Motivation and Connection to Earth on Geology Field Trips in New Zealand: Comparing American Study Abroad Students with Local Undergraduates

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Abstract:

Field education is a critical and enriching component of the undergraduate geoscience curriculum and is enhanced when combined with a study abroad program. The affective domain – defined in geoscience as emotion, motivation, and connection to Earth – is an integral part of the field experience. Using questionnaire data collected at the start of two geoscience field trips, this study compares motivation and connection to Earth of study abroad students from the United States with local New Zealand students. Results show that study abroad students are more intrinsically motivated for learning, place higher value on the field trip tasks, are more pro-environmental, and are more attached to and see more positive and diverse meanings in the field area. To leverage this and improve student outcomes, we recommend that this study abroad module be adapted to be more applied, environmentally focused, and place-based. Findings highlight the importance of teaching and learning to specific study abroad students, as compared to applying unchanged curricula from local institutions.

Introduction

For many university students, studying abroad is a highlight of their undergraduate experience. The number of students participating in such programs continues to grow, and study abroad has seemingly become part of the higher education "mainstream" (Niser, 2010, p. 3). The benefits of study abroad experiences are widespread, spanning personal and professional skills. Over 90% of students who studied abroad reported increased self-confidence and maturity, greater tolerance for

ambiguity, and long-lasting impacts on their worldview (Dwyer and Peters, 2004). Former study abroad students also reported greater interest in academic study and development of skillsets that influenced their future career paths (Dwyer and Peters, 2004). Furthermore, students who study abroad develop greater independence, global-mindedness, and intrinsic motivation (Hadis, 2005).

In geoscience, field education has long held a position in the higher education "mainstream" and its impacts are not unlike those of study abroad programs. Geoscience field education is regarded as beneficial for its development of transferrable skills such as problem solving, synthesis, and teamwork – all relevant for career preparation (e.g., Petcovic et al., 2009; Riggs et al., 2009; Stokes and Boyle, 2009; Whitmeyer and Mogk, 2009, Petcovic et al., 2014). Fieldwork draws students into the geoscience discipline (LaDue and Pacheco, 2013; Petcovic et al., 2014) and helps them develop their geoscientific identities (Petcovic et al., 2014).

The affective domain – broadly defined as emotions, attitudes, and values – is a crucial part of understanding student experiences in the field and why they engage with field learning (e.g., Boyle et al., 2007; Stokes and Boyle, 2009). This research seeks to investigate one broad question:

> What affective similarities and differences exist between students from the United States studying geology abroad in New Zealand and local students?

This work was pursued as part of a larger study addressing the development of sense of place on undergraduate geoscience field trips under varying pedagogical conditions (Jolley et al., 2018; Jolley et al., in review). We chose to compare students from the United States and students from New Zealand because we expected that there might be differences in how they interacted with the New Zealand landscape as visitors and locals. To understand this, we had to first uncover what perspectives the students were bringing to the field trip. Our choice of perspectives to investigate was guided by van der Hoeven Kraft et al.'s (2011) model for the affective domain in geoscience. This model is comprised of three different components: 1) emotion, 2) motivation, and 3) connection to Earth. Two of these aspects are addressed in this study and discussed in the following literature review: 1) motivation and 2) connection to Earth. Within the latter, both ecological worldview and sense of place are considered.

Motivation

Students' motivations for learning (e.g., Bandura, 1977; Dweck, 1986; Deci et al., 1991; Eccles and Wigfield, 2002) are guided by their attitudes and goals (Ryan and Deci, 2000). Self-determination theory addresses motivation by putting the individual and his or her choices at the core of understanding how these choices translate into actions (Deci and Ryan, 1985). In applying self-determination theory to education, Deci et al. (1991) identified three human needs important for the facilitation of motivation: 1) autonomy, 2) competence, and 3) relatedness. Support of these needs is required for the development of intrinsic motivation, or the desire to engage in a task because it is interesting or challenging (Ryan and Deci, 2000). The counterpart to intrinsic motivation is extrinsic motivation, or the desire to engage in a task because it is perceived to lead to a particular outcome (Ryan and Deci, 2000). Students who are intrinsically motivated have been shown to have greater conceptual understanding than those who are extrinsically motivated (Grolnick and Ryan, 1987). Intrinsically motivated students also tend to hold more engagement and enjoyment in their learning (Benware and Deci, 1984).

In the context of the geoscientific affective domain, van der Hoeven Kraft et al. (2011) highlight interest and self-efficacy, or the belief in the ability to successfully complete a task (Bandura, 1977), as key factors for developing shorter-term motivation for learning. They also point out that self-efficacy may be particularly low when students begin a discipline to which they have had limited previous exposure (Hidi and Renninger, 2006), as may be the case with geoscience (e.g., Jolley and Ayala, 2015). LaDue and Pacheco (2013) reviewed studies of how students become interested in geoscience (Levine et al., 2007; Houlton, 2010; Hoisch and Bowie, 2010). Three central themes emerged from LaDue and Pacheco's (2013) study that were widely consistent with the other studies reviewed: 1) academic experiences (e.g., introductory courses and field trips), 2) connections with people (most commonly instructors and family), and 3) engagement with Earth (e.g., outdoor experiences, travel, and rock/fossil collecting). Van der Hoeven Kraft et al. (2011) further suggest that identifying with the content may foster longer-term interest in the discipline. Previous work has suggested that the field is a crucial place where students cement their own personal identities as geoscientists (Kastens et al., 2009; Petcovic et al., 2014).

Connection to Earth

Connections with Earth influence student interest in geoscience and the continued desire to learn about it (van der Hoeven Kraft et al., 2011; LaDue and Pacheco, 2013). Global environmental issues and geopolitics are at the forefront of modern-day science and policy. Humans are dependent upon the environment, yet perceive varying degrees of entitlement in resource extraction and management. Geoscience spans fields such as oil and gas, groundwater hydrology, natural hazards, and engineering geology, and anecdotal data suggests that students studying geoscience may have variable motivations and interests within the discipline with respect to environmental problems.

Geoscience is increasingly expanding into sub-disciplines that incorporate earth systems science (Church, 1998; Whitmeyer et al., 2009). This disciplinary "paradigm shift" into a more systems-oriented earth science (Church, 1998, p. 172) is also reflected in the types of field courses that are offered. For example, research shows that while fieldwork is still widely valued, bedrock mapping is on the decline (Whitmeyer et al., 2009; Petcovic et al., 2014). Fieldwork is instead increasingly interdisciplinary, with added consideration for the interconnected nature of the Earth system (e.g., Trop et al., 2000; Eppes, 2009; Pearce et al., 2010).

Attention to places in which fieldwork is conducted provides a useful way to integrate interactions between people with the landscape. Previous work in human geography and environmental psychology describes the concept of 'sense of place' (e.g., Tuan, 1977; Brandenburg and Carroll, 1995; Williams and Stewart, 1998; Gustafson, 2001; Massey, 2005). Sense of place is formed through experiences, as people sense and perceive spaces and transform them into places through emotion and thought (Tuan, 1977). Two aspects of sense of place are commonly incorporated into management of natural places – place attachment and place meaning (e.g., Williams and Stewart, 1998; Young, 1999; Williams and Vaske, 2003). Place attachment describes the degree to which a person depends upon and identifies with a place (e.g., Williams and Vaske, 2003; Kyle et al., 2005; Chen et al., 2014). Place meaning describes the attributes that people identify in places (e.g., Young, 1999; Davenport and Anderson, 2005).

Van der Hoeven Kraft et al. (2011) highlight place attachment as a potential way to harness student connection to places through geoscience content. Both place attachment and place meaning have been previously investigated in geoscience education (Semken and Butler Freeman, 2008; Jolley et al., 2018; Jolley et al., in review). In the field, places are inherently at the center of the educational experience, even if only implicitly. Geoscience educators have explicitly incorporated place-based curricula that resulted in a variety of positive affective and cognitive student outcomes (e.g., Riggs, 2005; Semken, 2005; Semken and Butler Freeman, 2008; Williams and Semken, 2011; Monet and Greene, 2012). Even when not intentionally place-based, field trips that concentrate on one place or a small number of places produce positive shifts in place attachment (Jolley et al., 2018). In addition, place attachment correlates with pro-environmental behaviors (e.g., Vaske and Kobrin, 2001; Halpenny, 2010), as well as sensitivity to environmental impacts on that place (White et al., 2008).

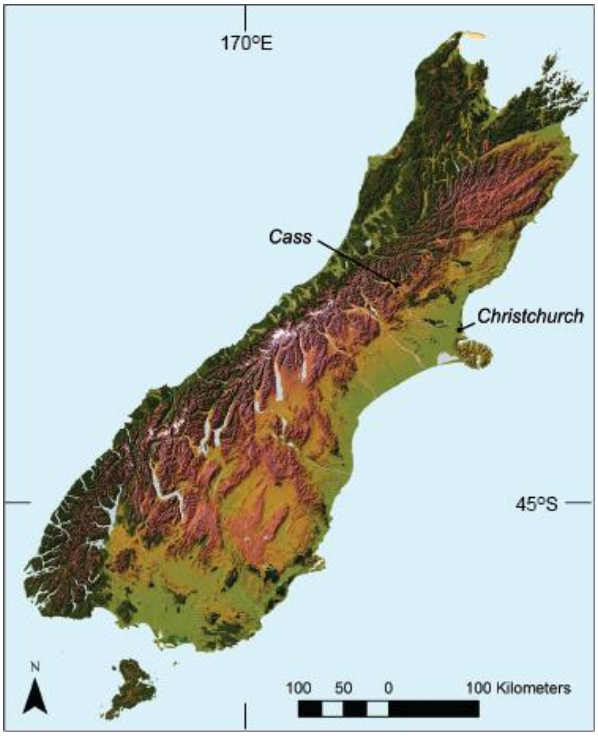
The previous sections have highlighted how aspects of the affective domain for geoscience (van der Hoeven Kraft et al., 2011) relate to why and how students learn in the field, through their motivation and connection to Earth. The importance of understanding connection to Earth in the context of increasingly interdisciplinary work in geoscience, with the potential for place-based approaches, was also discussed. In the following sections, we investigate some of the affective characteristics of a group of study abroad students visiting New Zealand. We use comparable data from local undergraduates to identify which of these characteristics set the study abroad students apart. We close with recommendations to further enhance the outcomes of study abroad students in the field.

Methods

Research Setting

This study examined two distinct student populations that undertook similar geological field studies at separate times in the same location: Cass (in the Castle Hill Basin), New Zealand (Figure 1). The two groups of students were: 1) U.S. undergraduate geology students studying abroad (referred to herein as "study abroad students") and 2) local NZ undergraduate geology students (referred to herein as "local students"). Study abroad students complete the field trip as a single module of a six-week field camp throughout New Zealand. This field camp is followed by a semester studying at the University of Canterbury in Christchurch (Frontiers Abroad, www.frontiersabroad.com). The students apply to and are selected for this program. Field camps are commonly required coursework for undergraduate geoscience students in the United States, but are not offered at all institutions (Whitmeyer et al., 2009). Combined with the fact that travel is a common reason people choose to study geoscience (LaDue and Pacheco, 2013), the Frontiers Abroad program is an appealing option for students.

Figure 1. Field trip location (South Island, New Zealand)



The local students complete the field trip as a stand-alone course immediately preceding the beginning of the academic year at the University of Canterbury, Christchurch, approximately one month after the study abroad students complete the equivalent module. The course is not required for completion of an undergraduate degree in geology, but it is required for admission to postgraduate study and is therefore completed by most geology majors. The learning objectives and associated assessments for the two field trips were similar (Table 1), with two additional short exercises on the trip with the local students.

Table 1. Learning objectives

Study Abroad Field Trip (U.S. Students)		**Local Field Trip (NZ Students)**	
Learning Objectives	**Assessment**	**Learning Objectives**	**Assessment**
Field mapping skills: contacts, structures, geomorphic features	Geologic map	Produce geologic maps of complexly deformed bedrock terranes	Geologic map and stratigraphic log
Interpretation of structural and geomorphic evolution (uplift, deformation, and glaciations)	Stratigraphic log	Recognize and measure bedding, cleavage, folds, and faults, and plot structural measurements on geologic maps	
Prepare geologic cross-sections	Cross-section	Produce geologic cross-sections from bedrock surface exposures	Cross-section
N/A	N/A	Identify and map geomorphic features related to active faulting	Active faulting exercise
N/A	N/A	Identify and map geomorphic features related to glacial processes	Geomorphic map

Most of the students were in their third year of study, though the age range of the local students was greater than that of the study abroad students (Table 2). Both groups had a similar range of ethnicities and number of previous geology field experiences. The gender breakdown in the two groups was different. The study abroad students were 74% female and 26% male, whereas the local students were 19% female and 81% male.

Table 2. Demographics of student participants

Characteristic	Variable	Study Abroad Students (n=23)	%	Local Students (n=31)	%
Gender	Female	17	74	6	19
	Male	6	26	25	81
Age	19	0	0	2	6
	20	16	70	11	35
	21	6	26	8	26
	22	1	4	5	16
	23+	0	0	5	16
Ethnicity	Caucasian/ NZ European/Pākehā	20	87	28	90
	Māori	0	0	1	3
	Asian	1	4	2	6
	Declined to Answer	2	9	0	0
Major	Geology	13	57	21	68
	Geology & Other Science*	6	26	7	23
	Environmental Geoscience	2	9	0	0
	Geology & Other Non-Science	2	9	3	10
Number of Geology Field Trips Previously Attended	0	1	4	0	0
	1-2	10	43	16	52
	3-4	8	35	9	29
	5+	4	17	6	19
*Includes geophysics and geochemistry majors.					

Survey Instruments and Analysis

Four validated and widely used instruments (Motivated Strategies for Learning Questionnaire, New Ecological Paradigm Scale, Place Attachment Inventory, and Place Meaning Questionnaire) were used to quantify student motivation and connection to Earth (see Appendix 1 for full questionnaire). We elected to only use validated instruments to ensure they measure what is intended. Furthermore, the selected validated instruments provide points of comparison with previous studies (e.g., Semken and Butler Freeman, 2008; Shephard et al., 2009). Demographic information, including gender, age, major, and previous field experience, was also collected (Table 2).

Questionnaires were administered at the beginning of the field trips, but before any activities had begun. The questionnaires were introduced by the lead author. The lead author accompanied the field trips as a researcher and not a tutor, and therefore had no influence over the students' performance in the course. Excerpts from student interviews have been incorporated to help contextualise the quantitative results where appropriate, by providing perspectives behind the data. Student interviews were conducted during the field trips when possible, or at most, three days later. These excerpts are

examples only and qualitative interview analysis was not a part of this study (see Appendix 2 for interview protocol).

Motivation

Student motivation was measured using the Motivated Strategies for Learning Questionnaire (MSLQ), which is comprised of two internally consistent and therefore independent sections (Pintrich et al., 1991). Only the motivation section (31 items) was used, as the learning strategy section was not relevant to the research question in this study. Students respond to statements that pertain to general student perceptions, as well as those specific to the course, using a Likert scale ranging from 1 (not at all true of me) to 7 (very true of me). There are six internally consistent scales within the motivation section of the MSLQ, each of which is given an average (out of 7) when scoring: 1) Intrinsic goal orientation: degree to which student is motivated by factors such as interest and challenge; 2) Extrinsic goal orientation: degree to which student is motivated by factors such as rewards, grades, and competition; 3) Task value: student perception of how interesting and useful the course is; 4) Control of learning beliefs: belief that student's efforts will result in a positive outcome; 5) Self-efficacy for learning and performance: expectation that student will do well in the course and can master the content; 6) Test anxiety: student stress and worry regarding the completion of tests/exams (high stakes assessments). Note that extrinsic goal orientation and test anxiety are the only constructs in which a lower score is desirable.

Connection to Earth

There is no single validated instrument to measure the connection to Earth component, including how people interact with the geology, as defined by van der Hoeven Kraft et al. (2011). Instead, we use three separate validated instruments to address some of the values, attitudes, and affinities that are highlighted in this component: 1) the New Ecological Paradigm scale (NEP; Dunlap et al., 2000); 2) the Place Attachment Inventory (PAI; Williams and Vaske, 2003); and 3) the Place Meaning Questionnaire (PMQ; Young, 1999).

The NEP contains 15 items that measure a person's pro-environmental orientation on a 5-point Likert scale ranging from strongly disagree to strongly agree (Dunlap et al., 2000). Dunlap et al. (2000) suggest conducting factor analysis on NEP responses before deciding whether to treat the scale as one or multiple constructs. Factor analysis helps identify patterns in responses and therefore aspects of thought that may be linked or categorized (e.g., Adams et al., 2006; Adams and Wieman, 2010; Jolley et al., 2012). Following Dunlap et al. (2000), we conducted principal components analysis with a varimax rotation (using SPSS Statistics 24). Our results indicate that all components have loadings greater than or equal to 0.325 on the first factor. Furthermore, eigenvalues of 4.01, 1.96, 1.58, and 1.17 suggest that much of the variance can be explained by one factor. These findings are similar to those of Dunlap et al. (2000), and like them, we have elected to use the NEP as one construct. Responses are averaged to give an NEP score out of a maximum of 5, to provide results comparable with another study done in New Zealand (Shephard et al., 2009).

The PAI contains 12 items that use a 5-point Likert scale ranging from strongly disagree to strongly agree to quantify a person's identity with and dependence upon a specific place (Williams and Vaske, 2003). In this case, the place name "Cass" was used on the questionnaire, as it is the name of

the field area and station. The instrument was otherwise left unchanged. Responses are totaled to give a place attachment score out of a maximum of 60.

The PMQ asks respondents to indicate the accuracy of 30 adjectives in describing a specific place, using a 5-point Likert scale ranging from poor description to excellent description (Young, 1999). As with the PAI, the place name "Cass" was used. The instrument was otherwise left unchanged. Responses are totaled to give a place meaning score out of a maximum of 150. Higher scores indicate more accurate (excellent as opposed to poor description) and diverse (more adjectives rated as accurate) descriptors.

Results and Discussion

Motivation

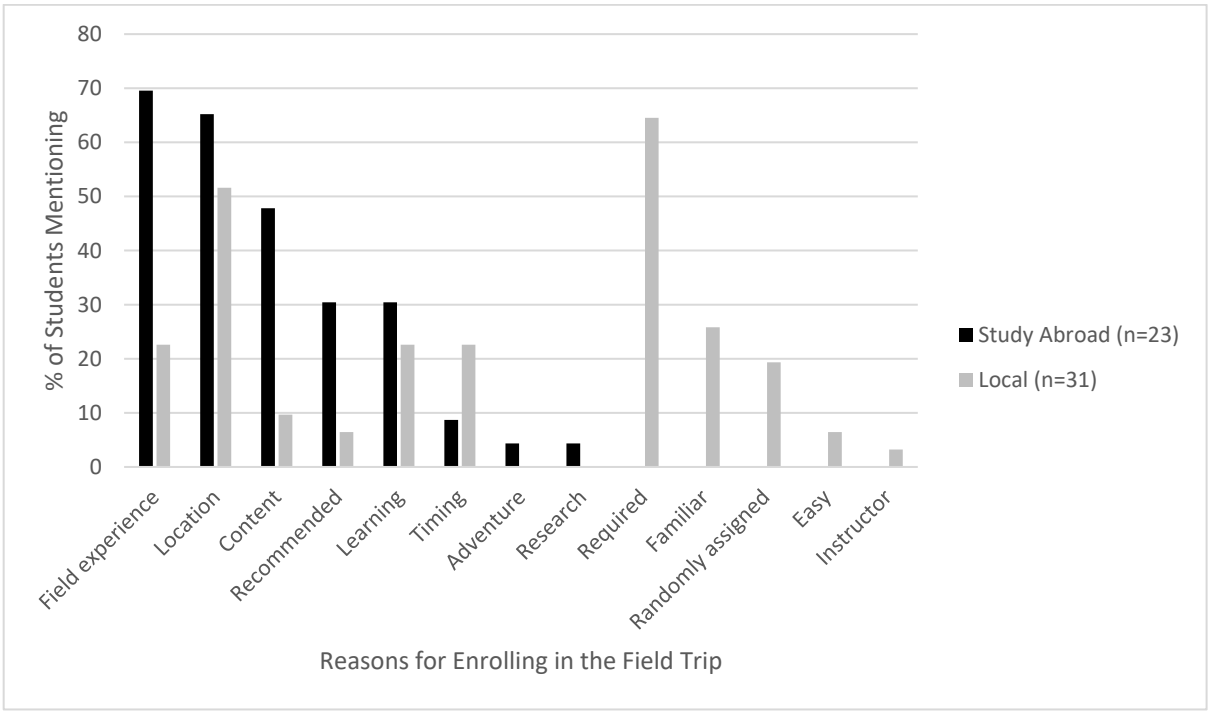
The study abroad students had significantly higher intrinsic goal orientation, lower extrinsic goal orientation, higher task value, and lower test anxiety than the local students (Table 3). However, they were similar in their control of learning beliefs and self-efficacy for learning and performance. The study abroad students apply to and are accepted in the field camp and are committed to a further semester of study abroad upon its completion. Therefore, it is perhaps unsurprising that they were more motivated by challenge and interest and less so by grades and fulfilling course requirements than the local students. Prior work suggests that intrinsically motivated students are more successful personally and academically when studying abroad (Chirkov et al., 2007; Chirkov et al., 2008), and that students self-report higher levels of intrinsic motivation after returning (Hadis, 2005).

Table 3. Motivated strategies for learning questionnaire results (each construct out of 7)

	Study Abroad (n=23)	**Local (n=31)**
Intrinsic Goal Orientation^	6.01 (0.65)	4.90 (0.91)
Extrinsic Goal Orientation^, [1]	3.42 (0.92)	5.35 (1.02)
Task Value^	6.41 (0.60)	5.39 (1.01)
Control of Learning Beliefs	5.39 (0.71)	5.71 (0.81)
Self-Efficacy for Learning and Performance	5.30 (0.83)	4.92 (0.98)
Test Anxiety*, [1]	3.50 (1.57)	4.50 (1.28)
Standard deviation in parentheses. *p=0.01, ^p<0.0001 (Mann-Whitney Test) [1]Note: lower score is desirable.		

Study abroad students also valued the field trip more than the local students (Table 3). Responses to the open-ended questionnaire question "describe why you enrolled in this particular course and field trip stream" (see Appendix 1 for questionnaire) were summarised and counted. Results from this question further clarify the differences between the study abroad and local students (Figure 2). The study abroad students gave largely intrinsic reasons for enrolling, including enjoyment of studying in the field, desire to visit New Zealand, interest in the content, and desire to learn/be challenged. Except for the desire to visit Cass, these intrinsic motivators were less prevalent among the local students. Instead, fulfilment of degree requirements was the most widely cited reason for enrolling, with just under one-fifth of the students reporting that they were randomly assigned to the field trip (two parallel trips with similar learning objectives are run in two different locations).

Figure 2. Reasons for enrolling in each field trip (Question: "Describe why you enrolled in this particular course and field trip stream.")



Both field trips involved the completion of a suite of assessments, handed in at the end of the field week/module. Students were given feedback while they were in the field, but the assessments comprised the entirety of their grades, and were largely summative in nature (e.g., Knight, 2002; Harlen, 2005; Taras, 2005). Local students' higher test anxiety (Table 3) may in part be attributed to the field trip being a prerequisite for postgraduate study. In contrast, some of the study abroad students were on a pass/fail system at their home institutions and did not receive grades. This difference in assessment structure may have contributed to the study abroad students' lower test anxiety (Table 3), as they would not have been stressed about what grade they were going to get in the course.

Previous research with the same study abroad program has found the study abroad students to report higher levels of confidence in their communication abilities than the local students (Dohaney et al., 2016). Although the students in this study do have significant differences in test anxiety, it is interesting that there were no significant differences between the students in both their control of learning beliefs and self-efficacy for learning and performance (Table 3).

Connection to Earth

Table 4. Connection to Earth results (ecological worldview and sense of place)

	Study Abroad (n=23)	**Local (n=31)[1]**
NEP (/5)*	3.91 (0.51)	3.69 (0.57)
Place Attachment (/60)**	32.39 (6.59)	25.52 (9.20)
Place Meaning (/150)^	104.00 (8.39)	80.61 (18.97)
Standard deviation in parentheses. *p=0.13, **p=0.01, ^p<0.0001 (Mann-Whitney Test) [1]For NEP, n=30 as one student did not answer this section.		

Ecological worldview

Study abroad students were on average more pro-environmental than local students, even if not statistically significantly so (p=0.13; Table 4). This contrasts with previous work that has found New Zealanders to be more environmentally concerned than Americans on average (Franzen, 2003). Many of the study abroad students also perceived this difference between the two nations, as indicated by this interview excerpt:

> "Well, I've always been an environmentalist-type person. And like, being in a place that is definitely way greener and more liberal towards like, 'global warming is real, guys!' than you know, the United States. It's nice because people compost, people recycle, people sort all their stuff without even thinking about it. And without bitching about it. Because people in the U.S. bitch about it, like it's some huge, horrible task." – Study Abroad Student 6

The local students in this study have more pro-environmental attitudes than the average New Zealand undergraduate student (average individual NEP scale scores of 3.69 vs. 2.46; Shephard et al., 2009). Geoscience majors appear to have more pro-environmental views as a whole; however, the liberal arts backgrounds of the study abroad students may promote even more pro-environmental views (e.g., Rowe, 2002; Weissman, 2012). Additionally, the two environmental geoscience students in the study abroad group were both more pro-environmental than the average student (4.20 and 4.47 vs. 3.91); however, they are too few to confirm whether this is a consistent trend. Regardless of whether or not students major in "environmental geoscience" by label, their relative pro-environmentalism might impact how they see themselves as geoscientists, or which sub-discipline they wish to pursue. When discussing the decision to major in geoscience, for example, one student explained:

> "The human use of the earth [course] was just so awesome. It was 9 a.m. and everyone else was like juniors and seniors trying to fulfil their science credit . . . but I was in the front row, the freshman nerd . . . One day [the instructor] was like, we're gonna spend the next six or seven lectures just on water. And I was like, what the fuck is that? Like what's going on? But then I was like super into it. And I went to office hours to talk to him about it and he told me to take hydrology, which is a 400-level class. And I was a freshman . . . So it was really scary . . . But the feeling of really being into it was what totally hooked me." – Study Abroad Student 6

Sense of place

Even before the field trip had taken place, study abroad students were significantly more attached to the field area, in which they saw significantly more positive and diverse meanings than the local students (Table 4). Questionnaire responses indicate that only 4% of the study abroad students had

ever been to New Zealand before, whereas 29% of the local students had been to the field area previously. At the time they completed the initial questionnaire, study abroad students had been in New Zealand for a total of one week and had only experienced a coastal landscape quite different from the landscape at Cass. The study abroad students' higher intrinsic motivation and task value may explain why they were more readily able to form attachments to and see a variety of meanings in the field area, as interest may develop due to task value and be supported by motivation (Hidi and Renninger, 2006). These students were completely invested in immersing themselves in New Zealand's outdoors to learn about the geology, and the landscape was completely novel to them. When discussing why they decided to come on this study abroad program, for example, one participant stated:

> "I mean, the rocks. Also, just adventure. I figured that eventually in being a geologist I'd make it to New Zealand. Just 'cause of the rocks. But I figured that I'd never really have the opportunity to just take off six months and just leave everything and come on an adventure. So, I figured now or never." – Study Abroad Student 5

In contrast, the local students were only 90 minutes from their university campus and were likely familiar with the type of landscape that characterized the field area, even if they had not previously visited the exact place. This is further evidenced by the 50% of local students that indicated that the location was a reason for enrolling in the field trip (Figure 2). The local students that had visited the field area before did have higher average attachment to it than those who had never visited it (28.11, n=9 vs. 24.45, n=22), though the difference was not statistically significant ($p=0.34$, note low n for those that had visited before). An interview with one of these students shows an interest in revisiting and learning more about Cass:

> "I lived in Christchurch, went to school here. We actually did lots of trips to Castle Hill when I was at school. So, that's why I was real keen to go to Cass. Thought I would do a bit of geology there." – Local Student 3

This higher attachment is consistent with other studies that have found differences in attachment after just one visit to a place (Semken et al., 2009; Jolley et al., 2018). However, the attachment of local students that had been to the field area before was still not as high as that of the study abroad students (28.11 vs. 32.39, $p=0.30$). It appears that novelty and motivation for being on the field trip have a greater influence on attachment than has been recorded with previous visits to a place. This is true even when the students may have discussed differing scientific and outdoor education perspectives during their previous visits, and hence, been previously introduced to a greater range of place meanings. Familiarity alone cannot produce stronger place attachments and meanings than those experienced by motivated study abroad students.

Gender differences

One notable difference between the study abroad and local groups is their nearly opposite gender ratios. Statistical analyses indicate that there are significant gender differences in the place attachment ($p=0.01$) and ecological worldview ($p=0.06$) data (MANOVA). Men in this study tend to have stronger place attachment, which is different to what has been previously reported in the literature (for a review, see Rollero and De Piccoli, 2010). Previous work has found either no gender differences, or that women have a stronger attachment (Rollero and De Piccoli, 2010). Women in this study tend to be

more pro-environmental, consistent with findings in environmental psychology (for a review, see Zelezny et al., 2000). No significant differences emerge in the effects of gender and field trip combined. Although the gender ratio has contributed to some of the trends in our results, we argue that in our case the central unit of analysis is student nationality/program of study. These demographics are typical of both the study abroad and local groups year to year, and therefore, recommendations are likely to be useful to the programs in future years.

Recommendations

In the following sections, we focus on recommendations for this and other study abroad field trips. Recommendations for the local field trip were outside the scope of this study; however, we expect that many of the broader lessons (e.g., the potential for place-based education and service learning in field education) will also apply to local contexts.

Specific Recommendations for this Field Trip

Questionnaire results are consistent with literature suggesting that study abroad students are intrinsically motivated and place high value on the learning activities in which they engage while overseas (Dwyer and Peters, 2004; Hadis, 2005). Future curricula for this program should be designed/modified to not only keep students engaged and interested, but also to take advantage of this added potential for learning (Kent et al., 1997). These study abroad students could be assigned more applied content (beyond the geology – see recommendations below), rather than simply the same curriculum and assessment that has been transferred over. However, care must be taken to ensure that these changes do not add too much cognitive load (e.g., Sweller, 1988; Sweller, 1994; Vytal et al., 2012). This is especially important given that the unfamiliar nature of the field environment (and in this case, a new country) also adds stresses on cognitive load (Orion and Hofstein, 1994).

Local field camps often draw upon collective knowledge about the geology of the field area and regional contexts that students obtain from prior coursework completed at their home institution. When developing instructional modules for study abroad students, acknowledgement needs to be made that these students will not have the same prior contextual knowledge that the local students have built over time. The tendency in this case may be to lean on previously published geological frameworks, which may promote more surficial learning or rote memorisation (e.g., Marton and Säljö, 1984; Trigwell and Prosser, 1991) and less student-centered learning (e.g., O'Neill and McMahon, 2005; Baeten et al., 2010). One solution may be to give students the opportunity to come up with their own descriptions or formal names for the features and stratigraphic units that they map in the area. This process will increase student autonomy and therefore aid in building connections with the place and its geology (Jolley et al., 2018). Using student-created descriptions and feature names also reduces the reliance on local geological knowledge, which may be helpful for instructors coming from abroad.

The more pro-environmental worldview of all students in the study (study abroad or local) may reflect the changing nature of the geoscience discipline and increasing focus on climate change and the Earth system (Church, 1998). It is reflective of work indicating that geoscience field education is adapting to be more interdisciplinary and less bedrock mapping-centric (e.g., Whitmeyer et al., 2009; Petcovic et al., 2014). There is added impetus for changes like this in the study abroad group, as these students are even more pro-environmental than their local counterparts. Students may be more interested in the environmental aspects of the field landscape, and this could be an added opportunity

to incorporate learning about attitudes toward and approaches to environmentalism specific to New Zealand (e.g., Cusick, 2009). For example, the field trip could incorporate discussions of local environmental attitudes (e.g., Shephard et al., 2009), management/conservation (e.g., Valentine et al., 2007), agriculture (e.g., Manderson et al., 2007), or natural hazards (e.g., Orchiston, 2012), or compare these to practices in the United States (e.g., Marshall et al., 2010). These broader contexts may be introduced as students progress through the study abroad module and could even be introduced on a more individual level to those who are more interested in environmental aspects.

Work in environmental psychology suggests that ecological worldviews are likely to influence how students develop a sense of place in the field area (e.g., Gustafson, 2001; van der Hoeven Kraft et al., 2011). It appears that for these study abroad students, the novelty of the field area and New Zealand supports a strong attachment to and positive meanings perceived in the field area, despite never having visited it, let alone the country, before. This novelty may create opportunities for greater interest in and engagement with the field area, which offers rich potential for the application of place-based curricula. Place-based education is structured around field locations and the cultural (human) meanings affixed to them through time. For example, place-based curricula may incorporate indigenous knowledge about the field area (e.g., Riggs, 2005; Semken, 2005; Penetito, 2009) or address local environmental issues (e.g., Gill et al., 2014).

The relevance of place-based education to the geosciences is widely recognised (e.g., Apple et al., 2014a; Apple et al., 2014b, Semken et al., 2017). Place-based curricula strengthen place attachment and meaning (Semken and Butler Freeman, 2008) and help to support "reciprocal equity" in places (Ault, Jr., 2008). Gruenewald (2003) put this best when he said, "place-based pedagogies are needed so that the education of citizens might have some direct bearing on the well-being of the social and ecological places people actually inhabit" (p. 3). The incorporation of place-based curricula could be extended further to include service learning, directly impacting the local community (e.g., Lewis and Niesenbaum, 2005; O'Steen and Perry, 2012).

General Recommendations for Study Abroad Field Programs

The many differences between the study abroad and local students in this study are helpful to consider in implementation of all study abroad curricula. In our experience, it is common for study abroad groups to request curricula and/or hire instructors from local institutions. While local instructors likely offer location-specific knowledge, they may not be familiar with teaching study abroad students or the ways in which they are different from local students. Local instructors might also not know exactly which assessment structure the students' home institutions use (e.g., pass/fail vs. letter grades), or how these structures are implemented in practice. Consequently, expectations may differ between home and local institutions and this may impact student motivation for learning. This is relevant to both curriculum design and intended learning outcomes, as well as how assessments are structured and evaluated. These considerations become increasingly complicated when study abroad programs accept students from several home institutions. Local instructors must then understand and respond to these differences from multiple perspectives.

The adoption of local curricula may be particularly common in field-based studies, such as geoscience, in which groups coming from overseas are unfamiliar with field locations and their geology. However, there is potential to develop field-based curricula to better suit study abroad

students and further enhance their learning outcomes. The results of this study highlight the importance of knowing the affective characteristics of the student population, as we have shown with environmental attitudes and sense of place. Addressing these needs through place-based or service learning content will help instructors develop and adapt curricula and assessments to be more relevant to their specific students. We suggest that site-specific geological knowledge, particularly when it relies on prior geological knowledge of the regional context, be at the periphery of these study abroad experiences. Instead, they should focus on transferrable skills and curriculum and assessment design that promotes student-centered learning and exploration of the field area.

Limitations and Future Work

This study solely focused on student characteristics at the beginning of the study abroad and local field trips. While our findings are important for the initial design and scoping of field curricula, an investigation into to what extent these characteristics are impacted by teaching and learning on the field trip would be worthwhile. Measuring student change in motivation for learning, pro-environmentalism, or sense of place after the field trip may help to identify specific practices that may be employed to further leverage these characteristics.

Similar research needs to be conducted on other field-based study abroad programs to see if our findings are specific to the New Zealand context, U.S. students, liberal arts students, geologists, or any combination of the above. It may also be interesting to investigate the same group of students on a field trip within their home state. This would aid in understanding whether our recommendations are more broadly applicable to other settings.

Conclusions

This study compared the affective characteristics of study abroad and local students before undertaking separate, but similar, field trips in New Zealand. Two components were measured using quantitative questionnaires before the field trip: 1) motivation and 2) connection to Earth, the latter of which is specific to the geoscience discipline. Within connection to Earth, ecological worldview, place attachment, and place meaning were investigated. Compared to local students, the study abroad students have on average:

- Higher intrinsic motivation
- Lower extrinsic motivation
- More task value on the field trip
- Lower test anxiety
- More pro-environmental worldviews
- More attachment to the field area
- More positive and diverse impressions of the field area characteristics

These differences suggest that it is not sufficient to apply local curricula to study abroad trips, as is often the case with field-based studies. Nor is it sufficient to bring in local instructors who are unfamiliar with study abroad students. With the above in mind, we make several recommendations to adapt local curricula and inform local instructors in a more effective manner:

- Adjust field area content to a more applied approach beyond geological content
- Incorporate environmental aspects of the landscape, including location-specific approaches
- Develop place-based curricula for study abroad field education, including service learning

These changes promise to result not only in more motivated and engaged study abroad students, but also more environmentally and socially conscious ones.

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Appendix A: Questionnaire

Part A
The following questions ask about your personal background. Please answer as honestly as possible. If you do not wish to answer a question, leave it blank. This is an anonymous survey, but your student number will be used to match pre- and post-trip questionnaires.

1. Gender: **2. Age:**

3.Ethnicity:

4.Major(s): **5. Year of Study:**

5a. Previous Post-Secondary Qualification(s): **5b. N/A:**

6. Circle any courses from the list below that you have taken at **university level**.

Anthropology	Engineering (any)	History	Physics
Biology	English	Māori and Indigenous Studies	Sociology
Chemistry	Human Geography	Maths	Statistics
Education	Physical Geography	Philosophy	Te Reo Māori

7. List and describe up to 5 **field-based courses** (including short courses and professional development) you have taken in **geology.**

8. List and describe up to 5 **outdoors or field-based courses** (including short courses and professional development) you have taken **outside of geology.**

9. List and describe up to 5 **employment positions** you have held in **geology, the outdoors, or a related field**, starting with the most recent.

10. Have you visited Cass before? **If yes**, please describe when you have visited and what you have done here.

11. Describe why you enrolled in this particular course and field trip stream (where multiple streams where available).

Part B
The following questions ask about your motivation for and attitudes about this class. Remember, there are no right or wrong answers, just answer as honestly as possible. Use the scale below to

answer the questions. If you think the statement is very true of you, circle 7; if a statement is not at all true of you, circle 1. If the statement is more or less true of you, find the number between 1 and 7 that best describes you.

	Not at all true of me						Very true of me
1. In a class like this, I prefer course material that really challenges me so I can learn new things.	1	2	3	4	5	6	7
2. If I study in appropriate ways, then I will be able to learn the material in this course.	1	2	3	4	5	6	7
3. When I take a test I think about how poorly I am doing compared with other students.	1	2	3	4	5	6	7
4. I think I will be able to use what I learn in this course in other courses.	1	2	3	4	5	6	7
5. I believe I will receive an excellent grade in this class.	1	2	3	4	5	6	7
6. I'm certain I can understand the most difficult material presented in the readings for this course.	1	2	3	4	5	6	7
7. Getting a good grade in this class is the most satisfying thing for me right now.	1	2	3	4	5	6	7
8. When I take a test I think about items on other parts of the test I can't answer.	1	2	3	4	5	6	7
9. It is my own fault if I don't learn the material in this course.	1	2	3	4	5	6	7
10. It is important for me to learn the course material in this class.	1	2	3	4	5	6	7
11. The most important thing for me right now is improving my overall grade point average, so my main concern in this class is getting a good grade.	1	2	3	4	5	6	7
12. I'm confident I can learn the basic concepts taught in this course.	1	2	3	4	5	6	7
13. If I can, I want to get better grades in this class than most of the other students.	1	2	3	4	5	6	7
14. When I take tests I think of the consequences of failing.	1	2	3	4	5	6	7

15. I'm confident I can understand the most complex material presented by the instructor in this course.	1	2	3	4	5	6	7
16. In a class like this, I prefer course material that arouses my curiosity, even if it is difficult to learn.	1	2	3	4	5	6	7
17. I am very interested in the content area of this course.	1	2	3	4	5	6	7
18. If I try hard enough, then I will understand the course material.	1	2	3	4	5	6	7
19. I have an uneasy, upset feeling when I take an exam.	1	2	3	4	5	6	7
20. I'm confident I can do an excellent job on the assignments and tests in this course.	1	2	3	4	5	6	7
21. I expect to do well in this course.	1	2	3	4	5	6	7
22. The most satisfying thing for me in this course is trying to understand the content as much as possible.	1	2	3	4	5	6	7
23. I think the course material in this class is useful for me to learn.	1	2	3	4	5	6	7
24. When I have the opportunity in this class, I choose course assignments that I can learn from even if they don't guarantee a good grade.	1	2	3	4	5	6	7
25. If I don't understand the course material, it is because I didn't try hard enough.	1	2	3	4	5	6	7
26. I like the subject matter of this course.	1	2	3	4	5	6	7
27. Understanding the subject matter of this course is very important to me.	1	2	3	4	5	6	7
28. I feel my heart beating fast when I take an exam.	1	2	3	4	5	6	7
29. I'm certain I can master the skills being taught in this class.	1	2	3	4	5	6	7

30. I want to do well in this class because it is important to show my ability to my family, friends, employer, or others.	1	2	3	4	5	6	7
31. Considering the difficulty of this course, the teacher, and my skills, I think I will do well in this class.	1	2	3	4	5	6	7

Part C

Please circle the response below that best describes your agreement with each statement (strongly disagree through strongly agree). Remember, there are no right or wrong answers, just answer as honestly as possible.

1. We are approaching the limit of the people the Earth can support.	Strongly Disagree	Mildly Disagree	Unsure	Mildly Agree	Strongly Agree
2. Humans have the right to modify the natural environment to suit their needs.	Strongly Disagree	Mildly Disagree	Unsure	Mildly Agree	Strongly Agree
3. When humans interfere with nature it often produces disastrous consequences.	Strongly Disagree	Mildly Disagree	Unsure	Mildly Agree	Strongly Agree
4. Human ingenuity will ensure that we do NOT make the Earth unlivable.	Strongly Disagree	Mildly Disagree	Unsure	Mildly Agree	Strongly Agree
5. Humans are severely abusing the environment.	Strongly Disagree	Mildly Disagree	Unsure	Mildly Agree	Strongly Agree
6. The Earth has plenty of natural resources if we just learn how to develop them.	Strongly Disagree	Mildly Disagree	Unsure	Mildly Agree	Strongly Agree
7. Plants and animals have as much right as humans to exist.	Strongly Disagree	Mildly Disagree	Unsure	Mildly Agree	Strongly Agree
8. The balance of nature is strong enough to cope with the impacts of modern industrial nations.	Strongly Disagree	Mildly Disagree	Unsure	Mildly Agree	Strongly Agree
9. Despite our special abilities, humans are still subject to the laws of nature.	Strongly Disagree	Mildly Disagree	Unsure	Mildly Agree	Strongly Agree
10. The so-called “ecological crisis” facing humankind has been greatly exaggerated.	Strongly Disagree	Mildly Disagree	Unsure	Mildly Agree	Strongly Agree

11. The Earth is like a spaceship with very limited room and resources.	Strongly Disagree	Mildly Disagree	Unsure	Mildly Agree	Strongly Agree
12. Humans were meant to rule over the rest of nature.	Strongly Disagree	Mildly Disagree	Unsure	Mildly Agree	Strongly Agree
13. The balance of nature is very delicate and easily upset.	Strongly Disagree	Mildly Disagree	Unsure	Mildly Agree	Strongly Agree
14. Humans will eventually learn enough about how nature works to be able to control it.	Strongly Disagree	Mildly Disagree	Unsure	Mildly Agree	Strongly Agree
15. If things continue on their present course, we will soon experience a major ecological catastrophe.	Strongly Disagree	Mildly Disagree	Unsure	Mildly Agree	Strongly Agree

Part D

The following questions ask about your perceptions of the location(s) of this field trip. Please circle the response below that best describes your agreement with each statement (strongly disagree through strongly agree). Remember, there are no right or wrong answers, just answer as honestly as possible.

1. I feel Cass is a part of me.	Strongly Disagree	Mildly Disagree	Unsure	Mildly Agree	Strongly Agree
2. Cass is the best place for what I like to do.	Strongly Disagree	Mildly Disagree	Unsure	Mildly Agree	Strongly Agree
3. Cass is very special to me.	Strongly Disagree	Mildly Disagree	Unsure	Mildly Agree	Strongly Agree
4. No other place can compare to Cass.	Strongly Disagree	Mildly Disagree	Unsure	Mildly Agree	Strongly Agree
5. I identify strongly with Cass.	Strongly Disagree	Mildly Disagree	Unsure	Mildly Agree	Strongly Agree
6. I get more satisfaction out of visiting Cass than any other.	Strongly Disagree	Mildly Disagree	Unsure	Mildly Agree	Strongly Agree
7. I am very attached to Cass.	Strongly Disagree	Mildly Disagree	Unsure	Mildly Agree	Strongly Agree

8. Doing what I do at Cass is more important to me than doing it in any other place.	Strongly Disagree	Mildly Disagree	Unsure	Mildly Agree	Strongly Agree
9. Visiting Cass says a lot about who I am.	Strongly Disagree	Mildly Disagree	Unsure	Mildly Agree	Strongly Agree
10. I wouldn't substitute any other area for doing the types of things I do at Cass.	Strongly Disagree	Mildly Disagree	Unsure	Mildly Agree	Strongly Agree
11. Cass means a lot to me.	Strongly Disagree	Mildly Disagree	Unsure	Mildly Agree	Strongly Agree
12. The things I do at Cass I would enjoy doing just as much at a similar site.	Strongly Disagree	Mildly Disagree	Unsure	Mildly Agree	Strongly Agree

Part E

The following questions ask about the location(s) of this field trip. Please circle the response below that indicates how accurately you think each word describes Cass (poor description through excellent description). Remember, there are no right or wrong answers, just answer as honestly as possible.

1. Adventurous.	Poor Description	Fair Description	Good Description	Very Good Description	Excellent Description
2. Ancient.	Poor Description	Fair Description	Good Description	Very Good Description	Excellent Description
3. Authentic.	Poor Description	Fair Description	Good Description	Very Good Description	Excellent Description
4. Beautiful.	Poor Description	Fair Description	Good Description	Very Good Description	Excellent Description
5. Comfortable.	Poor Description	Fair Description	Good Description	Very Good Description	Excellent Description
6. Crowded.	Poor Description	Fair Description	Good Description	Very Good Description	Excellent Description
7. Dangerous.	Poor Description	Fair Description	Good Description	Very Good Description	Excellent Description

8. Ecologically important.	Poor Description	Fair Description	Good Description	Very Good Description	Excellent Description
9. Educational.	Poor Description	Fair Description	Good Description	Very Good Description	Excellent Description
10. Exotic.	Poor Description	Fair Description	Good Description	Very Good Description	Excellent Description
11. Fragile	Poor Description	Fair Description	Good Description	Very Good Description	Excellent Description
12. Fun.	Poor Description	Fair Description	Good Description	Very Good Description	Excellent Description
13. Historical.	Poor Description	Fair Description	Good Description	Very Good Description	Excellent Description
14. Important for Māori culture.	Poor Description	Fair Description	Good Description	Very Good Description	Excellent Description
15. Important to preserve.	Poor Description	Fair Description	Good Description	Very Good Description	Excellent Description
16. Interesting.	Poor Description	Fair Description	Good Description	Very Good Description	Excellent Description
17. Overdeveloped.	Poor Description	Fair Description	Good Description	Very Good Description	Excellent Description
18. Pristine.	Poor Description	Fair Description	Good Description	Very Good Description	Excellent Description
19. Privilege to visit.	Poor Description	Fair Description	Good Description	Very Good Description	Excellent Description
20. Relaxing.	Poor Description	Fair Description	Good Description	Very Good Description	Excellent Description
21. Remote.	Poor Description	Fair Description	Good Description	Very Good Description	Excellent Description

22. Scenic.	Poor Description	Fair Description	Good Description	Very Good Description	Excellent Description
23. Scientifically important.	Poor Description	Fair Description	Good Description	Very Good Description	Excellent Description
24. Spiritually valuable.	Poor Description	Fair Description	Good Description	Very Good Description	Excellent Description
25. Threatened.	Poor Description	Fair Description	Good Description	Very Good Description	Excellent Description
26. Tranquil.	Poor Description	Fair Description	Good Description	Very Good Description	Excellent Description
27. Tropical.	Poor Description	Fair Description	Good Description	Very Good Description	Excellent Description
28. Unique.	Poor Description	Fair Description	Good Description	Very Good Description	Excellent Description
29. Unusual.	Poor Description	Fair Description	Good Description	Very Good Description	Excellent Description
30. Wilderness.	Poor Description	Fair Description	Good Description	Very Good Description	Excellent Description

Appendix B: Interview Protocol

Using a semi-structured format, students will be asked to discuss various factors relating to their field experience, primarily focusing on their perceptions of the place(s) that the field trip is occurring in. The following topics may be addressed during the interviews:

1. The student's personal background
    a. Where are they from?
    b. Where do they consider home?
    c. What are they majoring in (solely geology, or double major)?
    d. Why are they majoring that field?
    e. When did they decide on their major?
    f. Educational motivation or socio-environmental perceptions of interest that arise from the questionnaire.
2. General perceptions of the field trip
    a. What they like/dislike about it.
    b. What do they think the purpose was? What did they learn?

   c. What was most/least useful to learn?
   d. When was it most/least engaging?
3. How the location contributes to or detracts from the field trip
   a. Had they visited this location before? How many times? In what capacity?
   b. What are the most/least beneficial aspects of the location, as an educational environment?
   c. What is their favourite place in the mapped area?
4. Local visitation and education (where "local" is defined specifically for each area)
   a. What activities do they think locals participate in here?
   b. What features of the area do they think locals should learn about?
5. Tourist visitation and education (from further afield than what is defined as local)
   a. What activities do they think tourists participate in here?
   b. What features of the area do they think tourists should learn about? Do they think this should differ from what locals should learn about?
6. Personal interest in the location
   a. Would they return to this field trip location, in their own time?
   b. What types of activities could they see themselves doing?
   c. What are its most interesting/important features?
7. Impact of the field trip on their perceptions of the location
   a. How would they describe their relationship with the location(s)?
   b. Do they remember what their initial impressions were? Has the field trip changed their perceptions of its location(s)?
8. Miscellaneous other topics (study abroad students only, follow up interview):
   a. How attached do you feel to New Zealand, after spending a semester here?
   b. What are your most memorable experiences of your time in NZ?
   c. To what extent did The Lord of the Rings influence your decision to come here?
   d. To what extent did The Lord of the Rings influence your views on field camp and the outdoors in NZ?
   e. What are your perceptions of Kiwi attitudes towards the environment and conservation?
9. Any additional comments/questions that the interviewee introduces, based on the above series of topics.