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Considering Intergroup Emotions to Improve Diversity and Inclusion in the Geosciences

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1 **ABSTRACT**

2 The future viability of the geosciences is challenged, since as a community we continue to
3 lack demographic diversity representative of the wider population. Fundamentally, dominant
4 cultural, historical, and socioeconomic factors contribute to the lack of diversity and those factors
5 typically change slowly over generations. Proposals for more immediate changes have had some
6 effect but have not led to large-scale changes in the demographics of the geosciences. In this
7 commentary, we discuss the concept of intergroup emotions and recommend its use as a strategy
8 for improving diversity and inclusion within the geosciences. Intergroup emotions are emotions
9 that arise as a result of an individual's identification with one or more social groups, which makes
10 them particularly pertinent in the context of diversity and inclusion. While we call on the
11 geoscience community to conduct discipline-based research in collaboration with educational and
12 social psychologists, we argue that there is sufficient evidence to also begin implementing
13 interventions in classrooms, laboratories, and in the field. We believe strategies based on
14 intergroup emotions will make significant improvements in diversity and inclusion within the
15 geosciences.

16

17 **1.0 INTRODUCTION**

18 The geosciences community is one of the least demographically diverse within science,
19 technology, engineering, and mathematics (Velasco & de Velasco, 2010; Stokes et al., 2014; Glass,
20 2015; King et al., 2018; Vila-Concejo et al., 2018). This has been the case for decades as evidenced
21 by calls for special issues on diversity and inclusion in the *Journal of Geoscience Education* (Riggs
22 & Alexander, 2007; Gates et al., 2019) and funding granted by federal agencies such as the
23 National Science Foundation (e.g., Opportunities for Enhancing Diversity in the Geosciences
24 [OEDG] and Improving Undergraduate STEM Education: Pathways into the Earth, Ocean, Polar
25 and Atmospheric & Geospace Sciences [IUSE:GEOPATHs]). While there is some indication that
26 the gender gap has decreased over the past 40 years, racial and ethnic diversity has not improved,
27 as quantified by the demographics of those who obtained Ph.D. degrees in the geosciences
28 (Bernard & Cooperdock, 2018) and by analyzing photographs on geoscience department websites
29 (Sexton, et al., 2014). In a recent report by the American Geosciences Institute, there is also clear
30 evidence of ongoing attrition after geoscience degrees are awarded (Gonzales & Keene, 2020). As
31 such, one of the Grand Challenges identified by Riggs et al. (2018) in their report “A Community
32 Framework for Geoscience Education Research” is improving inclusion within the geosciences.

33 In this work, we use the term systemically non-dominant (SND) from Jenkins (2017)
34 instead of the term “underrepresented minority.” By using the term SND, we are explicit in stating
35 that systemic factors are primarily responsible for the lack of diversity and inclusion in the
36 geosciences (for reviews, see Marín-Spiotta et al., 2020 and Núñez et al., 2020). With this we are
37 encouraging the community to further move away from the older “deficit model,” which focused
38 on what an individual lacked (e.g., self-efficacy (Baber et al., 2010) and social capital (Callahan et
39 al., 2015)). While it may be true that those who are SND lack certain resources, those deficiencies
40 are symptoms rather than causes. Rather, systemic factors, which we discuss in more detail below,
41 are largely responsible for the lack of diversity within the geosciences.

42 Systemic factors pertaining to gender in the geosciences are discussed in several recent
43 works. [Dutt et al. \(2016\)](#) found that letters of recommendation written on behalf of female
44 postdoctoral researchers were of lower quality than those written for their male counterparts.
45 There is a gender gap in terms of first authorship on geoscience journal articles ([Pico et al., 2020](#))
46 and journals of the American Geophysical Union had fewer female scientists conduct peer review
47 of articles, due to both authors and editors inviting fewer female reviewers ([Lerback & Hanson,](#)
48 [2017](#)).

49 Additionally, systemic factors pertaining to race in the geosciences can compound
50 systemic factors related to gender when a person belongs to multiple marginalized groups (i.e.,
51 intersectionality, see [Crenshaw, 1989](#)). [Clancy et al. \(2017\)](#) found that Women of Color in
52 astronomy and planetary science reported the highest rates of negative experiences (including
53 harassment and assault) in the workplace. Furthermore, [Ford et al. \(2019\)](#) found that SND
54 researchers are less likely to be offered oral presentations at geoscience conferences, with SND
55 women being the least likely group. For intersectionality applied to the geosciences, please see the
56 recent work by [Núñez et al. \(2020\)](#).

57 There are also systemic factors pertaining to those with disabilities in the geosciences.
58 [Atchison and Libarkin \(2016\)](#) surveyed participants at geoscience conferences and found that
59 while perceptions about access varied depending on the type of disability, there were prejudices
60 mentioned by participants such as, “Without some field experience, an individual with a
61 geoscience degree/career is greatly disadvantaged.” These are a few examples of systemic factors
62 affecting diversity and inclusion within the geoscience community.

63 Systemic factors that contribute to the lack of diversity and inclusion, even though they
64 need to be changed, change slowly over generations. This is evidenced by the decades-long lack of
65 improvement within the geosciences. Proposals for more immediate changes have shown some
66 effect but have not led to large-scale changes in the demographics of the geoscience community.
67 It is thus clear that alternative methods of improvement are necessary.

68 In this commentary, we bring focus to the individual in considering how systemic factors
69 affect a person’s emotions. Particularly, we consider intergroup emotions, which are emotions
70 individuals experience as a result of their group membership being made salient in social
71 interactions. We focus on negative intergroup emotions since they are particularly detrimental to
72 efforts to improve diversity and inclusion within the geosciences. We also suggest that
73 interventions using reframing may be useful tools for improvement. This commentary is intended
74 to introduce intergroup emotions theory (IET) to the geoscience education community, to discuss
75 examples of IET research and interventions, and to call for discipline-based research that can test
76 the effectiveness of using IET for improving diversity and inclusion within the geosciences.

77

78 **2.0 INTERGROUP EMOTIONS**

79 Emotions have been scientifically investigated for at least 150 years (e.g., [Darwin, 1872](#);
80 [Barrett & Satpute, 2017](#)) and have been considered in educational settings for decades (see [Pekrun](#)
81 [& Linnenbrink-Garcia, 2014](#)). Since emotions are complex and are studied from a number of
82 perspectives including neuroscience (e.g., [Pessoa, 2008](#)), psychology (e.g., [Öhman et al., 2001](#)),
83 and anthropology (e.g., [Anderson, 2011](#)), we need to be specific in our treatment of emotions in
84 order to productively address diversity and inclusion in the geosciences. As such, here we bring
85 focus to *intergroup emotions*, which can be defined as “emotions that arise [in an individual]
86 when [they] identify with a social group and respond emotionally to events or objects that impinge
87 on the group” ([Smith & Mackie, 2016, p. 412](#)).

88 Central to intergroup emotions is the vital concept of *identity*, which, to simplify, is the
89 answer to the question: ‘Who am I?’ *Identity* can be divided into *personal identity* and *social*
90 *identity*. *Personal identity* involves aspects of the psychological self that are unique to an
91 individual, while *social identity* relates to an individual’s group membership (e.g., race, ethnicity,
92 biological sex, sexual orientation, gender, age, place of birth, marital status, disability, religion,
93 and socioeconomic status). An individual would consider people as ingroup members when they

94 share one or more social identities and would consider others as outgroup members when they
95 do not share social identities. Inspired by social identity theory (Tajfel, 1978) and self-
96 categorization theory (Turner et al., 1987), researchers developed intergroup emotions theory
97 (IET) over several decades (e.g., Mackie et al., 2000; Mackie et al., 2008; Ray et al., 2014). The
98 crux of IET is that when group membership is made salient, emotions experienced by an
99 individual tend to be dominated by intergroup emotions.

100 A number of studies have shown that emotions in intergroup settings can be destructive.
101 For example, early work by DeSteno et al. (2004) showed that when anger was induced in
102 participants during experiments, they showed automatic bias (viz. prejudice) towards outgroup
103 members (who were only randomly assigned that role). Gordijn et al. (2006) showed that
104 undergraduate students (who were residents of Colorado) deemed a fee increase aimed at out-of-
105 state students to be unfair when they thought of themselves more as students, but fair when they
106 thought of themselves as residents of Colorado. Similarly, Ray et al. (2008) found that
107 undergraduate students were less angry and more respectful towards Muslims when they were
108 conditioned to think of themselves as students, compared to thinking of themselves as Americans.
109 These studies give credence to the possibility of altering perceptions based on intergroup
110 emotions to improve diversity and inclusion. To that end, recent work in human resources
111 considered the connection between intergroup emotions and diversity. Tufan et al. (2017) used
112 IET to study how failure to meet diversity-related promises by employers resulted in higher
113 anxiety and avoidant behavior by ethnic minority employees.

114

115 **3.0 POSSIBLE INTERVENTIONS**

116 Diversity and inclusion in the geosciences require intergroup *contact* since it is crucial for
117 people of different backgrounds to interact with one another. Both direct interaction between
118 members of different social groups (Pettigrew & Tropp, 2006) and indirect (i.e., vicarious) contact

119 (e.g., [Vezzali et al., 2019](#)) can improve relations. Nevertheless, daily human conflicts from around
120 the world demonstrate that intergroup contact alone is not sufficient to improve relations.

121 Effective means of improving intergroup relations are still developing (e.g., [Schellhaas &](#)
122 [Dovidio, 2016](#) and references therein), but it is important to consider a few nascent strategies that
123 may help in the context of geoscience education. Previous works showed there to be less bias
124 towards outgroups when individuals are designated into multiple groups (i.e., *multiple*
125 *categorization*) than when they are classified into two dichotomous groups (e.g., [Crisp et al.,](#)
126 [2001](#)). Another strategy of reducing bias is to encourage people to classify themselves and their
127 outgroups into a *superordinate common ingroup* (e.g., human beings or college students; [Gaunt,](#)
128 [2009](#)). [Albarello and Rubini \(2012\)](#) found that combining those two methods was the most
129 effective way of lessening dehumanization of those who identify as Black. As we qualified earlier,
130 while these methods have been shown to work, they are not invariably effective. For instance,
131 [Schellhaas and Dovidio \(2016\)](#) noted that the process of recategorization into a superordinate
132 common ingroup is not effective when a group feels that they are losing their identity in the
133 process. As such, an effective strategy may be to encourage seeing commonalities between groups
134 while being careful not to discourage group identifications. Experiments by [Bruneau and Saxe](#)
135 [\(2012\)](#) support another strategy to improve intergroup dynamics. They suggest that attitudes
136 toward outgroups can be improved when members of the dominant group (e.g., White Americans
137 and Israelis) are ‘perspective-taking,’ while those in the nondominant group (e.g., Mexican
138 immigrants and Palestinians) are ‘perspective-giving.’ These three intergroup interventions (i.e.,
139 multiple categorization, superordinate common ingroup, and perspective-taking/giving) are listed
140 in [Table 1](#) (see [Section 4.0](#) for recommendations).

141 There are other interventions that have not yet been explicitly connected to intergroup
142 emotions that may be helpful for improving diversity and inclusion in the geosciences. An example
143 is building trust. Consider that SND students likely come into an institution with mistrust due to
144 past unfair experiences in academic settings (e.g., [Okonofua & Eberhardt, 2015](#)). [Yeager et al.](#)

145 (2017) note that an institution is seen as trustworthy when it is recognized by an individual to be
146 “procedurally just” in that it is fair, and the institution has “personal regard” in that they care
147 about the wellbeing of that person. In their study, they found that African American and
148 Latino/a/x middle school students’ awareness of bias was predictive of their decrease in trust in
149 the institution. Another intervention is to provide specific encouragement to SND students.
150 Yeager et al. (2014) found that African American students who were provided feedback along with
151 specific encouragement that indicated the instructor was giving feedback because they knew the
152 student was capable of high achievement were more likely to persist and performed better than
153 those who only received feedback on their schoolwork. Future research should explore these and
154 other interventions that can help improve intergroup emotions among SND students in the
155 geosciences.

156

157 **4.0 RECOMMENDATIONS FOR GEOSCIENCE EDUCATORS AND** 158 **RESEARCHERS**

159 We encourage geoscience educators to begin by reflecting on their current teaching
160 practices and the departmental or university contexts within which their teaching occurs. The
161 simple step of recognizing that student emotions, including the kind of intergroup emotions
162 discussed in this commentary, are an unavoidable dimension of teaching and learning may help
163 instructors identify ways that their teaching practices could encourage participation among SND
164 students. We encourage educators to consider implementing intergroup emotions-based
165 interventions that we have outlined.

166 We do recognize that it will be challenging for educators to implement intergroup
167 emotions-based practices on their own. To that end, it is vital that we as a community conduct
168 discipline-based research on intergroup emotions and work to develop evidence-based
169 pedagogies that provide specific emotional support for SND students. Research on first- and

170 second-year SND undergraduate students is an important area of focus since early (potentially
171 negative) experiences may be particularly potent and since just over 50% of graduates with a
172 bachelor's degree in the geosciences declared their major during those two years ([Wilson, 2018](#)).
173 Research could also collect and examine the experiences of undergraduates, alumni, and,
174 importantly, SND students who have left geoscience programs. These data could speak to the
175 salience of intergroup emotions discussed in this commentary and provide a foundation for future
176 interventions. Since this work is inherently interdisciplinary, we strongly recommend
177 collaborating with researchers from educational and social psychology who have extensive
178 expertise in emotions and intergroup relations. We have concise recommendations for geoscience
179 educators and researchers listed in [Table 1](#) for each of the three intergroup interventions (i.e.,
180 multiple categorization, superordinate common ingroup, and perspective-taking/giving) that we
181 discussed in [Section 3.0](#).

182

183 **5.0 CONCLUSIONS**

184 The importance of emotions has been well-established both in educational psychology
185 research and in pedagogy. Nevertheless, emotions are not sufficiently discussed in the context of
186 diversity and inclusion within the geosciences (e.g., [Gates et al., 2019](#)) nor, more generally, among
187 universities (e.g., [ASU Diversity Plan, 2018](#); [JHU Progress Report, 2018](#)). In this commentary we
188 focus on emotions, specifically how considering intergroup emotions may help improve diversity
189 and inclusion in the geosciences. We believe that geoscience educators and researchers can take
190 steps within this framework to work toward greater diversity and inclusion in the geosciences. As
191 such, we strongly recommend incorporating the IET in future geoscience pedagogy and research
192 in the earnest hope that within the next decade the geosciences will have made significant strides
193 to become one of the most diverse and inclusive fields within STEM.

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TABLES

Table 1: Summary of intergroup emotions-based interventions with suggestions for implementation for geoscience educators and researchers

Intervention	Educators	Researchers	References
Multiple Categorization	Encourage students to classify themselves and their classmates in terms of multiple social categories instead of, for example, categorizing solely based on gender or race	Study the effectiveness of multiple categorization within the geosciences	e.g., Crisp et al. (2001)
Superordinate Common Ingroup	Encourage students to classify themselves into a superordinate common ingroup, such as geoscientists or college students	Identify superordinate common ingroups that are more effective at improving intergroup relations within the geosciences	e.g., Gaunt (2009)
Perspective-taking/giving	Create a classroom culture that encourages students in systemically dominant social groups to actively listen to the perspectives of SND students	Determine barriers to perspective-taking/giving within the geosciences	e.g., Bruneau and Saxe (2012)

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