Predicting Performance in an Advanced Undergraduate Geological Field Camp Experience

Matthew J. Dykas[1,a] and David W. Valentino[2]

ABSTRACT

This study examined the factors that contribute to students' success in conducting geological field work. Undergraduate students ($n = 49$; 51% female; mean age = 22 y) who were enrolled in the 5-wk State University of New York at Oswego (SUNY Oswego) geology field program volunteered to participate in this study. At the beginning of the field program, students completed a series of questionnaires inquiring about their academic record and their personal attitudes and beliefs. Next, participants completed a continuous series of geological field activities across 35 d in two locations in the northeastern U.S. Finally, multiple instructors independently rated students' field work performance and assigned final field program grades. Findings indicated that factors such as students' cumulative grade point averages and self-perceived preparedness for field work did not predict higher final field program grades. Instead, self-reported indices of motivation, academic self-concept, and self-efficacy predicted those grades. Moreover, evidence emerged that two domain-specific factors—intellectual orientation and achievement orientation—were uniquely associated with students' final field work grades. The implications of these findings are discussed in terms of instruction, learning, and professional employment. *© 2016 National Association of Geoscience Teachers*. [DOI: 10.5408/15-128.1]

Key words: fieldwork, GPA, motivation, personality

INTRODUCTION

Field work has a central role in geoscience, and teaching students to conduct field work successfully is often a major learning objective in undergraduate programs (Drummond and Markin, 2008; Whitmeyer and Mogk, 2009; Mogk, 2011). When working in the field, students have the opportunity to observe the natural world directly and to discern how their observations relate to their understanding of the Earth (Kern and Carpenter, 1984, 1986; Elkins and Elkins, 2007). For example, the examination of spatial, textural, and true-to-scale geological features may aid students in understanding the higher-level complexities of geological processes (Noll, 2003; Elkins and Elkins, 2007; Kastens et al., 2009; Mogk and Goodwin, 2012). Such examinations may also lead to the formulation of new ideas and concepts that could perhaps strengthen preexisting theories or challenge them (Trop, 2000; Kastens and Manduca, 2012). Overall, field work is a valuable and unique context through which aspiring geoscientists are able to discover and apply knowledge of geology (Petcovic et al., 2014).

Given the importance of field work in geoscience education, researchers have sought to identify the factors that contribute to students' successes in this area (see Kastens and Manduca, 2012, for a review). In scholarly contexts, prior educational success has been identified as a relatively good predictor of future academic performance (see French et al., 2014). Therefore, it is plausible that students who have earned high grades in their academic course work could complete many aspects of geological field work competently. However, no empirical study, to our knowledge, has examined this link, even in light of researchers' claims that geoscience field work requires a sophisticated set of cognitive skills and abilities to address complex problems in the field (Mogk and Goodwin, 2012). Engaging in field work also requires students to perform academically familiar tasks, such as participating in semi-structured lectures, working with various geological samples, compiling data, and preparing technical project reports.

Field work is also highly immersive and may require uncommon skill sets not necessarily gained in normal academic training (Kastens and Manduca, 2012). Such skill sets may range from students being able to locate themselves on maps in unfamiliar areas to perceiving geological structures through nonidyllic patterns of weathering and vegetation. Also, unlike in relatively contained classroom exercises, in which specific data are formally presented, there is enormous uncontained complexity in field exposures. In broader field exercises, for example, students are required to observe and process complex data to identify which data are important (see Mogk and Goodwin, 2012). Additionally, unlike in a classroom or laboratory setting, in which a student is instructed to complete some academic task in a relatively stable and comfortable environment, field work often requires students to overcome a host of physical challenges that may or may not be related to the specific academic tasks at hand (King, 2008). Contextually, for example, field work often requires students to face a myriad of uncontrollable environmental obstacles, including poor weather conditions and potentially unsafe animal habitats (see Oliveri and Bohacs, 2005; Mogk, 2011). Field projects also often require moderate physical exertion, which could include traversing rugged terrain in semi-isolated areas (Mogk and Goodwin, 2012). Coping with these harsh environmental conditions could be physically and/or psychological taxing and could affect students'

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[1]Department of Psychology, State University of New York, Oswego, New York 13126, USA
[2]Department of Atmospheric and Geological Sciences, State University of New York, Oswego, New York 13126, USA
[a]Author to whom correspondence should be addressed. Electronic mail: matt.dykas@oswego.edu. Tel.: 315-312-4013.

abilities to complete field work satisfactorily (Mogk and Goodwin, 2012).

Educational field programs are also potentially taxing on students because of the myriad of social and living demands the program places on them (Mogk and Goodwin, 2012). In general, students are expected to live together with fellow students and instructors within a relatively confined space for a protracted period, without ready access to typical amenities or outside communication from relatives and friends. Time spent in a field camp also usually includes performing basic and necessary chores, such as upkeep of personal and community gear, cooking, cleaning, and engaging in basic camp maintenance.

THE PRESENT STUDY

Principal Aim

This study's principal aim was to examine whether students' academic records, along with a selected set of self-perceived thoughts and beliefs, predicted their field camp performance. The relatively novel focus on self-perceptions was based on emerging data indicating that the affective domain has an integral role in geoscience learning (McConnell and van Der Hoeven Kraft, 2011) and that field work is connected to how students think and feel about themselves, with more positive field work performance being linked to more positive emotions and beliefs (Boyle et al., 2007).

The following set of students' self-perceived thoughts and beliefs were examined:

(1) Students' self-perceived *preparedness* for field camp was examined to assess students' degree of underlying anxiety and confidence about completing field work (see Boyle et al., 2007, for the potential role anxiety has in field work performance).
(2) Students' *motivation* was examined. Motivation refers to a person being moved or energized to do something for either intrinsic or extrinsic reasons (Ryan and Deci, 2000; Deci and Ryan, 1985).
(3) The quality of students' *academic self-concepts* was examined. According to research on the self-system (c.f., Leary and Tangney, 2012), individuals will forge an inner belief system about how competent they are in academic settings and how well they can engage in academic activities, complete academic work, and receive positive grades (see Valentine et al., 2004). Research indicates that these academic self-concepts can affect achievement significantly (Guay et al., 2003).
(4) Students' degree of *self-efficacy* was examined. Self-efficacy generally refers to a person's degree of confidence in performing certain tasks and is considered a major contributor to how effective a person is in successfully meeting task demands (Bandura, 1997, 2001).

This study was conducted using data collected from students enrolled in the rigorous and longstanding geology field program offered by SUNY Oswego.

SUNY Oswego Geology Field Program

The SUNY Oswego geology field program is administered by the SUNY Oswego Department of Atmospheric and Geological Sciences. Every other year, this 35-d program provides approximately 25 undergraduate geology majors with the opportunity to experience advanced, inquiry-based geology field research in two locations in the northeastern U.S. SUNY Oswego faculty members, visiting faculty members, and camp assistants manage the program and provide a diversity of geology backgrounds.

The field program is divided into three parts, and all students are expected to perform field work in both favorable and unfavorable environmental conditions.

Part 1 is approximately 8 d and serves as an introductory period. Students arrive at the base camp with varying degrees of field experience and are integrated into instruction in field geology techniques. Students complete relatively basic field-based geology independently (e.g., students study simple rock features that are readily accessible by vehicle and/or by walking trails within parklands or nature preserves).

Part 2 is approximately 10 d and requires students to engage in moderately difficult field work in relatively difficult terrain. Such terrain typically has well-marked trail access but requires students to examine rocks away from trails. During this project, the overarching aim is for students to improve their ability to navigate in the field and improve their overall field competencies.

Part 3 is approximately 15 d and requires students to move to a different base camp to work on a diverse geology field project in relatively rugged terrain. At that point, students assume a lead role in managing their time, the base camp, and the project work in small teams, whereas the faculty advises and provides logistical support. Overall, the field projects for parts 2 and 3 contain aspects of both small group– and inquiry-based learning with the students working on original field research collaboratively with other students (Mastascusa et al., 2011; Blessinger and Carfora, 2015). In addition to training students and assessing their performance, this field program provides students with opportunities to continue field project research, to use additional research for credited senior theses, and to present results both at professional conferences and in peer-reviewed reports (e.g., Stilwell et al., 2005; Valentino et al., 2008, 2011, 2012).

During the entire field program, all faculty, camp assistants, and students are required to camp outdoors in either private or public campgrounds. At these campgrounds, a large common area is established. Separate female and male tent areas are also established, and students are required to preserve the structural and sanitary integrity of their personal sleeping quarters. The faculty and staff tent area is established approximately 100 m from the student camp to provide privacy to both parties during off-hours and adequate student supervision. The students are divided into four rotating teams that are responsible for performing specific camp chores on a daily basis, such as firewood collection, meal preparation, and cleaning. In light of these conditions, the field camp also aims to promote student morale and high-quality field work by providing students with sufficient time for recreation and for tending to personal items with 1 to 2 d off per week.

METHOD

Participants

Forty-nine geology majors (51% female; mean age = 22 y) volunteered to participate in the present study. Sixty-one percent of these participants enrolled in the 2012 SUNY Oswego geology field program (cohort 1), and the remaining participants enrolled in the 2014 program (cohort 2). Across the two cohorts, the overall participation rate was 96%, and only two eligible students declined to participate. The gender distribution was statistically the same in each cohort [$\chi^2(1, 49) = 0.17$, $p = 0.68$], and the overall race/ethnicity distribution was 92% white. The grade-level distribution of the sample was 4% rising juniors, 80% rising seniors, and 16% graduating seniors. Most participants (90%) attended SUNY Oswego full time and were enrolled in the field camp program to fulfill their major requirements. The other participants attended a different college and received course credit at their respective institutions.

Measures

Grade-Point Average

Participants reported their current cumulative grade-point average (GPA) scores from their undergraduate course work.

Self-Perceived Preparedness for Field Work Scale

A new 10-item scale was created to assess the degree to which participants felt prepared for a field camp experience (Appendix A). This scale was based on a previous measure used to assess students' degree of anxiety and confidence in completing advanced academic work (Griffin, 2016). Individual items were rated on a 7-point Likert-type scale ranging from *not at all true of me* (1) to *very true of me* (7). Good internal consistency emerged for this new measure ($\alpha = 0.89$), and items were averaged to create a self-perceived preparedness for field work score. Higher scores represented greater self-perceived preparedness for field work.

Academic Motivation Scale

A 28-item measure (Vallerand et al., 1992) was used to assess participants' motivations for engaging in academic activities. Using the sentence stem "Why are you going to college?" and a 7-point Likert-type scale, ranging from *doesn't correspond at all* (1) to *corresponds exactly* (7), students rated their motivations for attending college. Items fell onto the following seven subscales. One subscale, *amotivation*, measured individuals' general lack of academic motivation. The other six subscales measured individuals' degree of (1) *external regulation*—being motivated by external demand or possible reward, (2) *introjected regulation*—being motivated from internal feelings, (3) *identified regulation*—being motivated through an inner belief system, (4) *intrinsic motivation to know*—being motivated to learn new things as a source of enjoyment, (5) *intrinsic motivation to experience stimulation*—being motivated by intellectual/physical sensory stimulation seeking, and (6) *intrinsic motivation to accomplish*—motivation stemming from the desire to perform an activity for the satisfaction of accomplishing or creating new things. According to Vallerand et al. (1992), respective subscale items were averaged and higher subscale scores indicated greater motivation in that area.

Academic Self-Concept Scale

Seven items from Reynolds et al. (1980) scale were used to assess participants' general academic self-concept. Using a 4-point Likert-type rating scale ranging from *strongly disagree* (1) to *strongly agree* (4), students rated items, such as, "Being a student is a very rewarding experience," and "All in all, I feel I am a capable student." Items were averaged to create an academic self-concept score. Higher scores represented more-positive academic self-concepts.

College Self-Efficacy Inventory

A 19-item instrument (Solberg et al., 1993) was used to assess participants' degree of confidence in participating in and/or completing a variety of college-related activities. Using a 7-point Likert-type rating scale, ranging from *not at all confident* (1) to *extremely confident* (7), students rated items such as, "Talk to your professors/instructors," "Understand your textbooks," "Get along with others you live with," and "Manage your time effectively." Items were averaged to create a college self-efficacy score. Higher scores represented greater college self-efficacy.

Field-Camp Final Grades

During the field program, participants completed scholarly projects, and at least three faculty members independently scored these projects on four principal criteria: (1) quality of field notes and field maps, (2) field coverage of the geology, (3) quality and accuracy of the final geologic map, and (4) content of the technical report. The weighted value of these criteria toward total scores varied throughout the field-camp experience based on the increasing difficulty of the assignments. For example, initially, when the focus was on developing observation skills and navigating the field, field notes, maps, and coverage of the geology were most strongly considered. Later in the program, the weights are adjusted so that each of the four components became weighted equally. Because these projects did not include any evaluation of actual student behavioral performance in the field camp, participants also received an ancillary score for their overall field-camp maintenance and collegiality based on multiple instructors' evaluations. At the end of the program, scores were independently submitted to the field program director. Based on these scores, the director assigned participants an objective final course grade on a 0 to 100 scale. Students' scores on their scholarly projects accounted for 95% of their final course grade, whereas the camp maintenance and collegiality score accounted for the remaining 5% of their grade.

PROCEDURE

All demographic and self-reported survey data were collected on the first day of the field program during a single group-based data collection session. Participants then completed a 5-wk overnight field camp experience, which included comparable instructional activities in 2012 and 2014.

During the 2012 session (21 May to 22 June), the first base camp was located on the Neversink River in Cuddleback, New York (Fig. 1). During part 1, pairs of students completed instructional projects related to (1) stratigraphic and structural analysis, (2) mapping sedimentary rocks, and (3) mapping Middle Devonian sandstone and shale. Parts 2 and 3 of the field program were staged from a base camp located in the south-central Adirondack Mountains, New York. Working in teams of three, participants engaged in 4–12 km^2 area mapping projects. These areas had walking trails, a limited number of rugged backcountry trails, and canoe-accessible waterways. Overall, the weather conditions were relatively seasonal with average low and high temperatures of 56°F and 77°F (13.3°C and 25°C), respectively. In this habitat, the biting insect

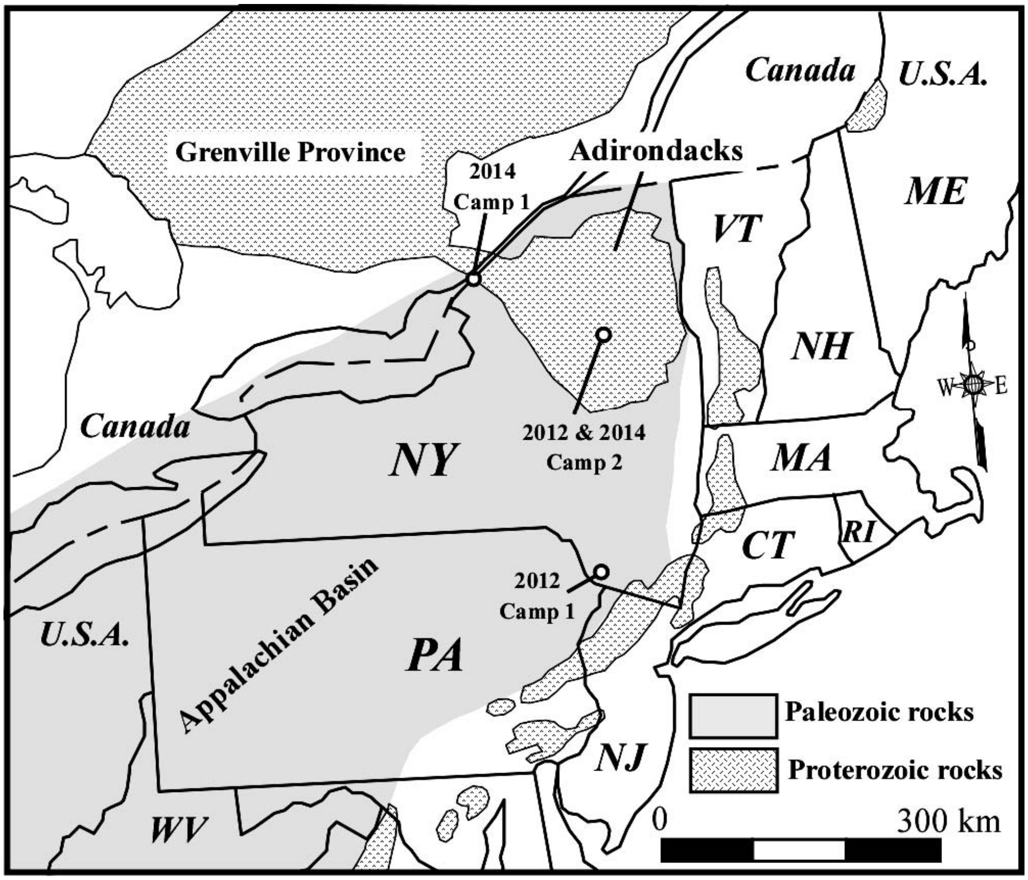

FIGURE 1: Map of the northeastern U.S. showing the locations of the SUNY Oswego geology field program base camps during 2012 and 2014.

condition was relatively poor, which resulted in one case of bite-related Bell's palsy.

During the 2014 session (21 May–24 June), the first base camp was located in the Thousand Islands Region of northern New York State. During part 1, pairs of students completed instructional projects related to (1) stratigraphic analysis, (2) mapping geological features, and (3) detailed structural analysis. Similar to the 2012 field program, parts 2 and 3 of the 2014 field program were staged in the Adirondack Mountains, New York. Working in teams of three, participants completed mapping projects in areas about 5–6 km^2, containing moderately rugged terrain and that were most accessible by a system of trails and waterways. Overall, the weather and biting insect conditions were similar to 2012. However, no students required serious medical attention for their bites.

At the end of both the 2012 and 2014 field camps, the field camp director calculated final grades for students based on aggregating separate and multiple evaluations of student work. The director and the instructors who had scored student work were blind to all information provided by the participants during the initial data-collection session for this study.

RESULTS

Descriptive Statistics, Preliminary Analyses, and Data Reduction

Table I contains the descriptive statistics for the main study scores. Overall, these scores showed sufficient variability. To examine whether any of these scores varied as a function of students' cohort assignment or gender, we conducted a series of independent samples *t*-tests. With regard to cohort assignment, 5 of the 12 *t*-tests were significant. More precisely, cohort 1 reported higher GPA scores than cohort 2 did [mean (M) = 3.05, SD = 0.47 versus M = 2.75, SD = 0.47, respectively, $t(47) = 2.17$, $p = 0.04$], as well as more amotivation [M = 1.87, SD = 1.33 versus M = 1.16, SD = 0.34, respectively, $t(47) = 2.26$, $p = 0.03$]. In contrast, cohort 2 reported more intrinsic motivation to know than did cohort 1 [M = 6.07, SD = .65 versus M = 5.43, SD = 1.07, respectively, $t(47) = 2.36$, $p = 0.02$], as well as more intrinsic motivation to accomplish [M = 5.16, SD = 0.80 versus M = 4.42, SD = 1.38, respectively, $t(47) = 2.12$, $p = 0.04$] and introjected regulation [M = 5.57, SD = 1.41 versus M = 4.54, SD = 1.55, respectively, $t(47) = 2.34$, $p = 0.02$]. With regard to gender, only 1 of the 12 *t*-tests was significant: females reported lower self-perceived preparedness for field work than did males [M = 4.26, SD = 1.22 versus M = 5.15, SD = 1.03, respectively, $t(47) = 2.75$, $p = 0.008$]. No significant cohort- or gender-related differences emerged in students' field camp final grades. Given this overall pattern of preliminary findings, we combined the data collected from cohorts 1 and 2 to maximize statistical power in our subsequent statistical analyses. However, in these analyses, we controlled for students' cohort assignment and gender to account for their potential effects.

TABLE I: Descriptive statistics ($N = 46$ for all scores).

Scores	*M*	SD	Range
GPA	2.93	0.49	1.55–3.95
Self-perceived preparedness for field camp	4.70	1.20	2.20–7.00
Motivation domains			
Amotivation	1.59	1.11	1.00–6.00
External regulation	5.49	1.34	1.75–7.00
Introjected regulation	4.94	1.56	1.00–7.00
Identified regulation	5.93	0.87	3.00–7.00
Intrinsic motivation to know	5.67	0.97	2.75–7.00
Intrinsic motivation to experience stimulation	3.78	1.27	1.25–6.75
Intrinsic motivation to accomplish	4.70	1.24	1.25–6.75
Academic self-concept	3.13	0.43	2.17–4.00
College self-efficacy	5.22	0.92	1.79–7.00
Field camp final grades	84.42	8.37	69.20–96.20

Principal Analyses

Partial correlation analyses indicated that neither students' GPA scores nor their self-perceived preparedness for field camp scores predicted their final field-camp grades (Table II). However, five of the seven motivation indices did predict those grades. More precisely, students who reported higher intrinsic motivation to know, greater intrinsic motivation to accomplish, greater identified regulation, greater external regulation, and lower amotivation earned higher final field-camp grades. Furthermore, students who reported a more positive academic self-concept and a higher degree of college academic self-efficacy earned higher final field-camp grades.

In light of these significant correlations, a follow-up hierarchical multiple regression analysis was conducted to determine which variables were the strongest predictors of students' final field-camp grades when considered together in the same statistical analysis. In preparation of this hierarchical multiple regression analysis, a principal-components factor analysis with an oblique promax rotation was conducted to reduce multicollinearity among the individual scores and to enhance the overall statistical power and interpretation of the subsequent regression analysis (Stevens, 1992). In this factor analysis, only the five significant motivation scores, the academic self-concept score, and self-efficacy score were included. Using both conventional eigenvalue and factor loadings cutoff scores of 1.0 and 0.40, respectively (see Stevens, 1992), the factor analysis revealed that the seven individual scores could be reduced into two latent factors (eigenvalues = 3.20 and 1.38, 65% of total variance explained; see Table III). Based on the factor loadings for the seven individual scores, an *intellectual orientation* factor score was computed based principally on intellectually related scores (i.e., intrinsic motivation to know, intrinsic motivation to accomplish, academic self-concept, and college self-efficacy scores). An *achievement orientation* factor score was also computed, based principally

TABLE II: Partial correlations between field camp final grades and other scores ($N = 46$ for all scores).

	Field Camp Final Grade Scores[1]	
Scores	*R*	*p*-Value
GPA	0.13	0.36
Self-perceived preparedness for field camp	0.15	0.31
Motivation domains		
Amotivation	**−0.35**	**0.01**
External regulation	**0.29**	**0.05**
Introjected regulation	0.24	0.11
Identified regulation	**0.28**	**0.05**
Intrinsic motivation to know	**0.33**	**0.02**
Intrinsic motivation to experience stimulation	0.27	0.07
Intrinsic motivation to accomplish	**0.35**	**0.02**
Academic self-concept	**0.35**	**0.01**
College self-efficacy	**0.37**	**0.009**

[1]The partial correlations were calculated after controlling for students' cohort assignment and gender. Significant findings are presented in bold text.

TABLE III: Summary of results from the principal components factor analysis ($N = 46$).

Scores	Factor Loadings[1]	
	Factor 1: Intellectual Orientation	Factor 2: Achievement Orientation
Motivation domains		
Amotivation	−0.40	−0.46
External regulation	−0.33	**0.95**
Identified regulation	0.31	**0.75**
Intrinsic motivation to know	**0.87**	−0.05
Intrinsic motivation to accomplish	**0.84**	0.03
Academic self-concept	**0.77**	−0.13
College self-efficacy	**0.68**	0.06

[1]Bold denotes which factor the scale scores loaded. Factor labels were assigned after the factor loadings were calculated.

on students' external and identified regulation scores, which focused on achieving general success and rewards.

After conducting this factor analysis, the two factor scores were entered into a multiple hierarchical regression (Table IV). Both of the factor scores accounted for a significant amount of variance (27% total) in students' final field-camp grades. Moreover, both intellectual orientation and achievement orientation accounted for a unique amount of variance in students' final field-camp grades. Overall, this analysis indicated that performance in field work is attributable to both underlying perceptions of intellectual ability and achieving general success and rewards.

DISCUSSION

In this investigation, evidence emerged that students' prior cumulative academic success did not predict their final grades in a relatively rigorous 5-wk geology field experience. Instead, performance was predicted by several types of student self-perceptions. This evidence is consistent with previous data indicating that affective components may have a critical role in field work (e.g., Boyle et al., 2007). Students' abilities to adjust to the field environment and satisfactorily complete field work could derive, in large part, to their abilities to remain motivated, especially in the face of relative personal and contextual adversity. Students who are intrinsically and/or extrinsically motivated may be more likely than nonmotivated students to successfully complete mentally and physically challenging field-work assignments and to work with other persons in a friendly, collegial, and cooperative way. Students who possess relatively positive academic self-concepts and/or possess higher levels of self-efficacy may also be more ready to manage the successes and failures present in novel field-work activities. These students may view challenging activities in a novel field-camp experience positively because they possess a general belief system that they are competent and/or confident in handling different sorts of academic work. On the other hand, students who possess a more negative academic self-concept and/or are less efficacious would not have such a general belief system to rely on when entering a novel field-camp experience, which would place them at risk for performing field work poorly. Considered as a whole, two domain specific factors—intellectual orientation and achievement orientation—can also uniquely account for differences in students' field-work final grades. This novel finding indicates that students who are oriented toward intellectual practices or achieving good outcomes (or show some combination of both) will be competent in conducting geological field work.

From a pedagogical perspective, instructors should consider the intangible factors that lead to students' field work success. Students who do not perform well in traditional classroom settings could perform well in the field if they are intellectually and achievement oriented. Conversely, high-achieving and seemingly well-prepared students may not flourish in those circumstances if they lack motivation, self-assurance, and/or self-efficacy. Instructors may consider remaining open minded regarding students' capacities to conduct field work, perhaps by giving low-achieving students the opportunity to engage in field work and monitoring high-achieving students for uncharacteristic struggles.

TABLE IV: Summary of the hierarchical multiple regression analysis predicting field camp final grades ($N = 46$).

	Field Camp Final Grades[1]			
	b (p-Value)	β	ΔR^2 (p-Value)	Total R^2
Step 1			0.03 (0.46)	0.03
Cohort	−1.28 (0.61)	−0.08		
Gender	−2.83 (0.25)	−0.17		
Step 2			**0.27 (0.001)**	**0.30**
Intellectual orientation	**3.30 (0.006)**	0.40		
Achievement orientation	**2.33 (0.04)**	0.28		

[1]b and β weights are from the variable's entry into model. Significant findings are presented in bold text.

Students could also benefit from an awareness of these findings. Low classroom and laboratory grades may not necessarily mean that one cannot do well in the field. Alternatively, students who have been academically successful and/or feel self-assured should take into consideration the dynamic nature of field work. Similarly, students seeking jobs requiring geological field work should consider that field work requires certain intangibles that may not necessarily be linked to how well they have completed geology course work. If these individuals are to succeed in field work, they may need a certain degree of inherent motivation and self-regulation to be outdoors working for extended periods under stressful conditions. Moreover, students and their instructors could take into special consideration that some female students may feel less prepared for field work than male students do, which is consistent with other gender-related findings reported in undergraduate science programs (see MacPhee et al., 2013). Although self-perceived preparedness for field work appeared to have no bearing on the quality students' actual field work in our investigation, gender differences in preparedness could have other consequences. For example, feeling less prepared, females may experience greater stress in the field than males.

For employers aiming to hire qualified geologists, prospective employees may have excellent academic records and might ''look good on paper,'' but their abilities to successfully conduct field work may not necessarily be linked to such factors. Thus, although an employer's first instinct may be to offer a job to the potential employee with the best academic record, employers might also consider that GPAs and self-perceived preparedness for field work are not good predictors of how well the potential employee will conduct geological field work. Rather, the employer could consider whether prospective employees, including those with subpar academic records, could possess the diligence to successfully conduct field work if they are inherently motivated and demonstrate positive scholarly attitudes. For field-work positions, employers could interview a range of individuals and offer positions to prospective employees based on an integrated consideration of prior academic success, personality traits, and scholarly thoughts, feelings, and ambitions.

In moving forward, this investigation only examined a selected set of factors that might have contributed to students' success in conducting geological field work. Future studies should examine this measure's validity and its relation to indicators of field-work performance. Future studies could also examine a variety of other factors, such as emotional intelligence (i.e., the capacity to express and regulate emotions in a self-aware and empathetic manner; see Goleman, 2005) and/or creativity (i.e., the pursuit for the novel and useful; see Batey, 2012). A new measure was also used to assess students' self-perceived preparedness for conducting field work. On a related note, students' GPA scores are a good, but perhaps not the best, marker of intellectual ability (see Neisser et al., 1996). Therefore, future researchers could take into consideration more general, domain-specific, and/or alternative indices of intellectual ability when attempting to predict field-work performance (c.f., Sternberg and Kaufman, 2011), as well as programs that may enhance students' mental preparedness for field work. Given both the physically rigorous nature of field work and the body–mind health connection (Astin et al., 2003), future researchers may also consider whether students' general physical fitness predicts field-work performance. Indeed, physically prepared students might cope better with the more-difficult field days, which could reduce stress and free both physical and psychological resources to conduct field work satisfactorily (see Vischer, 2007, for a general theoretical account of this potential link).

Furthermore, although this investigation provides new information about factors that predict students' success in a geology field-camp program, some important study limitations and caveats could affect the generalizability of the findings. First, the inferences and conclusions drawn from the statistical analyses rely on correlational data. Thus, although the findings support the claim that self-perceptions make a significant contribution to students' overall success in a geology field-camp program, causal claims cannot be made. Second, although the sample's gender distribution was balanced, the sample was rather homogenous regarding participants' race/ethnicity and educational background. Different findings might emerge in more ethnically/racially diverse groups of participants who are educated at colleges other than SUNY Oswego. Different findings might also emerge in other populations of students, including those with physical and/or learning disabilities.

Third, this study's findings could possibly have been related to the characteristics of the SUNY Oswego field-camp program. Different findings might emerge in studies in which the field camp is shorter or longer than 5 wk, where a greater number of students from nonsimilar institutions are present, and/or where a different degree of physical rigor is required. General camp conditions could also be a potential moderating factor, such as whether students live in large cabins versus personal tents, conduct field work in hot/dry weather versus cold/wet weather, and/or are exposed to venomous snakes versus biting insects.

Fourth, because the faculty sponsors and students lived in close proximity for several weeks, it is possible that faculty sponsors' evaluations of student work could have been implicitly biased by their personal relationships with students. For example, the thoughts and feelings expressed within these relationships and possibly captured in the student questionnaires could have affected the faculty sponsors' assessments of students' work. However, in this study, any faculty sponsor bias related to grading was likely minimal considering that all students were independently scored by at least three faculty members on each field-work assignment. Moreover, the rubric used to grade student work was largely objective in scope, and any student affective and social behavior was scored separately. These affective/behavior scores only contributed to a negligible portion of the students' final field-work grades. Finally, the final course grades were based largely on three project assessments, and different results might emerge in studies with different types of assessments. Future investigations could address these limitations and/or consider them when devising studies to examine the factors contributing to student success in geological field work.

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APPENDIX A
Self-Perceived Preparedness for Field Work Scale

Instructions: The following 10 statements refer to things that you will soon experience. There are no right or wrong answers, so please answer as accurately as possible. Use the scale below to respond to each statement. If you think the statement is very true of you, circle 7; if the 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
I believe that I will do well in the Field Program.	1	2	3	4	5	6	7
I feel uneasy or uncomfortable with the Field Program as a whole.	1	2	3	4	5	6	7
I am confident that I can address even the hardest aspects of the Field Program.	1	2	3	4	5	6	7
Thinking about the Field Program makes me feel anxious.	1	2	3	4	5	6	7
The process of doing projects in the Field Program may be difficult or hard, but I think I will be successful anyway.	1	2	3	4	5	6	7
I am worried about my final grade in the Field Program.	1	2	3	4	5	6	7
I know that I have learned what is necessary to complete the Field Program.	1	2	3	4	5	6	7
I feel my heart beating faster as I start to think about the Field Program.	1	2	3	4	5	6	7
I am sure that I will be able to address the more challenging/difficult projects in the Field Program.	1	2	3	4	5	6	7
I worry about what the Field Program will be like.	1	2	3	4	5	6	7