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RESEARCH REPORT

Perceived Impact of COVID-19 and Other Factors on STEM Students' Career Development

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Abstract: *In early 2020, colleges shifted abruptly from traditional in-person to remote distant instruction due to COVID-19 potentially exacerbating science, technology, engineering, and mathematics (STEM) students' recruitment and retention. This preliminary study using survey methodology was conducted with STEM students at a small (700 students) private college to examine questions related to students' perceptions of natural science careers, career decision-making factors, barriers influencing students' career path, including effects of COVID-19 on career goals, mental health, and perceived quality of instruction. A Qualtrics® survey was sent to 180 STEM students, from which we received 53 responses (29.4% response rate). Consistent with other studies, family was one of the most important factors supporting their career path. Students had a relatively upbeat career outlook despite being in the middle of a global pandemic and were only moderately worried about the impact of COVID-19 on their future career. Despite these relatively positive outcomes, the abrupt switch to online instruction was viewed unfavorably by most respondents, who valued the hands-on learning experiences obtained with traditional in-person instruction. It is possible that respondents' views of online instruction may improve over time as instructors become more adept at using new instructional tools. Future research should evaluate this aspect and whether students' career goals change across time as the pandemic unfolds.*

Keywords: *STEM, career choice, COVID-19*

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Introduction

The coronavirus disease (COVID-19) was first reported in Wuhan, China during late December, 2019 and by March, 2020 quickly spread to become a worldwide pandemic (World Health Organization, 2020). In the U.S., state governmental bodies quickly acted to curb the spread of COVID-19 and reduce fatalities. Strategies included a massive shut down of the economy, reshaping of social interactions (e.g., wearing a facial mask and maintaining three meters' distance between people), heightened personal hygiene practices (hand washing, refraining from touching one's face) and increased sanitization of objects and surfaces, to name a few (National Governors Association, 2020). Higher than normal unemployment rates occurred in the U.S. due to the shutdown of the economy U.S. Bureau of Labor Statistics showed a record unemployment rate of 14.7% in April, 2020 (US Bureau of Labor Statistics, 2020). For college and university students, this situation presented specific challenges.

Particularly under the conditions at the time of this study conducted in May 2020 (i.e., pandemic, economic concerns, etc.), difficulties in mental health status such as depression, anxiety, and/or stress was a concern. Wang et al. (2020) conducted a large (N =1,210) anonymous online survey of the general public in China during January 31 - February 2, 2020. A third of their sample indicated that they were experiencing moderate to severe anxiety with college students showing significantly higher anxiety and stress scores on the Depression, Anxiety, and Stress Scale (DASS-21) compared to those employed. Students in the U.S. may be similarly experiencing high anxiety and stress scores during the pandemic as some research has found (Rudenstine et al., 2020).

University and college students living in dorms, eating in cafeterias, and attending classes together present circumstances ripe to foster the spread of the virus. To cut rising transmission rates during the pandemic, colleges and universities around the world shifted en masse from traditional, in-person to remote delivery of instruction (Regehr & Goel, 2020). These instructional changes may make students less confident about whether they can reach career goals, which may result in changes in students' career interests. In particular, these COVID induced changes in instructional format for science, technology, engineering, and mathematics (STEM) students, may reduce hands-on laboratory and field experiences. Reduced confidence in performance skills and self-efficacy may reduce confidence in attainment of career goals.

Investigating STEM students' career perceptions is important to ensure that sufficient numbers of students enter STEM fields to create an ample skilled workforce, increase research and development of innovations, and train the scientists needed to solve significant problems. Between 2010 and 2020, the U.S. Bureau of Labor Statistics projected an 18.7% increase in

employment in all science and engineering fields. Biological, agricultural and environmental life scientists' employment projected an increase of 20.4% (STEM Education Data and Trends, 2014). Despite the lucrative career opportunities in STEM fields, enticing students to pursue a degree in science has faced challenges even prior to the pandemic. The National Center for Education Statistics (NCES) reported that between 2001 and 2018, 20% of all bachelor degrees were awarded in STEM fields. While the overall number of completed bachelor degrees had increased by 59% during that time period, health related professions showed a 12% increase and engineering and biological sciences fields each only showed a 6% increase (National Center for Education Statistics [NCES], 2020). To make matters worse for filling increasing opportunities in science and technology, Chen (2013) found an attrition rate of 48% of bachelor and 69% of associate degree students in STEM fields between 2003 and 2009.

Social cognitive career theory (SCCT; Lent, 2013; Lent et al., 1994) provides a framework for understanding the complex factors that may influence students' decisions to seek education and careers in STEM areas. Some of the main components proposed in the SCCT model include contextual factors, learning experiences, barriers, self-efficacy, outcome expectations, contextual supports and barriers leading to career performance and attainment of goals (Lent & Brown, 2019; Lent et al., 2000). Stemming from Bandura's (1986) theory, self-efficacy refers to a person's view of their ability to perform a task. Outcome expectations are the beliefs that certain career actions will have particular results (Lent, 2013). For example, being good at identifying different species of plants will lead to an environmental science career working outdoors and being in good health. Career barriers have been defined as "events or conditions either within the person or in his/her environment that make career progress difficult" (Swanson & Woitke, 1997, p. 446). Contextual forces (e.g., economic, family support, financial situation) may influence self-efficacy and then career choices and goals with an ultimate impact on performance and attainment of goals (Lent et al., 2003). Over the past 25 years, the SCCT model and its offshoots have received much research support (Lent & Brown, 2019).

Applying the SCCT model to the situation at the time of this study, COVID-19 and high unemployment represent contextual factors that may impact students' career goals and/or confidence in attaining that goal (Lent et al., 2000). The partial shutdown of the economy is another palpable and severe threat that may make certain STEM careers less appealing (e.g., health concerns) or unattainable (e.g., reduced financial resources). Outcome expectations related to employment availability may impact students' career interest. Under changing conditions during the COVID-19 pandemic, whether STEM students are confident in attaining their career goals and have the necessary support and lack of barriers to strive toward career goals is a question that needs to be addressed. Moreover, whether this milieu derailed the career interests of (STEM) college students has not been extensively studied.

Conversely, the pandemic may be associated with positive student attitudes (e.g., questioning, curiosity, skepticism, creativity) and have a beneficial influence on STEM students' career development. COVID-19 poses a significant problem for science to solve and may be, for a STEM student, motivation for further study. Students may be intrigued by the research questions that the pandemic presents such as, how can zoonotic or animal-human disease transmission be reduced? Can vaccine testing be made more efficient? Additionally, the media's portrayal of scientists showcasing an understanding of the problem and possible solutions to COVID-19 may serve as a role model and promote STEM career interest and positive career outcome expectations (Lent, 2013).

The purpose of this descriptive research is a preliminary examination of STEM college students' career goals during transition to online instruction due to COVID-19. The following research questions were examined using a survey method with STEM students at a small private college:

1. What are students' perceptions of natural science career outcome expectations?
2. What general career decision-making factors are important in supporting STEM students' career/graduate school path?
3. What general barriers influence STEM students' career/graduate school path?
4. Is COVID-19 affecting STEM students' career goals?
5. How do students perceive the pivot to online instruction due to COVID-19 impacted their STEM courses and laboratory classes?
6. Are STEM students experiencing high levels of stress, anxiety, or depression?

Method

Participants

There were 53 respondents out of a total of 180 STEM students (29.44%) who received the announcement and answered part of the survey, which represents a 10% margin of error at the 90% confidence level. However, there were 38 (21%) who completed the entire survey. For those who responded, the sample consisted of 26 (68.42%) males, 11 (28.94%) females, and 1 (2.63%) questioning or unsure. The average age was 22-years-old ranging from 19 to 26 years. Ethnic/racial background included 36 (94.74%) white, 1 (2.63%) black or African American, and 1 (2.63%) Hispanic, Latino, or Spanish origin. The average cumulative grade point average (GPA) for those respondents who gave permission was 3.56, ranging from 2.55 to 4.00 with 4.00 the maximum possible. The major selected for over half of all participants was either Fisheries & Wildlife Services, Environmental Science or Natural Resources and Conservation Management majors (see Table 1). There were 36.84% (n = 14/38) who were first generation or had parents who never attended college.

Participants' names were entered into a drawing for a $50 gift card upon completion of the survey as indicated in the study announcement. The College at Brockport-SUNY Institutional Review Board approved the study and participants provided informed consent prior to completing the online survey.

Table 1.

Number of respondents in each STEM major

Major	n	%
Fisheries & Wildlife Services Majors	13	33.33
Environmental Science	6	15.38
Natural Resources and Conversation Management	6	15.38
Forest Ecology Management	4	10.26
Biology	3	7.69
Ecological Restoration	3	7.69
Human Health and The Environment	2	5.13
Environmental Studies	1	2.56
Sustainability	1	2.56
	39	

Materials

The Qualtrics® survey contained a battery of measures, totaling 47 questions. Survey topic areas, in order of presentation, were career choice, important factors supporting career, barriers, effect of COVID-19, online instruction, mental health status, and demographic questions.

Career Decision-making. Career choice was assessed by asking respondents to select the occupation most closely matching their future desired career. Occupations listed as career possibilities from which to choose were based on those from the 2017 National Survey of College Graduates, National Science Foundation (NSF), United States Census Bureau. Additional careers were added in the natural science area.

The Engineering Outcome Expectations scale was utilized in this study (Lent et al., 2001; Lent et al., 2003). This scale assesses respondents' perception of what will be likely as result of a major in engineering with 10-items (e.g., do work that I would find satisfying) rated along a 5-point scale labelled as not at all likely, a little, moderate, quite, and extremely likely. In this study, the original question stem was modified by replacing the engineering major with natural science career path and an additional item was be able to maintain good health. Psychometric evaluation of the original scale suggests that it has good internal reliability and correlates with measures of task and coping efficacy, interests, and choice goals (Lent et al., 2003).

Career contextual supports and barriers were measured with a 17-item scale used by Haynes and Jacobson (2015) based on the widely used Perceptions of Barriers scale developed by McWhirter (1997). Respondents were asked to rate the degree of importance of each item for supporting their current career/graduate school path along a 7-point scale (e.g., mother, father, subject teacher, etc.). Additional items added to the list included internship experiences and

service-learning experiences. Barriers for career/graduate school path (e.g., lack of family support, not knowing how to study well) were rated along a 7-point scale ranging from 1 (not a barrier) to 7 (very much a barrier). Adequate test-retest reliability and concurrent validity with career decision making self-efficacy, vocational skills self-efficacy, and outcome expectations has been found with the Perception of Barriers scale (McWhirter et al., 2000).

COVID-19 Impact on Career. Several questions were constructed to directly assess the possible effects of COVID-19 on participants' academic and career interest. These questions were reviewed for face validity by the authors and two students. One question concerned participants' perceived confidence in attaining career goals given the current health concerns (i.e., COVID-19) as measured along a 4-point scale labeled as extremely confident, moderately confident, slightly confident, and not at all confident.

Another question posed was to what degree has the COVID-19 pandemic impacted your interest in science using a 5-point scale labeled as extremely positive to extremely negative. If a respondent selected extremely positive then a question was asked about in what way(s) has the COVID-19 pandemic positively affected your interest in science. The respondent could check any or all items from a list for their answer to this question (e.g., presents a critical health concern to address, provides role models or heroes to emulate, demonstrates the usefulness of science for solving important problems, illustrates the importance of data for decision making, sparked interest in animal-human disease transmission (zoonotic), and other).

Respondents were also asked to what degree has the COVID-19 pandemic impacted their career goal, with a 5-point scale labeled as extremely positive impact, somewhat positive, no impact/unsure, somewhat negative impact, and extremely negative impact. If a respondent selected extremely negative impact, then they were asked, in what way(s) do you perceive that COVID-19 pandemic has negatively impacted your career goal. Various possibilities were listed for the respondent to select including cannot pursue my original career goal, financial, inability to concentrate on my studies, increase in negative emotions impairing everyday functioning (e.g., anxiety, stress, depression), difficulty with switching to online instruction, perceived reduced quality of instruction, and worry about one's college.

The survey also contained a question asking respondents to rate the degree to which they are worried about the impact of COVID-19 pandemic on their future career. A 5-point scale labelled as a great deal, a lot, a moderate amount, a little, and none at all was provided.

Online Instruction. A series of questions were asked about the respondent's online instruction experience including whether the individual had previously completed online college/university-level courses and, if so, how many. How has online instruction impacted their science classes and, in a separate question, their laboratory classes were also asked. Both questions used a 5-point scale labeled as extremely positive impact, somewhat positive impact, no impact/unsure, somewhat negative impact, and extremely negative impact.

Mental Health. The Depression, Anxiety, and Stress Scale (DASS-21; Lovibond & Lovibond, 1995) was used as a screening tool to assess mental health status. Support for use of the DASS-21 as an assessment of general distress with young adults exists (Kia-Keating et al., 2018).

Demographic Information. Demographic information collected included age, gender, race/ethnic background, GPA, and major area of study.

Procedure

A descriptive research design with survey method was employed to gather information about respondents' career goals, career barriers and supports, impact of COVID-19 on career and science interest, mental health status, and demographics. The online survey was sent to 180 STEM students at a small (approximately 70 students) private college in upstate New York. The announcement to participate, with an embedded link to the Qualtrics® survey, was emailed by one of the authors prior to the end of spring, 2020 term on May 1, 4, and 12, 2020. Campus shut down and transition to online classes occurred March 23, 2020 under the directive of the Governor of New York such that students were exposed to online instruction for 5 to 7 weeks prior to completing the survey.

Scoring of DASS-21 responses by the researchers occurred within 24 hours after submission of the survey by a respondent. If a respondent's DASS-21 scores for depression, anxiety, and/or stress were in the severe or extremely severe range then a recommendation to access mental health services with a counselor's name and contact information was emailed to the individual.

Quantitative Data Analysis

Data analysis involved treating Likert-type scale data as interval measures. Descriptive statistics, including means (M), standard deviations (SD), and Pearson Product Moment correlation coefficients were used to summarize the data.

Results

Future career

Over half (59.6%, 28/47) of respondents identified biological scientist (e.g., botanists, ecologists, zoologists) or natural resources (e.g., fisheries technician, environmental technician, wildlife scientist, conservation scientist, land use planner) as their future career (Table 2).

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Table 2.

Respondents' selection of an occupation that most closely matches their future desired career (N = 46).

Future Desired Career		Number of Respondents
Biological/Life Scientist	Biological scientists (e.g., botanists, ecologists, zoologists)	14
Natural Resources		14
Teacher-Pre-college		3
Consultant		2
Law Enforcement		2
Engineering		1
Technologist/Technician/Surveyor		1
Health Occupation-epidemiology		1
Lawyer/Judge		1
Green Construction Specialist		1
Wildland Fire/USFS Forestry		1
Technician		1
Zookeeper/Animal Care Specialist		1
Ecological Restoration		1
Law Enforcement/Ethics Advisor		1
Research Associate/Assistant		1
Service Occupation, Except Health		1
Manager, Tree Care Industry		1
	Total	46

Respondents evaluated what their future career will be like on the Outcome Expectation scale, as seen in Figure 1. Many respondents perceived that it is extremely likely that their natural science career will allow them to experience satisfying work (54.6%, M = 4.3, SD = 0.8), do exciting work (40.9%, M = 4.1, SD = 0.9), have a career valued by family (38.6%, M = 4.0, SD = 1.1), do work that can "make a difference" in people's lives (38.6%, M = 4.3, SD = 0.6), feel that there are people "like you" in this field (31.8%, M = 4.1, SD = 0.9), and maintain good health (25.0%, M = 4.1, SD = 0.7). On the other hand, they were not at all likely to feel pressure from parents or other important people to change their major/career to some other field (59.9%, M =1.7, SD = 1.0) nor receive negative comments about their major/career from their friends (58.1%, M = 1.8, SD = 1.1).
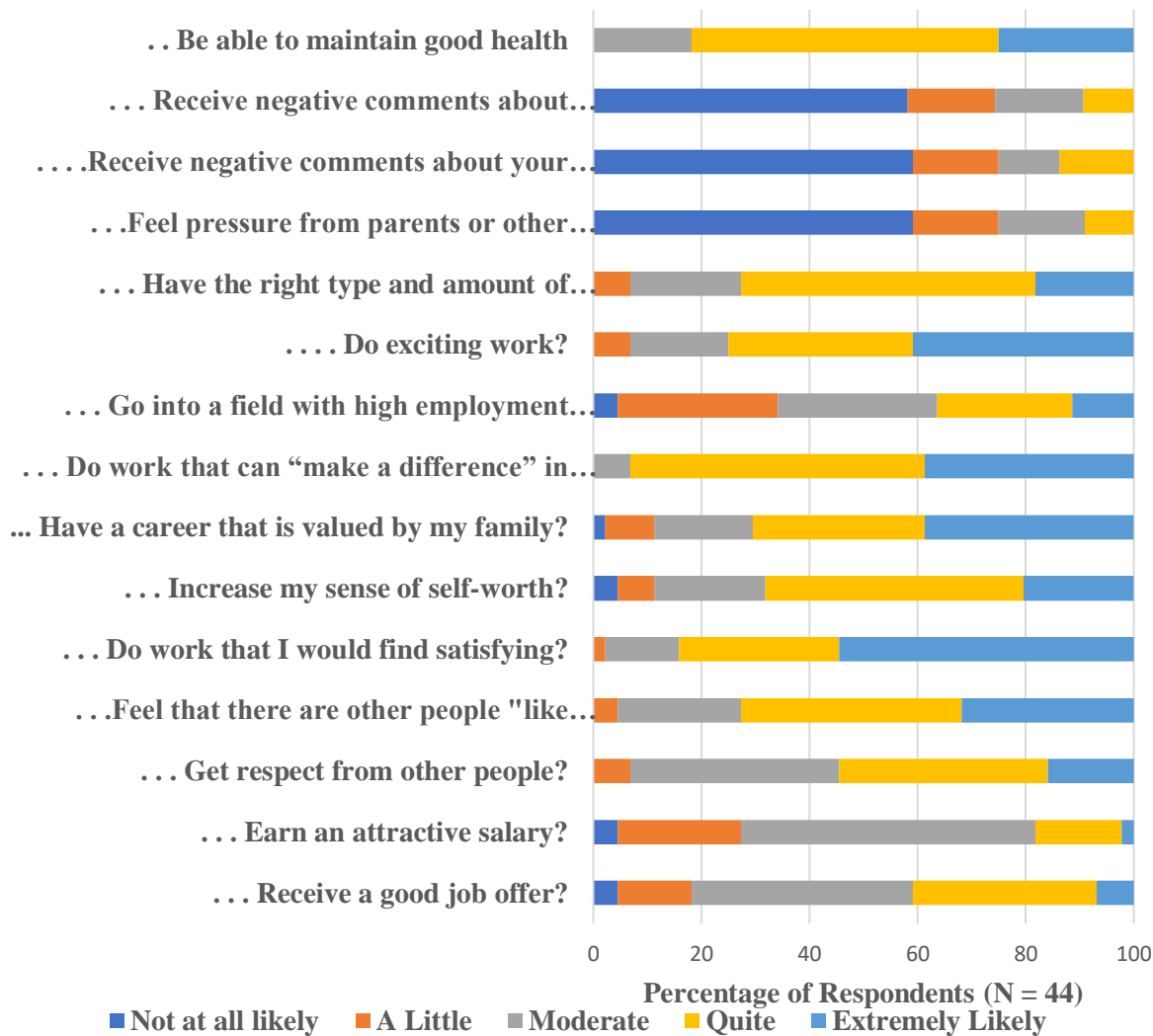
Figure 1. Percentage of respondents' ratings along a 5-point Likert-type scale of the perceived likelihood of various events and situations if they were to go on into a natural science career.

Using the Contextual Supports and Barriers scale, factors rated as very important by respondents include mother (43.2%, M = 5.2, SD = 2.1), knowledge about occupation (40.9%, M = 6.1, SD = 0.9), being naturally inclined (39.5%, M = 5.9, SD = 1.2), college teacher (34.9%, M = 5.2, SD = 1.2), science related classes (34.1%, M = 5.6, SD = 1.6), and father (31.8%, M = 4.8, SD = 2.1) as seen in Figure 2.
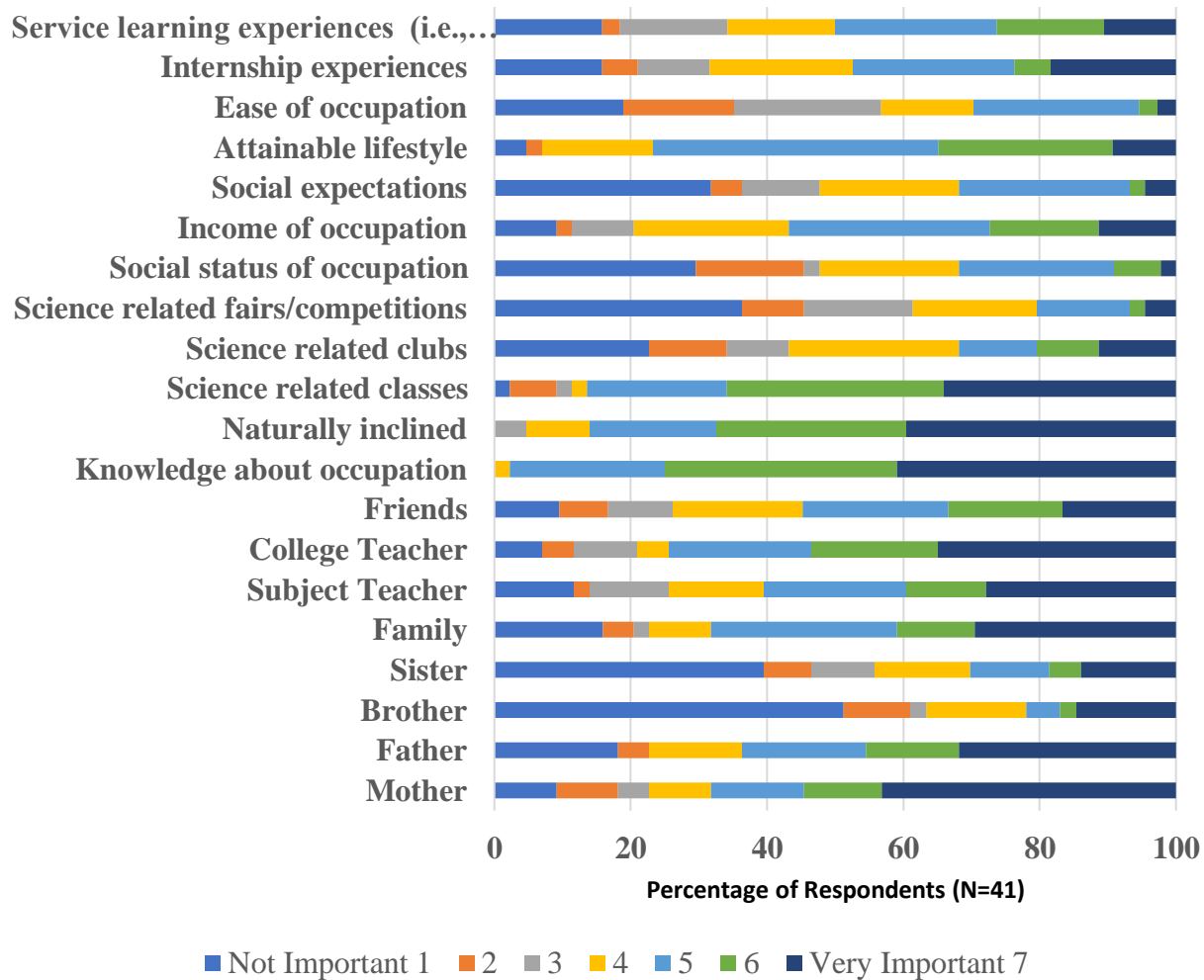
Figure 2. Percentage of respondents' ratings along a 5-point Likert-type scale of the perception of the importance of factors in supporting their current career/graduate school path.

Barriers for respondents' career/graduate school path were also rated (Figure 3). Overall, no item was perceived as a barrier for all and there were only a few barriers noted by many. The main career barriers identified by respondents were school is too expensive (M = 4.3, SD = 2.0), lack of financial support (M = 3.8, SD = 2.1), and lack of field experience opportunities (M = 3.2, SD = 1.9).

Rate the degree to which the following factors are barriers for your career/graduate school path
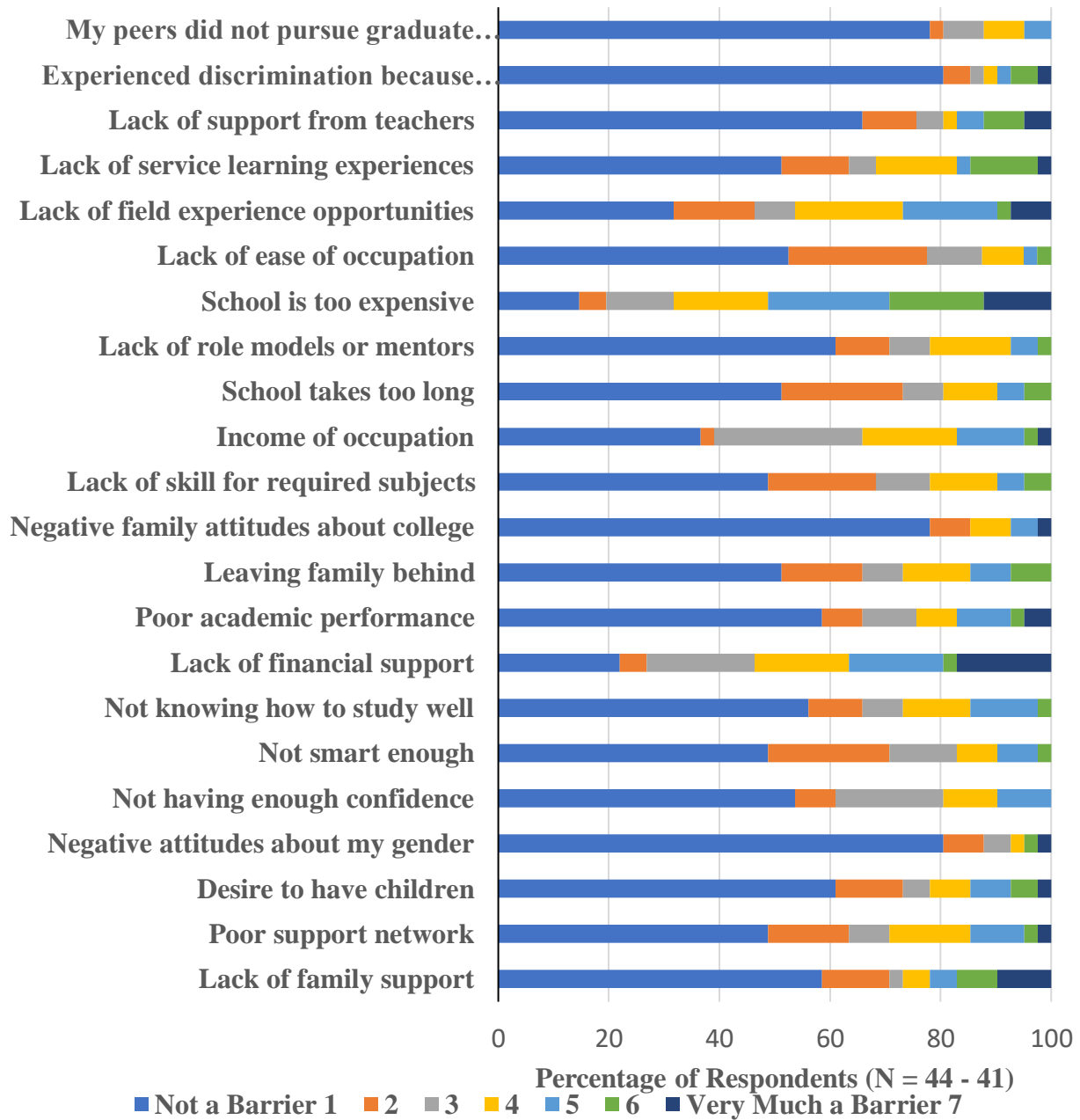

Figure 3. Respondents' ratings along a 5-point Likert-type scale of the perceived barriers of various factors for their career/graduate school path.

COVID-19

Most respondents were moderately (41.5%) or slightly (26.8%) confident about attainment of their career goals in light of COVID-19 (M = 2.8, SD = 0.92) as seen in Figure 4, panel 1.
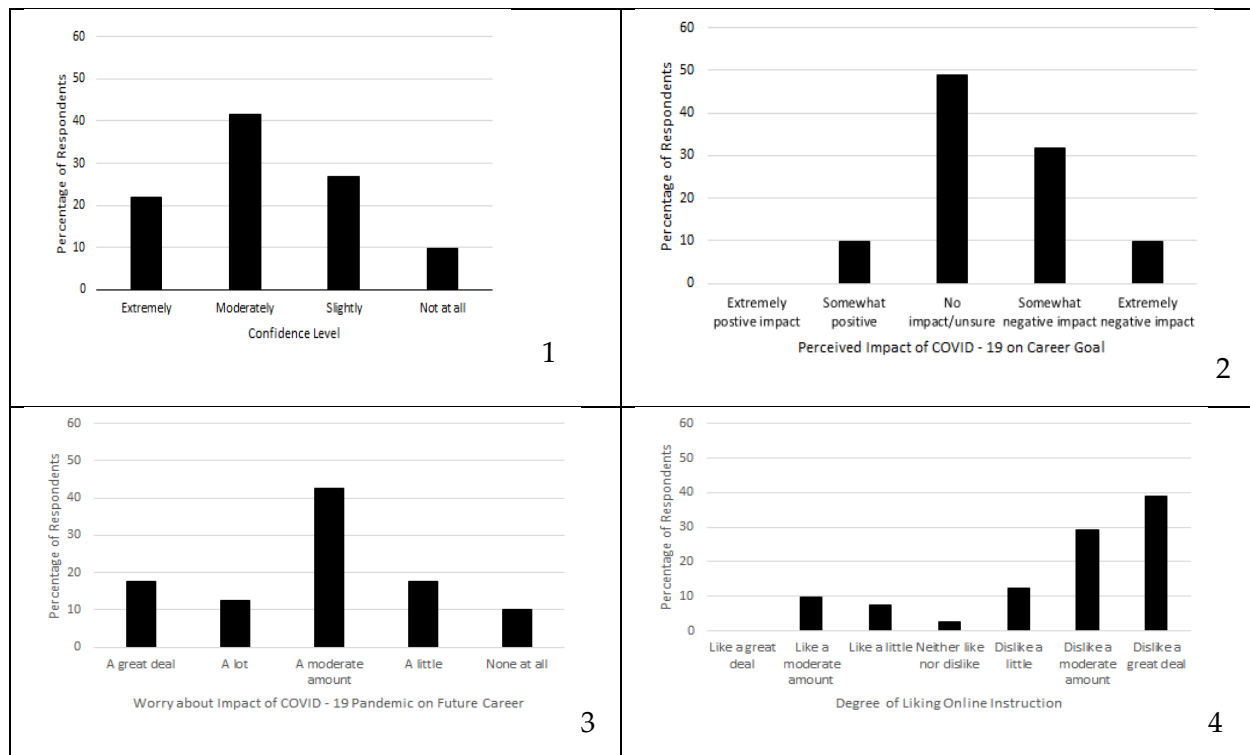
Figure 4. Panel 1. Respondents' degree of confidence in attainment of career goals, given the current health concern (i.e., COVID - 19). Panel 2. Percentage of respondents' ratings of the degree to which COVID - 19 pandemic impacted their career goal. Panel 3. Percentage of respondents' degree of worry about the impact of COVID-19 pandemic on their future career. Panel 4. Percentage of respondents' perceived degree of liking online instruction.

Regarding respondents' perception about the impact of COVID-19 pandemic on their career goal, no respondents were extremely positive and only 10% were somewhat positive (Figure 4, panel 2). Most respondents perceived that COVID-19 had no impact/unsure (48.8%, 20/41) or a somewhat negative (31.7%, 13/41) impact on their career goal (M = 3.5, SD = 0.8). For those who rated the impact of COVID-19 as having an extremely negative impact, reasons selected for why varied widely and, at most, three respondents indicated that it was due to an inability to concentrate on studies, financial reasons, perceived reduced quality of instruction, or worry about their college. One respondent wrote "Nobody is hiring due to the lockdowns, and all positions with relevant experience are full." Additionally, there was a negative association between ratings of confidence in career goal given COVID-19 and level of anxiety (r (41) = -0.31, p< 0.05). As respondents' confidence in their career goal increased, their anxiety decreased. Additionally, respondents' confidence in career goal given the current health concern (i.e., COVID-19) was positively correlated with likelihood of maintaining good health in one's future

career (r (41) = 0.37, p < 0.05). As confidence in career goal increased, respondents rated being in good health higher.

The impact of COVID-19 on most respondents' interest in science was neither positive nor negative (68.3%) with 29% of respondents indicating somewhat or extremely positive impact. For those who indicated that COVID-19 had an extremely positive effect on their interest in science (12.2%), it was attributed to presenting a critical health concern to address (22.7%, 5/22), demonstrating the usefulness of science for solving important problems (22.7%, 5/22), and sparking interest in animal-human disease transmission (zoonotic) (22.7%, 5/22).

Only 10% of respondents were not at all worried about the impact of the COVID-19 pandemic on their future career (Figure 4, panel 3). Of the remainder, the majority (41%) were worried a moderate amount, while 30% were worried a lot to a great deal about the impact of the pandemic on their future career (M = 3.1, SD = 1.2).

Respondents' perceived COVID-19 impact on interest in science was positively correlated with internship barrier (r (38) = 0.35, p < 0.01). As respondents' ratings of interest in science increased, a greater perception of a barrier of internship experiences occurred.

Participants' perceived impact of COVID-19 on their career goal was negatively correlated with confidence in career/graduate school path such that, as COVID-19 impact increases, confidence in one's career/graduate school path decreases (r(38) = -0.36, p < 0.05.

Online Instruction due to COVID-19

There were 68.3% (28/41) of respondents who had previously completed online college/university courses prior to the current term. Most respondents disliked online instruction a moderate amount (30%, 12/41) or a great deal (37.5%, 16/41) (Figure 4, panel 4). Regarding the impact of online instruction on science classes, most perceived it as somewhat (52.5%, 21/41) or extremely negative (32.5%, 13/41). Those respondents who indicated an extremely negative impact were asked, how has switching to online instruction been difficult. In response to this question, 33.3% (2/6) of respondents selected lack of privacy or space needed for focus.

Most respondents indicated that online instruction impacted their laboratory classes in an extremely negative way (51.2%, 21/41). When asked why they believed that the quality of their instruction was reduced, 37.5% (3/8) indicated that it was due to the removal of hands-on learning experiences. Respondents' degree of liking online instruction was negatively correlated with lack of field experiences (r (41) = -0.34, p < 0.05), such that as participants liked online instruction less, there was a greater perception of lack of field experiences.

Mental Health Status

Regarding mental health status as assessed by the DASS-21, 16.6% (7/42) of respondents experienced depression, 7.1% (3/42) anxiety, and/or 9.5% (4/42) stress at the severe or extremely severe level. Additionally, 14.3% (6 of 42) of respondents reported moderate depression, anxiety,

and/or stress. Overall respondents, the average depression score was in the mild range (M = 5.2, SD = 4.5) while levels of anxiety (M = 3.5, SD = 3.6) and stress (M = 5.4, SD = 4.4) were normal.

Discussion

In general, the STEM students who participated in this study maintained a relatively upbeat career outlook despite being in the middle of a global pandemic and experiencing major disruptions to their lives on many levels (e.g., change from residence hall to home, in-person to online instruction, social interaction restrictions). Respondents, who were mostly destined for biological/life scientist or natural resource careers, believed that attaining their career goals would allow them satisfying and exciting work, which would make a difference in people's lives. Participants were highly confident that they would attain their career goals, even with the current health concerns (COVID-19).

Knowledge about career, natural inclination, science related classes, parents and college teachers were identified as very important factors in supporting respondents' career path. This is in keeping with other research that also found that peers and family were rated as most important support for careers by college students (Peña et al., 2016; Raque et al., 2013).

Regarding reactions to COVID-19, most participants perceived that COVID-19 did not impact their career goals and were only moderately worried about the impact of COVID-19 on their future career. Moreover, many participants were optimistic that, if they were to continue on in their natural science career, they would be able to maintain good health. A strong belief in being able to maintain good health was associated with increased confidence in attainment of the individual's career goal. It is possible that the type of occupation of respondents (i.e., scientific and natural resources) in this study served to buoy the potential ill effects of the current situation and students preparing for very different occupations (e.g., occupational therapist, nurse) may be less optimistic.

From the perspective of SCCT, contextual factors such as the respondents' support system (e.g., parents, teachers) may provide insulation from barriers such as COVID-19 and unemployment rates resulting in confidence in career attainment (Lent, 2013). The results of previous research suggest that parents are perceived as having a beneficial impact on college students' career decision-making (Craig et al., 2018; Workman, 2015) and may even decrease career barriers (Raque et al., 2013)

In contrast to these relatively positive attitudes, the switch to online instruction was viewed unfavorably by most respondents. Similarly, in Baloran's study (2020), many of the 530 students surveyed from two private colleges in the Philippines also perceived as negative the change to online instruction due to the pandemic. In Baloran's study this negative perception of online instruction was primarily due to slow internet connections. In contrast, in the current study

remote learning was thought by respondents to have an extremely negative impact on their laboratory classes and somewhat negative impact on their science classes. Respondents reported that the problems with online instruction were due to removal of hands-on learning experiences, field laboratory experiences, and/or direct peer/student interchange. From a SCCT model, a student's self-efficacy may be lessened when exposure to key laboratory experiences are lacking (Lent, 2013). Future research should target STEM students' career self-efficacy and how COVID-19 may impact it as it relates to the changes in the model of instructional delivery. A measure of self-efficacy was not included in this study.

It is possible that respondents' difficulties with online remote instruction (e.g., lack of hands-on learning, field experiences) will be mitigated in future by most schools. In addition to having more time for instructors to prepare for classes, albeit in person, online, or some combination of the two, institutions have ramped up their faculty development training and promoted new instructional tools (e.g., virtual labs, simulation labs, lab in a box that is mailed to the student) to tailor instruction to the content, learning objectives, and mode of delivery.

Although many students prefer in-person, hands-on instruction over online instruction, acquisition of course knowledge during remote delivery may be equal or even superior to that of in-class presentation of the material. Brinson (2015) compared virtual remote to traditional hands-on labs for learning objectives achievement (e.g., inquiry, practical skills) and found that it was the same or better for non-traditional labs in the 56 studies reviewed. Academic performance was not examined in the current study but should be explored in future research.

A major perceived barrier for achieving respondents' career goals was education costs. This barrier may have been an issue for students even prior to the epidemic. Finances were similarly perceived as the most significant barrier by the STEM students in Pena et al.'s (2016) study. The rising costs of tuition has characterized higher education in the U.S. (https://nces.ed.gov/programs/digest/d18/tables/dt18_330.20.asp). Although we did not assess this, an economic barrier may impact the likelihood that STEM students pursue their career path. Future research should evaluate if students who are supported with tuition grants are more likely to complete their degrees and continue in STEM fields compared to those without such support. Given the tremendous upheavals students were experiencing March through May, 2020 due to the COVID-19 pandemic, the occurrence of psychological distress is to be expected. Although a substantial number of respondents in the current study reported severe mental distress (19%), it was less than that found in other studies surveying college students during COVID-19 (Baloran, 2020; Rudenstine et al., 2020; Wang et al., 2020). Moreover, the incidence of mental health difficulties experienced by participants in this study were comparable to levels observed in other samples of college students pre-COVID-19 (Auerbach et al., 2016). In the current study, respondents' confidence in attainment of career goal was negatively associated with levels of anxiety. Other research has shown a relationship between student career self-efficacy and anxiety

(Işik, 2012). These findings suggest that providing support to promote students' career development may alleviate their anxiety.

Limitations of this study include small sample size and lack of diversity of the sample characteristics, which may reduce the generalizability of the findings. Additionally, respondents were from a small private college located in a rural setting, which may not be representative of students at larger institutions or those in an urban setting. The psychometric qualities of the COVID-19 questions also need to be better established with reliability and validity analyses. Future research should evaluate whether students' career goals change across time as the pandemic unfolds. It may be that this assessment of students' views soon after the emergence of COVID-19 are unique and respondents' perspectives would differ if measured at other times. Other research questions to explore include whether STEM and non-STEM students share similar views. Possibly, the scientific quest to understand and solve the COVID-19 pandemic may be more intriguing to STEM students and these students experience less anxiety and more confidence about the future compared to non-STEM students.

Based on these survey results, possible actions to support STEM students achieving their career goals include:

- Identify approaches to online science instruction that incorporate hands-on or experiential learning (Beier et al., 2019; Mohammadi et al., 2019).
- Adopt empirically-validated, authentic instruction such as engaging and interactive online lectures and remote labs (Beier et al., 2019; Sauter et al., 2013).
- Provide information on college tuition funding sources and money management instruction to address financial barriers such as requiring students to complete a financial literacy course (Goetz et al., 2011)
- Address students' career-related anxiety by offering various career development opportunities (e.g., internship, service learning, conferences). Opportunities for students to engage in career exploration and work toward career goals may be fruitful in reducing career anxiety (Deer et al., 2018; Lent et al., 2019; Slovacek et al., 2019).
- Enlist parents and peers as effective support agents to encourage students' career development (Rozek et al., 2017).

The adjustment to the "new normal" will require flexibility, creativity and patience on the part of all involved in higher education. The academic classroom can now exist anywhere that communication between instructors and students is established. It will be critical to ensure that students and, in particular, STEM students who require interactive and experiential learning, have the ability to learn and absorb material through multiple methods (Education & Human Resources, 2020). Instructors' adaptability and feedback on instructional effectiveness is important pedagogy as we continue to acclimate to the COVID-19 academic challenges.

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Acknowledgement

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