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More than a Hobby: Marine Science Career Development through the Lens of Social Cognitive Career Theory

RESEARCH AND EVALUATION

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ABSTRACT

Entering the UN Decade of Ocean Science there is high demand for a diverse marine science workforce, even as our understanding of what motivates people toward marine science careers is limited. To address this, we interviewed thirty ocean and marine science professionals across a range of jobs to identify a comprehensive series of factors that promote marine science career interest as well as factors that impact the choice to move into this career space. We then mapped those to the social cognitive career theory (SCCT) model of career development (Lent, Brown & Hackett 2002) and identified which factors most present themselves as positive drivers or negative barriers to choosing the career field. We identified two themes that promoted interest and career choice-making in the marine science field: 1) participation in ocean recreation and 2) access to informal learning experiences. Conversely, the major barriers for entry into the marine science field were 1) education costs including unpaid internships and 2) job competition and corresponding low pay in the field. Both of these barriers significantly impact underrepresented populations within this field. Elements of the SCCT model were utilized to not only devise the interview questions for this study but also the qualitative codes (inductive and specific factors) used to analyze the 16 hours of interview data. The four themes (positive drivers & negative barriers) that emerged from the data are presented within this paper, along with a model of the findings.

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INTRODUCTION

This research explores the factors that promote early interest and impacts in pursuing a marine and ocean science career through the lens of social cognitive career theory (SCCT).

Researchers have identified the unique challenges in achieving advanced careers in the marine science field such as the financial instability, mental stress, and lack of strong mentorship in graduate marine science programs (Andrews et al., 2020). While important for long-term retention, these studies are focused on graduate pursuits, while our study uniquely focuses on factors impacting the crucial early phase of marine science career decision-making.

There is also a systemic lack of sociocultural diversity in marine and ocean science which has been assessed from both a formal measurement and an anecdotal perspective (Goldstein, 2013; Perry, 2017; Carney, 2019). Whilst there is research addressing the positive retention strategies of underrepresented minorities in ocean science (Johnson, 2016), there are still significant gaps in the literature when it comes to early marine science career drivers (Guitard, 2018)

To address the gaps in the research, we executed a qualitative study with interviews of marine science professionals to generate factors that either supported or inhibited their marine science careers. Thirty professionals, representing a range of marine science research and education career paths, participated in structured interviews about their vocational choices. The interview instrument and analysis were structured using SCCT, and participant responses describing aspects of career development were coded as factors under specific elements in the model. This approach attempts to identify specific critical factors and incidents in participants' lives that led them to become interested in marine science. It also explores participants' unique experiences to shed light on what supported and inhibited their career development. Results can inform practice and policy for families, schools, organizations, and government in addressing opportunity gaps, specifically by understanding the types of experiences that support ocean and marine science career development. The findings can also help highlight factors aligned with systemic barriers to marine science career access.

RELATED WORK

One core theoretical model and three clusters of prior research in academic literature inform this research, including work on career development theory, critical perspectives in career development, and marine science career development specifically. The key framework underpinning this work is social cognitive career theory (SCCT).

CAREER DEVELOPMENT THEORY

While this paper employs SCCT as the basis for understanding career development factors, this model is informed by and situated among a large existing body of literature on career development. The goal of this section is to provide a broad view of the many attempts at explaining vocational choice. Scholars have undertaken many efforts to create theories of career development to explain how people develop vocational interests and make education and training decisions (Crites, 1976; Super, 1992; McMahon & Patton, 1995; Hoekstra, 2011). As a result, there are many career development models available to researchers seeking to explore, explain, or map specific factors leading to individual choice and success in marine and ocean careers. Scholars have developed several approaches to explore and attempt to explain career development since the middle of the 20th century, resulting in several types of models. Examples include environmental models (e.g. Erickson, 1959; Super, 1963), deterministic models based on personality development (e.g. Roe, 1956; McClelland, 1962), trait based models (e.g. Holland, 1974), and models of self-concept (e.g. Gottfredson, 1986).

These models are widely disparate in what they credit for career choice. For example, Roe (1956) applied personality theory to develop a model of career development that posits that peoples' choice of career path is heavily influenced by their interaction with parents. She created a taxonomy of career types (service, outdoors, science, business, etc.), as well as a responsibility scale ranging from "follow basic instructions" to "independent responsibility" and stated that parental interaction heavily influenced where people sought employment. Super (1963) leveraged the growing field of self-concept theory, pertaining to people's beliefs

about themselves. Gottfredson (1986) introduced a social systems perspective to career development theory, integrating it with the then dominant psychological models. Gottfredson increased focus on a person's concept of self in career development, considering mediating factors such as self-perception of intelligence, sex, and social class. Super (1992) presented two models to represent career development. In the first model, Super focuses on how people play different roles in their life at different times. The second component of the model refers to the environmental and personal elements (values, interests, and skills) that influence career choice, as well as external factors (such as the economy). Similarly, Hoekstra (2011) devised a six-item taxonomy from existing literature on career development (maker, expert, presenter, guide, director, inspirator). And Hirschi & Läge (2007) measured career choice readiness based on a six stage career development model. They found that the further along students were in the model, the more career choice readiness they exhibited. They also found a curve-linear distribution of career choice consideration on the part of students, with the fewest options considered toward the beginning and end of the model.

As this body of work shows, research on career development is broad and complicated. McMahon & Patton (1995) examined prior work and synthesized a growing argument from many scholars who came to believe that career development theory was highly incomplete and segmented (citing Osipow, 1983; Brown, 1990; Super, 1990; Arthur, Hall & Lawrence 1989; Hackett, Lent & Greenhaus, 1991). They note "the traditional base for individual career development theories was narrow and did not take into account broader contextual influences." (McMahon & Patton, 1995: 15) They also noted that career models had become increasingly "eclectic" and concluded that any one theory or framework of career development is unable to account for complex human behavior needed to explain vocational paths and choices and argued in favor of integrative theories blending both systems theory and career theory.

The breadth of technique and theory applied across these various attempts to explain career development highlights the complexity of developing a comprehensive explanatory framework for vocational choices in a general sense, much less within a specific career area such as marine science. With this history in mind, particularly the critiques of career development theory synthesized by McMahon & Patton, one subsequent theory stood out as particularly suited to support the work of this research- social cognitive career theory (SCCT).

SOCIAL COGNITIVE CAREER THEORY

Social cognitive career theory (SCCT) (Lent, Brown & Hackett 2002) provides a framework for understanding the factors that guide what careers people become interested in and choose to pursue. The roots of social cognitive career theory stem from Bandura (1986), and his work on social cognitive theory. Bandura's work inspired two tracks of career inquiry. The first comes from Krumboltz (Krumboltz, 1979; Krumboltz, Mitchell & Jones, 1976; Mitchell & Krumboltz, 1976), whose work focused on the relationship between social learning processes and career decision making. The second track informed the work of Hackett & Betz (1981), who applied the social cognitive construct of self-efficacy to women's career development. Lent, Brown, and Hackett developed the SCCT model by synthesizing elements of these two lines of thinking. The resulting SCCT model is driven by three core variables- a person's self-efficacy beliefs, their outcome expectations, and their personal goals.

Self-efficacy beliefs are an individual's beliefs about their ability to accomplish tasks and engage in behavior that will achieve particular performance attainments (Bandura, 1977).

Learners may have a high, medium, or low degree of self-efficacy in their belief that they can understand or accomplish something. Lent, Brown, and Hackett describe self-efficacy as a dynamic trait situated in a specific context and "specific to particular performance domains and that interact in a complex way with other person, behavior, and environmental factors" (Lent, Brown & Hackett 2002: 262). The SCCT model adopts Bandura's four categories by which self-efficacy beliefs are acquired and modified by learning experiences. These are (1) personal performance accomplishments, (2) vicarious learning, (3) social persuasion, and (4) physiological and affective states.

Outcome expectations are expectations that people have about what exhibiting particular behaviors will achieve. These expectations can be cognitive, in that a person may expect either positive or negative cognitive performance outcomes because of a specific behavior. However,

the range of an individual's outcome expectations can be broad and can include expectations such as positive or negative working conditions, rewarding or unfulfilling daily work, and financial or social rewards or penalties. This factor is often summarized as the answer to people asking themselves "what will happen if I do this?"

Personal Goals are achievements that an individual aspires to work toward and reach. In SCCT there are two types of goals, which are (1) choice goals and (2) performance goals. "People tend to set goals that are consistent with their views of their personal capabilities and of the outcomes they expect to attain from pursuing a particular course of action" (Lent, Brown & Hackett 2002).

In addition to these core factors, there are several other elements embedded in the SCCT model. Among these, "person inputs" represents an individual's identity such as gender, ethnicity, and predispositions. "Background environmental influences" represent the environment in which a person was raised, and the environmental conditions in which they live their life. Both of these impact the types of learning experiences a person is exposed to, and the extent to which they benefit from them. This is reflected in the "learning experiences" node in the model. A person's learning experience directly impacts their sense of self-efficacy and their outcome expectations. Next, the self-efficacy expectations and outcome expectations that emerge from an individual's learning experiences directly influence their choice goals, choice actions, and lead to specific performance attainments. There is one final note in the model, "proximal environmental influences" which are supports and barriers that mediate a person's choices. For example, the availability of a supportive undergraduate college counselor that provides resources and guidance to a student is a proximal support, while an environment full of misogyny or microaggressions may be a proximal barrier in choices and actions.

CRITICAL PERSPECTIVES IN CAREER DEVELOPMENT

There is a rich body of research exploring identity in prior work on career development, which relates to this work in that many factors will intersect, especially in relation to person inputs. This work seeks to identify themes that shed light on critical aspects of marine science career development and highlight aspects within this sample that may inform what sorts of barriers and supports may be tied to gender, socioeconomic status, or other person inputs in the SCCT model.

Some of this prior work focuses on gender. For example, Crozier (1999) explored women's career development from a relational perspective and theorized that much of women's career development had been explored from a male perspective. Crozier then tapped into a body of work on women's identity and career development to postulate that many of the underlying assumptions in traditional career theory often don't apply to women. For example, they found work plays a different role in identity development. Crozier concluded that viewing career development through a relational context provided a different view of women's career choice making, development stages, definitions of success, and life roles.

Other critical work in examining career development has focused on ethnic identity and explored unique barriers and varying cognitive, emotional, and cultural aspects of career development. For example, Rivera et. al. (2007) used path analysis (an element of structural equation modeling) to identify relationships between perceived barriers, acculturation, and role model influence on Hispanic womens' career self-efficacy and career consideration. This team found that a female-dominated model accounted for more variance (26%) than the male-dominated model (16%). They also found that perceived career barriers were related to female-dominated career consideration, and "Anglo acculturation" contributed to female-dominated career self-efficacy. In other words, Hispanic women tended to have a higher sense of self-efficacy the more they were acculturated into "Anglo society". Similarly, Holloway-Friesen (2018) also examined perceived ethnic and career barriers of Latina students and found significant impacts of acculturation and attitudes in college environments to be predictors of career choice.

SCCT engages numerous factors that intersect with the areas this critical work explored, and the types of gender, ethnic, and socioeconomic factors impacting careers found in the results of this body of work also emerge in SCCT model.

MARINE SCIENCE CAREER DEVELOPMENT

Some prior work on careers focuses directly on marine science and related fields, such as environmental science and geoscience. For example, a survey of 524 marine science high school students used structural equation modeling to explore relationships between major satisfaction, career search efficacy, and career exploration behavior and found that major satisfaction significantly affected career search results (Heo, 2013). This work also found no significant direct causal relationship between major satisfaction with career exploration behavior, however there were significant indirect effects from major satisfaction.

Callahan et. al. (2017) explored the persistent underrepresentation of racial and ethnic minorities in the geosciences by analyzing a geoscience journal's most recent ten years' worth of papers. This resulted in a classification scheme outlining how some inputs and environments affect outputs, such as results in academic programs. These authors also concluded that self-efficacy, identity, microaggressions, stereotype threat, and SCCT can guide programmatic interventions that increase participation in the geosciences.

Some prior work on ocean and marine science career development intersects career theory and critical theory on career development. For example, to explore how women early in college view science careers and how they make career decisions, Packard & Nguyen (2003) interviewed 41 women between 18 and 21 years old. They used the "possible selves" psychological theory to understand how participant career behavior stems from future images about themselves. Possible selves are visions of "what people hope to become, expect to become, and fear becoming in the future" (Packard & Nguyen, 2003: 252). In studying women who change from a STEM to a non-STEM plan, this team found that "in early adolescence, these participants did not have much information about the careers to which they aspired, and learned over time that they were not as interested in the careers as they once thought". For women that maintained their STEM career aspirations, a common theme was opportunities to meet science professionals in the workplace, as well as teachers and mentors who taught them about their future careers. A study in the UK that examined the loss of women in maritime industries at each consecutive career stage found that there are specific aspects of marine science careers that make succeeding more difficult for women relative to other careers. These include disproportionately low numbers of women and challenges of working aboard ships and offshore (Mackenzie, 2015). Using an SCCT model, Ferry et. al (2000) found that family background and parental encouragement had a significant impact on outcome expectancies and learning experiences, particularly grades in math and science.

RESEARCH QUESTIONS

Based on this background, and using the frame of SCCT, this work seeks to answer the following research questions:

R1: What factors inform career interest and decision making toward marine science careers?

R2: What factors informing marine science career decision making are associated with elements in social cognitive career theory?

R3: What factors promoting interest and decision making toward marine science careers are associated with barriers to access?

RESEARCH METHOD

The method used in this research project involved a series of semi-structured interviews with marine science professionals (N=30), designed to collect qualitative data about their career development arc, with most questions aligned with SCCT. All interviews were recorded, transcribed, then inductively coded using the qualitative analysis software Dedoose. Once all transcripts were coded, major themes and factors expressed by the participants were mapped out, providing the results for the study. The interview instrument consisted of a set of 14 structured questions, with allowances for clarification and follow-up questions. Interviews were structured to generate data addressing different nodes in the SCCT model, and analyses were structured along the same nodes. Participant responses describing aspects of career development were organized under specific factors in the model.

SAMPLE AND RECRUITMENT

A purposive sample of 30 participants was assembled to provide the basis of data collection for this study. The primary inclusion criterion was that each participant must be engaged in an ocean science or marine science related career. This was interpreted broadly, and included people with a range of qualifications, from high school diploma supplemented with experience, to master's degrees, to those holding PhDs. This inclusion criterion was intentionally interpreted broadly, as the research team wanted to capture a full range of career experiences, including those that were planned and followed a trajectory to a predetermined goal, as well as capture people in marine science careers that may have taken a more circuitous route to their role. The second inclusion criterion was that participants were actively engaged in a marine science career, or actively working on a program of instruction with the end goal of achieving a marine science career. Finally, given the nature of the grounding theory of this work, only participants working within institutions and geographic areas associated with the United States were considered for this study.

Conversely, people who's professional and academic training is in ocean or marine science, but who had left the field or were not currently working in the field were not considered for participation. Participants outside of the United States were not recruited. Additionally, only legal adults (18+) were recruited or considered for this study.

This group of participants is not intended to be statistically representative of the ocean and marine science vocational field from which they were drawn, as is typically the case with purposive samples. Similarly, relative rates of responses within this sample are not intended to be representative of the marine science career field as a whole. As the role of a purposive sample is to intentionally recruit from a wide range of participant types and to represent many types of vocations and careers within the ocean and marine science umbrella, care was taken to assemble a participant pool that reflected this diversity. As a result, the goal is to ensure a sample that will capture as many types of considerations as possible for the model. As often as practical, interviewers collected additional context or clarification by asking follow-up questions, to confirm or reject links between specific nodes in the SCCT model.

As a purposive sample designed with a specific intent, the research team used several methods to recruit participants. Several career specific message boards were used, such as the Scuttlebutt Listserv from The Bridge Ocean Science Education Resource Center, and boards for several marine science affinity groups. Finally, to round out the sample and increase representation in specifically identified purposive areas, word of mouth was used, and regional groups were contacted to seek out people that might fit the requirements of parts of the sample that were not yet complete.

Through all recruitment channels, participants were provided an email address to contact if they were interested. All participants were informed that the interview would take approximately 30 to 60 minutes, and all recruitment messages informed participants that they would be eligible for compensation of $25 for participation.

INTERVIEW INSTRUMENT AND PROTOCOL

The primary method of data collection was semi-structured interviews. This instrument included 14 primary questions, some of which had secondary questions, and pre-planned follow-up questions depending on the nature of the response. The interview instrument was designed to be congruent with the SCCT model, and capture as many critical factors tied to nodes in the model as possible. The instrument also included instructions for the interviewer, to ask follow-up questions to statements participants made that seemed like they could provide additional data or context that were relevant to the study.

All participants were read a consent statement at the beginning of the interview and all participants consented to have their interview recorded over a Zoom video conference session, for later review and analysis. The final data set included 16.2 hours of recorded interviews across 30 research subjects.

ANALYSIS APPROACH

All 30 video recordings were converted into audio transcripts, to facilitate analysis. All audio transcripts of the interview were then loaded into a study workspace in the qualitative analysis software Dedoose. Once in Dedoose, the team began coding the interview for themes and major factors that were tied to elements of the SCCT model.

The coding schema was built using The Coding Manual for Qualitative Researchers (Saldaña, 2015). Ambiguous statements were not coded and were not assigned value in the results. The coding schema resulted in a two-tier hierarchy of codes. The first level was the specific element of the model a statement was tied to.

A set of preliminary codes consistent with elements in the SCCT model were established in advance of coding, such as "proximal barrier" or "person input". In this way, the resulting codebook contained specific terms, actions, behaviors, circumstances, and other factors that are keyed to nodes within the SCCT model. The results were also organized along the lines of the SCCT model and are presented in a graphical representation in this model (Figure 1).

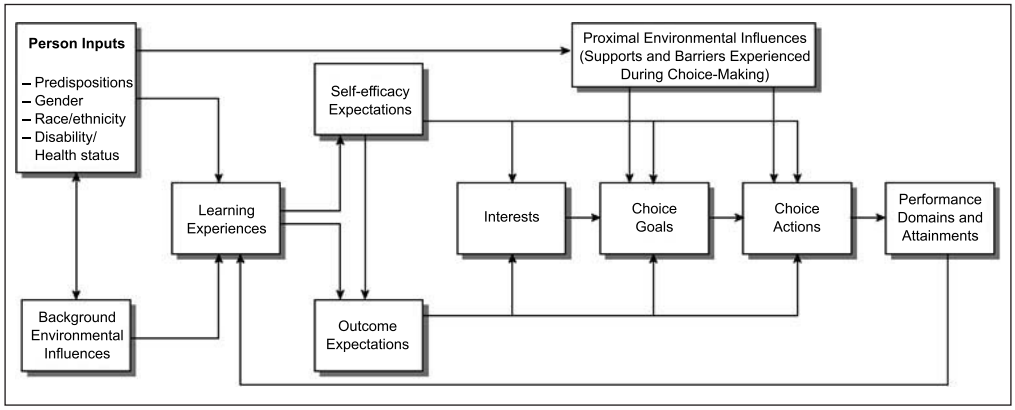

Figure 1 Social Cognitive Career Theory model of career development, adapted from Lent, Brown, and Hackett (1994).

In addition to naming and noting major factors from the data, and which element of the SCCT node to which they belong, analysis included marking key quotes to use as exemplar comments, and providing additional context and concrete examples that support the results.

RESULTS

The diagram below (Figure 2) represents the key result of the research. This represents an answer to R1- presenting the factors that impact marine science career interest, with the inventory of items in the cultural and cognitive nodes representing these results. The totality of the model represents the answer to R2 – showing all the factors that emerged in the sample, and which nodes of the SCCT model they influenced. The items below are mapped across the ten nodes of the model, and cultural, cognitive, and contextual influences are indicated. Cultural influences stem from person inputs (identity), as well as background and environmental influences, signifying the aspects if the model most impacted by culture. Cognitive influences include the aspects of self-efficacy and outcome expectations, as these are functions of cognitive reasoning. The inclusion criteria for this model were that a factor needed to have been indicated by more than one participant, and items that were mentioned by at least ten participants are noted in bold. Items with a negative sign were explicitly noted as barriers.

Note, that in a few instances, the same item appears in multiple elements of the diagram, as the item was described as a factor in multiple contexts. For example, some participants listed SCUBA training as a formative learning experience that impacted their sense of self-efficacy. Other participants listed SCUBA experiences as something that explicitly increased their interest in marine science, so it appears in both the "learning experiences" and "interests" nodes. These items all stem from coded statements and sentiments that influenced a participant, within each of these points in the model.

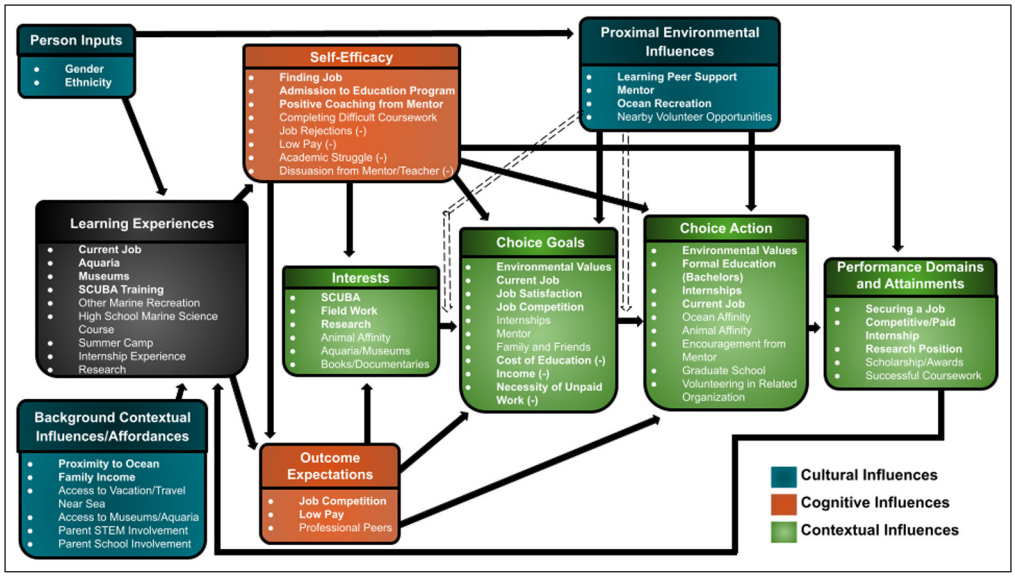

Figure 2 Marine Science SCCT Model.

Most items and relationships in Figure 2 can be understood and described in plain language. For example, higher "access to travel/vacation near sea" was an important contextual influence that positively impacted the learning experiences of participants, and field work positively impacted participant interest in a marine science career and influenced choice goals. Similarly, many job rejections negatively impacted participant self-efficacy, and negatively weighed on choice goals and actions.

CULTURAL INFLUENCES ON MARINE SCIENCE CAREERS

Four key items impacting cultural influence stood out and were noted by a preponderance of participants. Gender and ethnicity were the two person inputs in this element of the model, and both were noted by participants as strongly influencing their career path. Two background contextual influences of proximity to ocean, and family income were listed as background factors that supported or enabled efforts toward a path in marine and ocean careers. Finally, ocean recreation, learning peer support, and mentors were environmental factors that influenced decision making within this element.

For example, multiple participants noted the person input "gender" impacted learning experiences and mentorship considerations. Participants made such statements as "this field has tended to attract more women than some other fields, and definitely other STEM careers" (P11), and "there are a lot of women in the lower levels of marine science careers, but senior positions are still dominated by men" (P14). Participants expressed similar sentiments for ethnicity, specifically noting that the field tended to lack diversity. Numerous participants noted that they believed people of color had different proximal environmental influences and learning experiences than most of the field, which is dominated by White people who represented 75% of the career field in 2021 (Zippia, 2022).

COGNITIVE INFLUENCES ON MARINE SCIENCE CAREERS

The three most significant items related to cognitive influences were being admitted to an education program, finding jobs within the career field, and receiving personal motivation from mentors in the field. Outcome expectations were heavily impacted by a broad understanding of fierce competition in the job market, and low pay for jobs that do exist.

CONTEXTUAL INFLUENCES ON MARINE SCIENCE CAREERS

The most complex arrangement of factors impacting ocean career interest was within the contextual influence elements. Having worked on research or completed fieldwork strongly increased interest in ocean careers, as did SCUBA diving and direct interaction with ocean environments.

Choice goals were heavily impacted by several items, such as having positive environmental values, and believing that having a job in this field would lead to high job satisfaction. There were also several factors that deterred or adjusted individual choice goals. The expectation of

fierce job competition altered many participants' goals and were believed by participants to have deterred others from joining the field. Similarly, the cost of education, and an expectation of low earnings affected participants' choice goals and were reported to have further deterred people from this specific field. Likewise, the expectation of a high amount of unpaid labor to establish oneself in the field was noted as a similar deterrent, and even disabling for many would-be participants in marine and ocean sciences.

Choice actions were heavily impacted by several themes. The choice to pursue a bachelor's degree or professional certification in a marine or ocean science area was the most common choice goal that participants believed would help them succeed in achieving their desired career. Many actions taken by people seeking marine or ocean science careers were predicated on environmental values, and a wish to participate in environmental and remediation or justice. Internships and a job they already held also strongly impacted specific actions that people made, in this case promoting further education goals, certifications, and other concrete actions leading toward either an entry-level career or continued participation in the career field.

Finally, the primary performance attainment that participants listed, as representing concrete goals they achieved with relation to their career, was above all securing a job in the field. However, securing paid internships, research positions, and other roles that were not necessarily permanent full-time work were also commonly noted as important attainments.

DISCUSSION

Four major themes associated with R1 and R2 present themselves in the data, two of which are themes that support and reinforce career decision making toward ocean careers, and two of which deter it. These are (1) access to informal learning experiences, (2) ocean recreation, (3) costs and unpaid internships, (4) pay and competition. While embedded in the discussion, these themes emerge as a response to R3- SCCT factors associated with barriers to participation in ocean and marine science careers.

Access to informal learning experiences related to marine science was a major collection of items positively impacting marine science career interest and decision making, represented across the same elements of the model as ocean recreation. These experiences included visiting museums, zoos, and aquariums, participating in ocean related summer camps, community science projects, volunteering in related organizations, as well as activities such as reading books and watching documentaries on marine science. This theme is consistent with recent work such as Maiorca et. al (2021), who found increased interest in STEM careers and STEM self-efficacy of youth after a summer of informal STEM learning experiences. Similarly, Vela et. al. (2020) found improved student perceptions of STEM careers after participating in learning in informal science environments, and Wang et. al. (2021) used surveys and structural equation modeling from a sample of 1,133 students to determine that informal learning experiences positively impacted student interest in STEM careers more than formal learning experiences.

Most prior work on the theme of informal learning experience impact, and interest in STEM careers are not specific to ocean careers, but at least one study has looked at marine science more specifically. One such study found that informal experiences more heavily impacted ocean career interest than formal education, noting "although it was expected that scientific literacy in formal education plays an important role in motivating marine biology students, the results showed that intrinsic motivations and informal education play a more crucial role" (Lucrezi, 2018: 391). This theme from the work adds additional weight to the importance and positive impact of informal learning experiences on interest and self-efficacy in marine and ocean careers. One clear implication of this is that inability to access informal marine and ocean science learning experiences, due to barriers such as socioeconomic or geographical constraints, will limit those who can access the career field.

The second theme that emerged from the data is the positive impact of ocean recreation, which represented a major set of motivators in interest development, as well as background influences on people working in ocean and marine careers. SCUBA diving appears particularly common and influential. Ten participants specifically listed SCUBA diving as a motivating activity that continued to spur their interest and goal setting, and across all participants many other formative experiences on and near the water were listed. Snorkeling, boating, and fishing

were also common responses, as well as other ocean activities such as swimming and visiting tide pools. These items were listed across background environmental influences, interest development, and goal setting.

With both the themes of informal learning in marine sciences and ocean recreation, participants themselves noted unique challenges to access. First, access to the ocean was listed by participants as a primary point of entry, but many participants also noted that one clear implication is that youth who are not near the ocean or otherwise don't have access, have limited ocean recreation and related informal learning activities, and are less likely to have formative experiences that might encourage a career in marine or ocean sciences.

Multiple participants noted that this is detrimental to people whose families have low income or have structural or cultural barriers to accessing the ocean. Several specific instances were cited. For example, due to restricted access to swimming facilities in the 1920s and 1930s, and 1950s and 1960s, "swimming never became integral to Black Americans' recreation and sports culture and was not passed down from generation to generation as commonly occurred with whites" (Wiltse, 2007: 366). Similarly, Wolch & Zhang (2004), found that Black and Latinx Americans were less likely to engage in beach recreation, and tie contemporary gaps in use to a history of racial segregation of beaches enforced by local authorities, and even the KKK. Regarding improving diversity in ocean careers, it follows that one potential remedy is to enhance ocean recreation, access to ocean experiences, and informal learning related to oceans. Some not-for-profit organizations are already engaged in efforts to address these gaps, such as the Black Girls Dive Foundation (2022).

Two additional themes emerged from the data- education costs including unpaid internships, and job competition and corresponding low pay in the career field. As with the themes of informal learning experiences and ocean recreation, participant beliefs about socioeconomic access to factors that facilitate interest and ocean career goal setting were also noted. Anecdotally, these themes are frequently cited as barriers to people who come from lower income backgrounds, and the results of this work provide evidence that supports these anecdotes.

An overwhelming majority of respondents (25) cited cost of education as one of the greatest access barriers to ocean careers, and it was the most critical factor in establishing choice goals. Similarly, unpaid internships significantly impacted individual choice goals, and were reported by many respondents as a major factor they believed would be a detriment to people without significant economic means. Numerous participants mentioned that they would never have been able to complete their degrees or professional training without financial support from their families while they completed unpaid work. Several participants even claimed our sample would not likely include those people who were able to complete professional programs, nor were unable to conduct unpaid work, as they are vastly less competitive when it comes to finding a job. Once again, respondents identified socioeconomic background as a differentiating factor, and disproportionately people of color. One participant went so far as to say sardonically that, because of this, a career in marine science is referred to as "a white girl's hobby". This idea has been addressed in a survey of environmental and natural resources students in the US and found "attracting most students to field experiences- especially racial or ethnic minority students- will require pay above minimum wage" (Jensen, 2021: 757). These results are consistent with other prior findings that unpaid internships inhibit career progress of students from families with lower income.

Finally, job competition and low pay associated with the career was the final overarching theme that emerged from the data. Many participants (more than 10) stated that they had applied to scores or hundreds of jobs before finding one. Several participants also worked multiple part-time jobs to make ends meet. Words in the data to refer to job searching include "brutal", "demoralizing", and "exhausting". Awareness of this challenge altered several participants' goals and was again listed as a factor that makes the marine science field inaccessible to people without families or additional resources that can support their career aspirations. This is consistent with work relating generational wealth to career outcomes. Generational wealth refers to economic assets such as cash, stocks, and property that are passed from one generation to the next (Pino, 2022), and some scholars have linked this to career opportunity. Some argue that generational wealth should be a factor considered in vocational psychology

as this wealth provides more career paths to those that benefit (Diemer & Ali, 2009) and numerous scholars have explicitly connected these socioeconomic status concerns with career outcomes (Fouad & Brown, 2000; Blustein et al., 2005).

This model of marine science career development, developed using the lens of SCCT, represents a novel and inductive qualitative approach to understanding specific career development factors of a particular sample. These findings have specific implications for the field of marine science, and institutions that serve to help youth and young adults develop their career interests and decision making. These findings indicate that formative experiences with the ocean, and informal marine science learning are significant factors that led to increased career interest and self-efficacy of marine science and ocean careers. The cost of education, the need to complete unpaid internships, and low career pay coupled with heavy competition were the most significant barriers to ocean science careers participants reported. These findings reinforce prior research in the field by using an established and grounded theoretical frame for career development.

INTERVIEW INSTRUMENT

1. How were you first introduced to the ocean or marine science?
2. Are there any specific experiences that stand out to you about the ocean or marine science in your early years?
3. If so, what cultivated your interest in the ocean or marine science through your early years?
4. What motivated you to pursue a career in marine science?
5. What factors have contributed to your decision to specialize in marine science education? What is your current role?
6. What learning experiences have you had that increased or decreased your interest in a career in marine science?
7. Have you sought out any formal training or education in marine science? (And if so, what training or education did you receive?)
8. How about when you're thinking about your career path, and where do you go for information about it?
9. Do you plan on continuing your education? If so, how?
10. Did you feel like you could personally achieve a career in marine science?
11. What factors helped or hindered your belief that you could achieve a career in marine science?
12. What current goals do you have for your professional career?
13. What are some of the biggest barriers you think are for this generation with regard to marine science and ocean related careers?
14. What do you think are some of the biggest barriers that you've personally had to overcome in regard to your own career path?
15. Do you believe elements of your background have helped or hindered your progress and decision making toward a marine science career?
16. What sorts of career achievements are you most proud of?
17. Have you ever felt you had to step away from a career opportunity in this field due to any outside factors?
18. What types of opportunities do you think would be beneficial to provide to the marine science community?
19. If you could give career advice to your past self, what would you tell yourself?

COMPETING INTERESTS

The authors have no competing interests to declare.

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