implementation. Additionally, maintaining inclusion requires flexibility and a constant iterative process of reflection and revision. Through this deliberate reflection from all program stakeholders, this inclusive practice will promote a shift towards advocacy and transformational change, but also drive innovation in scientific research.

In addition to the recommendations we offer above, we encourage the geography community to seek and utilize resources from other field related science and social science disciplines whose literature critically examines the evolution of inclusion in traditional pedagogies. Importantly, what we are discussing within a geographic education journal is not new to other fields; there are countless cited examples from other fields, including many of the articles cited herein. We argue that for our discipline to be more inclusive of students with all skills and abilities, these debates, dialogues and case studies need to be present in geographic education journals in order to render them more visible to our field. Realizing that challenges exist, remaining open to learning from those challenges, and including the student voice in decision-making are the foundations of creating inclusive teaching and learning experiences. These skills are not trivial. Program leaders should remember that students, faculty, and staff are often learning how to become – and in the state of becoming – inclusive researchers and supportive team members. All participants should trust the process and understand that the challenge will broadly benefit the entire community of research and learning. As more geography research programs strive toward becoming inclusive, viewing all students as active contributors, and not just passive receivers, we are confident that diversity, equity, and inclusion will continue to grow.

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The authors declare that they have no relevant or material financial interests that relate to the research described in this paper.

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