Creating and Using a Career Development Course to Prepare Life Science Students

for Career Decision Making

by

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ABSTRACT

Providing adequate resources for undergraduate students' career development has been of utmost importance to meet demands from national agencies and industry leaders. At Arizona State University, the size of the undergraduate populations in the School of Life Sciences (SOLS) grew from 1,591 to 3,661, an increase of over 130% from 2003-2017. As of December 19, 2019, SOLS hosted a record 5,318 undergraduate majors on campus and 1,646 students in its online biological sciences program. This steady increase in life science undergraduate student enrollment at ASU attested to the need for appropriate career development education to be woven into the curriculum. Under the framework of higher education's purpose to provide adequate resources for career success, a career development intervention was designed and implemented as a career planning course for life science students. The purpose of this project was to provide a continuum of job and career information to SOLS' students to ensure they had appropriate, comprehensive information as they learned about and considered various career opportunities in the life sciences. Three theoretical perspectives guided the research project: Holland's (1985, 1997) theory of vocational personalities and their connections to work environments, Sampson, Peterson, Reardon and Lenz's (2003) cognitive information processing career decision theory (CIP), and Bandura's (1986) self-efficacy theory.

Survey results showed increases in all seven constructs—knowledge of career exploration and development tasks, perception of possible professional and career goals and opportunities, goal selection, occupational information, problem solving, planning, self-appraisal—over time among the students. Interview data indicated students noted (a)

enrollment in the course for reasons such as determining a career choice that met their needs and preferences while managing expectations and pressures from external sources; (b) broadening perceptions of career options, and (c) developing career exploration and planning skills. The success from this discipline-specific career development course was timely because university leaders were seeking solutions to increase students' career readiness. The discussion focused on complementarity of the data, connections to the extant research, implications for practice and research, personal lessons learned, and a conclusion.

DEDICATION

I dedicate this work to the following people who each played a pivotal part in this dissertation becoming a reality:

To my fiancée, Jonathan: I love you with my whole heart. Thank you for keeping me honest when I told you shortly after we met that I was going to pursue a doctorate within five years. Also, I am so thankful you ended up buying a house 10 minutes from the West campus, providing even more motivation to get through those long night classes. Coming home to you and a warm meal every Thursday brought me so much peace and nourishment. I am proud of us for always supporting each other and am so excited for our future together. Thank you for being such a loving partner throughout this experience.

To my mom, Beverly: I literally would not be the person I am today were it not for your fierce (and sometimes tough) love, wisdom, encouragement, and teaching me the importance of grace under pressure and appreciation for the little things in life. You will forever be my hero and inspiration.

To a lifelong friend and now family member, Michele: my whole collegiate education journey (and honestly, my adulthood) started because of your patience and commitment to my own success. I am so thankful for the countless memories we have made filled with love, laughter, and support. I would not be here today without you.

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To Mom, Dad, and Sarah: what else can I say but thank you. I know I have put you through a lot over the years with my adventures, antics, and ambition, and you have continuously been there for me. Thank you for checking in on me, the fun care packages, and for making me laugh and smile. I love and miss you (and our furbabies) so much.

Thank you to every single one of my teachers from preschool until today – you helped me become the person I am because of your dedication and commitment to your students. Each of you added to the foundation that got me here, so this celebration is not just mine to enjoy, but all of ours. Thank you for believing in me and for preparing me not just for this program but for so many other scenarios thus far and what's to come.

Next is a quick shout-out to Susan Snyder and Courtney Chamness – your detailed edits and encouragement kept me going in the spring 2019 term. Thank you for your relentless dedication to me and my success week after week.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

LEADERSHIP CONTEXT AND PURPOSE OF THE STUDY

Throughout the 21st century, national educational policymakers and scientists

have focused on raising awareness about the opportunities in science, technology,

engineering, and mathematics (STEM) because of the demand for this skillset in the

current job market. In the United States job market from May 2009 to May 2015,

"Employment in STEM occupations grew by 10.5 percent, or 817,260 jobs … compared

with 5.2 percent net growth in non-STEM occupations" (Fayer, Lacey, & Watson, 2017,

p. 2). As discussed in the National Center for Education Statistics' (NCES) report

Students who study science, technology, engineering, and mathematics (STEM) in

postsecondary education,

> Rising concern about America's ability to maintain its competitive position in the
>
> global economy has renewed interest in STEM education. In 2005, for example,
>
> three preeminent U.S. scientific groups—the National Academy of Science, the
>
> National Academy of Engineering, and the Institute of Medicine—jointly issued a
>
> report, "Rising Above the Gathering Storm: Energizing and Employing America
>
> for a Brighter Economic Future," that called for strengthening the STEM pipeline
>
> from primary through postsecondary education (National Academy of Science,
>
> Committee on Science, Engineering, and Public Policy, 2005). This report
>
> recommended increasing investment in STEM programs, enhancing the STEM
>
> teaching force, and enlarging the pool of students pursuing degrees and careers in
>
> STEM fields. Similar policy recommendations have come from other
>
> organizations and government agencies (Government Accountability Office,

2006; National Science Board, 2007; United States Department of Education, 2006) (cited in Chen & Weko, 2007).

There has been a defensible need to continue promoting careers in STEM, as "STEM occupations are projected to grow by 8.9 percent from 2014 to 2024, compared to 6.4 percent growth for non-STEM occupations" (Noonan, 2017, p. 2). When discussing employment trends, it was important to note whether the data point focused on occupations that employed the most people, i.e. "big growth," or grew most rapidly, i.e. "fast growth" (Reardon, Lenz, Peterson, & Sampson, 2019). "Big growth" jobs were those that were "familiar and common," such as personal care aides, registered nurses, home health aides, software developers, janitors and cleaners, and fast food workers (Reardon et al., 2019, p. 89). Contrarily, "fast-growth" occupations were those that might not necessarily have employed a large number of individuals, but as the name implied, have had a rapid increase in employment. For the 2016-2026 time frame, some of the top twenty fast-growth occupations included solar photovoltaic installers, wind turbine service technicians, home health aides, physicians assistants, and bycicyle repairers. For that same decade, the projected size of the top 20 projected big-growth occupations was over 39 million, whereas the fast-growth occupations were expected to increase by only approximately 7 million. To clarify, the U.S. Census Bureau has labeled "STEM" as "computer and mathematical occupations, engineers, engineering technicians, life scientists, physical scientists, social scientists, science technicians, and STEM managers … STEM-related occupations consist of architects, health care practitioners, health care managers, and health care technicians" (U.S. Census Bureau, 2014, Occupation, para. 8).

With the focused attention on increasing investment in STEM programs, it was no surprise that there has been an increase in STEM degrees conferred in the United States – from 2008 to 2016, this number rose from 472,262 to 667,919 (NCES, 2017). From 2000 to 2011, the number of biological sciences degrees alone conferred in the United States rose from 64,887 to 93,654 degrees (NSF, 2014). Nevertheless, only 15% of students with a biological, environmental, or agricultural science degree were employed in a STEM occupation in 2012 (U.S. Census Bureau, 2014). The top five occupations for this group were Healthcare (30%), Managers (non-STEM) (13%), Education (10%), Sales, (6%), and Life scientists (6%) (U.S. Census Bureau, 2014). It was evident there was a strong interest in the life sciences and that these students were finding employment, just in a broader range of occupations compared to what has typically labeled as STEM. How were these graduates introduced to these occupations, when traditional life science programs prepared their students for more socially constructed life science careers of medicine or research?

In the Coalition of State Bioscience Institutes' (CSBI) 2018 *Life Sciences Workforce Trends Report*, "Executives note that too many young people are still unaware of the vast and exciting careers available in the life science industry, and the opportunities to move into well-paying, interesting, mission-driven jobs that provide lifelong learning opportunities" (p. 28). Thus, it is posited that students have not availed themselves of opportunities in alternative careers because they were unaware of those possibilities during their undergraduate education experience, which suggests Colleges should provide more relevant career development programming as part of students' schooling.

History of Life Sciences at America's Most Innovative University

When Michael Crow assumed his position as president of Arizona State University (ASU) in 2002, he replaced former president, Lattie Coor. During Coor's 12 years at the helm, the university's funding for research and development more than doubled from $47 to $115 million. This increase in funding was primarily in the sciences and was consistent with national policymakers' demands for more investment in the sciences (Gonzalez, 2001). Crow intended to keep this momentum going. During his inaugural address, he announced that the university would follow a new model he called the "New American University." In this model, Crow redefined what a public research institution would and should look like in the 21st century, eventually leading the school to be named "America's Most Innovative University" for six years straight from 2015-2020 (New American University, n.d.; Office of the President, n.d.).

The first academic unit created as a result of this new higher education model was the School of Life Sciences (SOLS), which combined the biology, microbiology, and plant science academic departments into one multi-disciplinary unit (About | School of Life Sciences, n.d.). Since 2017, I have served as an academic advisor also known as an Academic Success Coordinator who has been responsible for all undergraduate career and internship programming. From 2003-2017, the size of the undergraduate populations in SOLS grew from 1,591 to 3,661, an increase of over 130%. From 2017 to 2018, enrollment for the fall semesters increased from 3,661 to 4,767 undergraduates, a 30.21% increase in only one year, due to the launch of the new online biological sciences program that academic year (L. Zafirakis, personal communication, December 4, 2018). As of August 22, 2019, SOLS was expected to host a record 3,654 undergraduate majors

on campus and 1,562 students in its online biological sciences program, with over 1,000

first-year students (K. Kusumi, personal communication, August 22, 2019). See Figure

1. This steady increase in life science undergraduate student enrollment at ASU was

consistent with the trend for increases in conferred bachelor's degrees in biological

sciences across the United States during roughly the same time frame (NSF, 2014).
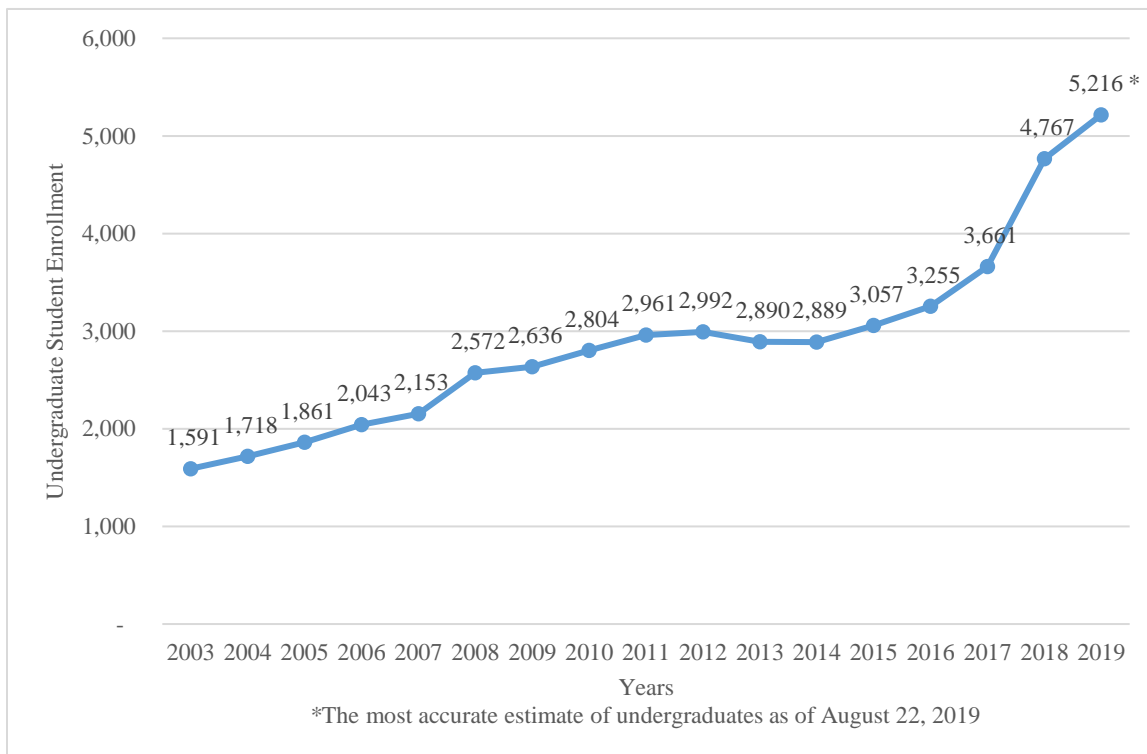
Figure 1. SOLS Undergraduate Enrollment - Fall Semesters Only, 2003-2019*

SOLS Alumni Data and Job Market in Arizona

ASU has become one of the nation's largest public universities, reaching over

100,000 student enrollment in fall 2017, with biological sciences coming in as the third

most popular major at the university (Ryman, 2017; 2018). As illustrated in Figure 2,

from 2006 to 2016, there was over a 48% increase of individuals with jobs in Arizona in

bioscience industries, 15,423 employees as compared to 22,931 employees, respectively.

See Figure 2. Employees in these industries were clustered into categories of agricultural

feedstock and chemical; medical devices and equipment; bioscience-related distribution; drugs and pharmaceuticals; and researching, testing, and laboratories (MassBioEd, 2018).
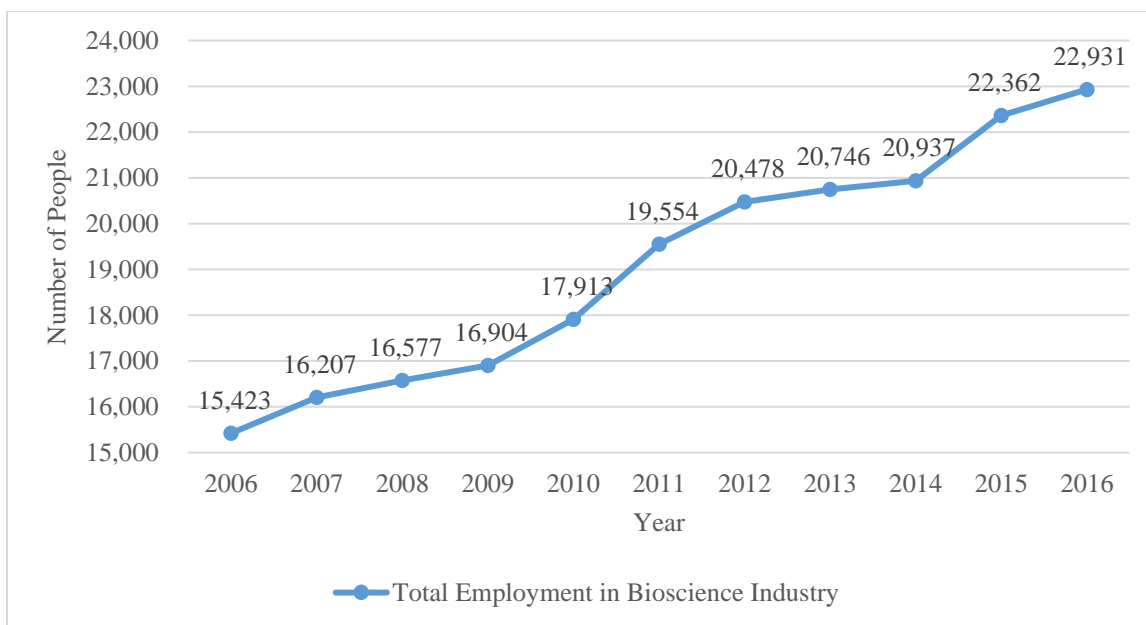
Figure 2. Total Employment in Bioscience Industry in AZ, 2006-2016

With employment increasing in bioscience industries in Arizona, Figure 3 demonstrated the number of job openings in those fields has been relatively steady since 2010 (MassBioEd, 2018). See Figure 3. The market has not been decreasing, emphasizing the demand for life science practitioners in Arizona, with 64% of those job openings requiring at least a bachelor's degree in 2016-2017 (MassBioEd, 2018). Notably, this trend suggested it has become more important to provide students with information about the broad array of positions in the bioscience industry to ensure they understand there were alternative, employment positions available to them. Moreover, of those job openings requiring at least a bachelor's degree in the same year, Figure 4 illustrated the demand for soft skills increased by at least 3%, with a decrease in science and research skills specifically stated in postings dropping 3% (MassBioEd, 2018). See Figure 4. This outcome was corroborated in recent findings from the *2018 Life science*

6

workforce trends report, which noted a national job qualification trend as well (Coalition of State Bioscience Institutes, 2018, pp. 13-17). These "soft skills" were interpersonal and communication-related skills that helped individuals to work together, manage their own work, and solve problems. In MassBioEd's (2018) job market analysis in Arizona, soft skills were further delineated as *problem solving, communication skills, team work/collaboration, decision making, organizational skills, planning,* and *multi-tasking*. In other words, they have been more accurately reframed as "social skills" (Villiers, 2020). It was important to note the employers' increased desire for social/soft skills versus science and research technical skills as a signal for higher education leaders to not only focus on technical skills needed to understand life science processes, but also the need for scientists to work together for discoveries and progress to occur (Villiers, 2020; Coalition of State Bioscience Institutes, 2018, pp. 13-17). Again, this information on soft skills suggested students would be served better by providing support to them in these areas as they considered various, alternative career paths, which capitalized on these skills.
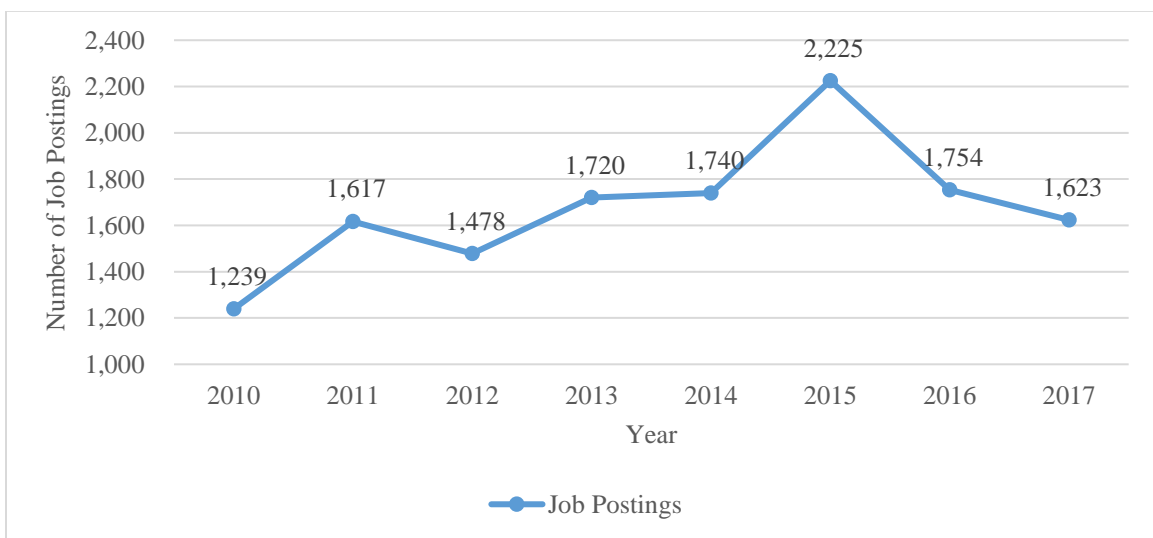
Figure 3. Bioscience Job Listings in AZ, 2010-2017
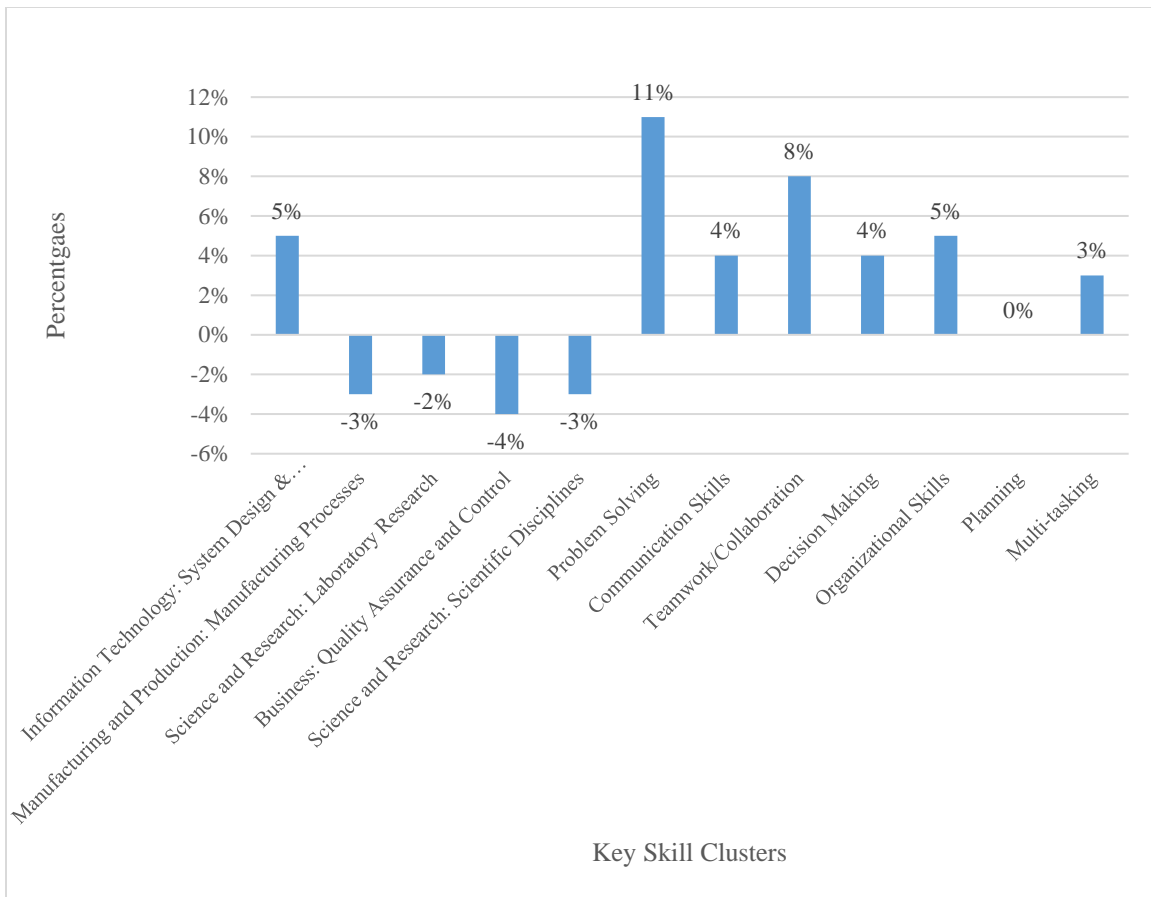
Figure 4. Percentage Change in Key Skill Clusters Included in Bioscience Job Postings in Arizona from 2010-2011 to 2016-2017

As of the second quarter of 2018, data obtained by Emsi Student Insight on behalf of the ASU's Alumni Engagement and Impact Office showed of 4,093 SOLS' graduates whose data could be retrieved, 60.86% of them were residing in the state of Arizona. The second largest group, 3.05%, were located in California. These data demonstrated the relevancy of Arizona's job market data (2018). The top five occupation groups of these alumni were postsecondary teachers, 5.18%, medical scientists/except epidemiologist, 3.08%, chief executives, 2.69%, general and operations managers, 2.22%, and market research analysts and marketing specialists, 2.08%. Moreover, data about job postings in bioscience indicated there were increases that required a broader range of job skills of

8

bachelor's degree graduates. Finally, these increasing job market projections represented

continued STEM job growth, confirming the need for SOLS staff and faculty members to

prepare its undergraduates to be competitive candidates for these positions.

Utilization of ASU's Career and Professional Development Services

To adequately prepare students for the diverse employment market, student

services departments at the university have been charged with providing appropriate

career development guidance and resources. At ASU, the Career and Professional

Development Services (CPDS) office serves as the place for students to receive guidance

on how to search for and attain internships, apply for jobs, and pursue graduate school, if

students so choose. These services have been provided for the students' entire careers

after graduation, not just during their formal education days (Educational Outreach and

Student Services [EOSS], n.d.).

Because I am responsible for SOLS' career and internship programming for

undergraduate students, I compared the utilization of CPDS' services against a school of

similar discipline and also one of similar size within the College of Liberal Arts and

Sciences (The College), the administrative unit for SOLS, to better understand whether

SOLS students were taking steps to prepare for life after graduation. The School of

Molecular Sciences (SMS) was used as a basis of comparison for similar fields within the

College because it included the biochemistry and chemistry academic programs. The

Department of Psychology (PSY) was used to compare programs of similar size in

undergraduate enrollment within the College. See Table 1 for enrollment data (L.

Zafirakis, personal communication, June 12, 2018).

Table 1

Undergraduate Enrollment from 2012-2018 in SOLS, PSY, and SMS

Year:	2012	2013	2014	2015	2016	2017	2018
SOLS:	2,762	2,645	2,634	2,727	2,909	3,301	3,574
PSY:	2,065	1,682	1,510	1,530	1,568	1,816	1,723
SMS:	482	507	563	679	741	740	544

CPDS provided data from 2012-2017 that included numbers of students from each of those programs who scheduled general career advising appointments, attended workshops and events, or submitted applications through the university's job portal (the numbers for these categories were combined for this analysis in Figure 5; A. Butkiewicz, personal email communication, June 15, 2018). See Figure 5.
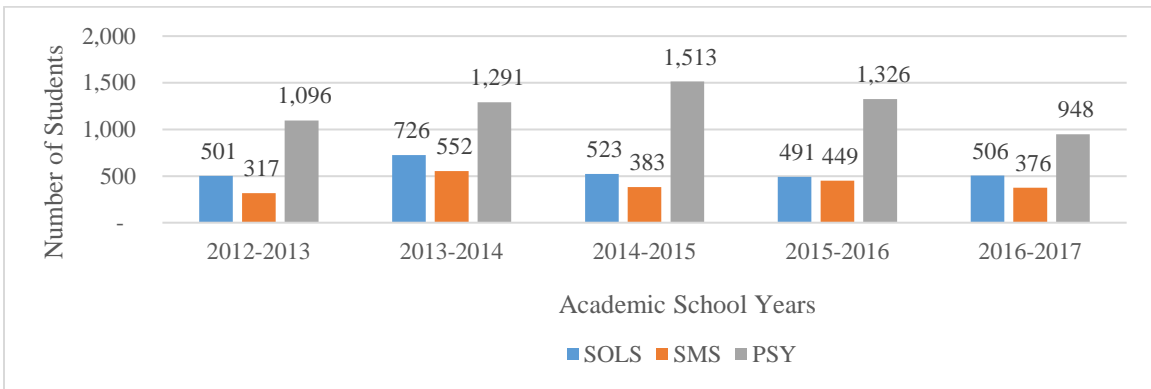
Figure 5. Utilization of CPDS' services by SOLS, SMS, and PSY 2012-2017

As seen in Figure 5, although the PSY program includes a comparable number of undergraduates, PSY students have been utilizing the CPDS team at about twice rate at which SOLS students have used these services. This does not necessarily mean PSY students were more prepared for the workforce than SOLS students, but this could have been the result of a number of factors. First, the notion of how careers have been socially

10

constructed by discipline/major might have influenced utilization. For example, for psychology majors because there was less clarity about what defined a career in psychology upon graduation, part of the culture within psychology programs may have established a norm for students to seek advice and resources from a career center. By comparison, science careers have been more commonly discussed in concrete terms such as researcher, lab technician, physician, etc. Anecdotally, many students shared stories of faculty in the foundational biology courses highlighting examples specifically for pre-health students (those interested in pursuing professional programs in medicine, dentistry, physical therapy, etc.), but no other kind of specific examples were provided. Because attention was given to succeeding in academia or pre-professional program routes, life science students might have thought there was no need to participate in career services because they believed they knew about their options.

Nevertheless, upon reviewing the CPDS utilization data, it was clear the SMS numbers were much higher given the student population. This could have reflected how SMS has been committed to career development by assigning this matter to a faculty member who was charged with developing this area, as opposed to SOLS, which expected an academic advisor to do the same task with more limited resources. Similarly, the PSY department committed resources to building a robust career development site in 2019 (https://psychology.asu.edu/psychforlife/careers) by designing their own special topics course regarding career development, *PSY 294 Psychology Pathways: What's Your Plan*. However, this course was first offered in the 2017-2018 academic year, which was after the time period for this data. Moreover, this course has been on the schedule for at least one term per academic year since fall 2017. Finally,

11

PSY also has organized its own long-standing discipline-specific career fair, reflective of its own organizational commitment to career development. SOLS and SMS have also organized their own joint career fair, but given the cultural differences between the units, as well as social constructions of possible career pathways, it was understandable why SOLS' students simply have not utilized CPDS nearly as much as SMS or PSY. Thus, these data suggest there is an opportunity and need for more career-focused programming within SOLS. See Appendix A for further data points on this topic.

Preparing SOLS Students for the Workforce

Since its inception on July 1, 2003, SOLS has been highlighted as a prime example of the success of interdisciplinary collaboration as well as innovative research developments at the university (About | School of Life Sciences, n.d.). This merger of life science disciplines into one unit facilitated the development of a new environment for collaboration and innovation, resulting in a never-before attained ranking of SOLS as a top 25 research entity in 2011 (Arizona State University, 2011). However great this recognition has been, the question remained: Is SOLS preparing its students for the world of work or a narrow path focused on research and medicine?

When life science students have enrolled in SOLS, they typically believe they would learn everything they needed to be successful in their career choice involving biology, microbiology, or molecular bioscience and biotechnology (MBB). They anticipated their baccalaureate degree from an accredited university was an appropriate way to begin their careers in a desired position. Nevertheless, students have not always attained the position they initially desired; thus, students' consideration of alternative career paths has become more important so they can use their degree in more flexible

ways. Such an outcome revealed a potential problem in career advising, but it also

offered an opportunity to broaden students' perceptions of how to apply their education.

Through their home online portals ("My ASU") and academic departments' websites,

students have been prompted to turn to advising staff for guidance on how to use their

degrees, as well as what to do to achieve their goals of further education or entrance into

the workforce. Nevertheless, among many students there has been a commonly-held

belief that the only options with a life sciences education were in either medicine or

research, which students have revealed upon discussing career options in academic

advising appointments. Students were unaware of other potential career paths. As a

result, it appears programming such as a career development course in SOLS could assist

with increasing their awareness.

Further, although students could attain information about alternative career

pathways through CPDS, they used this service at low rates as noted previously. Given

the fast-paced nature of students' lives, a more readily available process that included

online delivery at a time and place convenient to students may provide for greater levels

of use by them. Thus, an online career development course may provide a more viable

alternative for dissemination of this important information. Moreover, online students

are likely to also benefit from such a course rather than using the services provided by

CPDS.

The Need for Career Development Consistency in SOLS Curriculum

SOLS' enrollment has continued to increase over the years, especially with the

skyrocketing numbers of over 1,000 students in the first year of the online biological

sciences program (S. Schoenborn, personal communication, July 3, 2018). Because a

large number of SOLS' students were not utilizing services of the CPDS team, the Director of Undergraduate Advising in SOLS tasked the Career and Internship Development Lead (me) to create a professional development course specifically for life science students.

After conversations with career development experts and academic advising colleagues across ASU, the biggest gap in career readiness and development services for SOLS students appeared to be in the extremely limited presentation of career development and planning topics and activities in the curriculum. First-year students have been introduced to CPDS in the required first-year seminar course, completing activities to gain familiarity with CPDS's broad and extensive career development tools. Nevertheless, no consistent curriculum content on career readiness was provided after that initial course. This has been a concern because some students have changed their major into SOLS later on in their career or transferred into the university. As a result, these students were unable to participate in this one, sole curricular opportunity to discuss career development matters.

In March 2018, a curriculum alignment expert began working with SOLS faculty members on revising curriculum to be consistent regardless of who was teaching each class and through what medium, online as compared to face-to-face. This "BioSpine" process has been challenging faculty members to determine the specific outcomes of the numerous programs in the school. Working collaboratively, the curriculum designer and the entire BioSpine team concluded there was a need for a professional development class to support students in meeting the school's established outcomes, in addition to bolstering the consistency of SOLS' academic programming. Moreover, the BioSpine

leader suggested faculty members were beginning to realize that not every SOLS

graduate would be entering an academic setting and research environment like them, so a

paradigm shift has been initiated that has informed course design and instruction.

> … in our intro biology classes this year there's a fundamental shift in the way the
> curriculum is being taught; in in the past, it was traditionally taught as a lecture, it
> is taught about information, concepts, ideas. Now, it's problem-based learning …
> that's exactly tied to career development, because you're taking a scientific
> problem, you're applying it to a real-world type of application. … I think
> eventually careers will be integrated fully into the curriculum, maybe not so much
> like 'this is how you do a résumé,' that's something that we could add in there.
> But their career development is about real-world applications for biological
> concepts (SOLS staff 1, 2018).

These curriculum changes reflected an improvement in alignment of higher

education department outcomes and what was desired and needed in "the real world." As

discussed earlier, employers in the life sciences industry have been seeking students with

technical *and* interpersonal skillsets. The timing of SOLS' faculty awakening to the

possibility (and reality) that their students would pursue a broad range of careers could

not have been better, because it was aligned with data from U.S. Census Bureau,

Coalition of State Bioscience Institutes, and MassBioEd regarding where life science

graduates were actually becoming gainfully employed and how those data sometimes

contrasted with socially constructed ideas of "life science careers."

In the CSBI 2018 *Life Science Workforce Trends Report*, "executives continue to

lament the lack of preparedness of students coming out of university programs. Some

criticize institutions for focusing on developing talent for an increasingly small number of academic positions rather than for high-demand careers in the industry" (p. 28). Earlier in 2018, I was working with an MBB professor on gaining the necessary approval for a student's proposed internship site, and without any prompting by me, he stated, "Not every student is meant to follow in our footsteps and research comes in all shapes and forms" (T. Mor, personal email communication, May 9, 2018). Beyond this isolated incident, meetings with MBB faculty confirmed their pragmatic approaches toward career development and preparation because they commonly described their program as an *applied* biological sciences program compared to other programs within SOLS. The MBB and the Biology & Society programs have been the only two majors within SOLS' 11 programs that required an internship or research experience. In the other programs, this extracurricular experience has been an option within required lab coursework. Nevertheless, it has not been specifically included as a graduation requirement. As SOLS' administrative leaders have begun to shine the spotlight on students' career preparation and readiness, the MBB program will likely be an exemplar in this conversation. Faculty members have been reflecting on what the job market has been demanding in existing openings and what was expected of future life scientists in an attempt to answer the question: What kind of bioscientists do we, the staff and faculty members of SOLS, want them to become? The BioSpine team has made progress on answering this question because the current version of the BioSpine program student outcomes showed skills and competencies divided into four areas: science, cognitive, interpersonal, and intrapersonal (J. Caulkins, personal communication, May 1, 2018). The explicit categories outside of scientific skills indicated initial buy-in by faculty

members to ensure SOLS' graduates were successful in their careers as well as acknowledgement of the changing job market. Further, this reflected that faculty members' recognized MassBioEd's (2018) employer data on the increase in soft skills compared to technical skills. Finally, SOLS administration's new emphasis on ensuring specific program outcomes for all SOLS graduates will likely change the curriculum to ensure further development of career readiness.

Support for and Definition of the Intervention

In March 2019, a 40-item survey was created and distributed to gather SOLS alumni's top priorities and preferences related to career development and readiness. Of the 1,885 graduates from Fall 2013 – Fall 2018, 66 individuals started the survey, 45 completed it, and 18 emails bounced back. Of the 45 individuals who completed the survey, more alumni support a life science-specific career development course ($n = 40$ who strongly agree, agree, or somewhat agree) over a generalized one ($n = 31$ who strongly agree, agree, or somewhat agree). In other words, two-thirds of the alumni agreed with requiring a generalized career development course, whereas almost 87% of the alumni supported the discipline-specific course.

Similarly, the 4,762 undergraduate students currently enrolled as a SOLS major or minor in their academic program of study were asked to complete a survey including Taylor and Betz's (1983) Career Decision-Making Self-Efficacy Scale (CDMSE) in March 2019. As a part of the survey, these current students were asked nine additional questions relating to their interest in a career development course, self-efficacy, and career readiness. At the closing of the survey, only 135 individuals started the survey and 86 completed it. Most students agreed ($n = 66$ who strongly agree, agree, or somewhat

agree) that a generalized career development course should be required for program participants. This finding was consistent for all students, regardless of when they were graduating. For example, only one out of the 17 students graduating in Spring 2019 who completed this survey disagreed with this idea. Further, 75% of current sophomores (graduating in the 2021-2022 academic year) agreed with this suggestion. When presented with the option of a *life science-specific* career development course, an overwhelming majority (82 students, or 94%) of the current SOLS undergraduates surveyed agreed this discipline-specific course would be beneficial.

As described previously, my problem of practice is that life students are unaware of their career options and since they underutilize the resources offered by CPDS (A. Butkiewicz, personal email communication, June 15, 2018), there is a need for SOLS to offer career development-focused programming. Regardless of my supervisor first delegating the task to create a career development course for life science students, the research I conducted surrounding the local and larger context supports this intervention. Thus, my intervention for this dissertation was the creation and implementation of a career exploration and readiness course specifically for life science students. To measure its effectiveness, I examined students' perceived career readiness by measuring their perceptions of possible professional and career goals and opportunities, knowledge about employment-seeking skills, and career decision making self-efficacy prior to and following participation in the course. I also analyzed the students' self-report career state as it related to their clarity in, certainty of, and satisfaction with a career goal before and after the innovation.

Purpose Statement and Research Questions

The purpose of this project was to provide a continuum of job and career information to SOLS' students to ensure they had appropriate, complete information as they learned about, considered, evaluated, and prepared for various career opportunities in the life sciences. It was clear that a biological science student minoring in digital media with a desire to be a photographer for a science publication required different advising and resources compared to a biological science student who wanted to conduct laboratory research for a top research institution. With the growing breadth of jobs available to life science students, as well as the reality that many of them were unaware of alternative career options, it was clear an expansion of career advisement and planning was required. Given the need and purpose to provide appropriate, comprehensive career planning, the following research questions (RQ) guided the conduct of the study.

RQ 1: How and to what extent did a life science career development course affect students' abilities to

a. engage in goal selection related to career exploration and planning;

b. identify appropriate academic major, occupational information, and/or employment opportunities in the life sciences in relation to personal characteristics;

c. formulate action plans and strategies for implementing life/career goals;

d. conduct problem solving efforts related to career exploration; and

e. engage in self-appraisal with respect to career exploration and planning.

RQ 2: How and to what extent did a life science career development course affect students'

    a.   knowledge about employment-seeking skills;

    b.   perception of possible professional and career goals and opportunities; and

    c.   readiness for career problem-solving and decision making.

CHAPTER 2

THEORETICAL PERSPECTIVES AND RESEARCH GUIDING THE PROJECT

Providing adequate resources for undergraduate students' career development has been of utmost importance to meet demands from national agencies and industry leaders who insisted that individuals in the workforce possess skills related to science, technology, engineering, and mathematics (STEM). The number of students earning biological sciences degrees has been on the rise nationwide, growing by 87.8% between 2000 and 2016 (National Center for Education Statistics, 2017). Arizona State University's School of Life Sciences (SOLS) has grown 71.68% in the 2017-2018 year alone (L. Zafirakis, personal communication, August 23, 2018). Although these students have been gaining knowledge in the life sciences, a majority of them will more than likely not use their degree, as noted by the United States Census data (2014) that showed 74% of Americans who have a STEM degree were *not* employed in roles utilizing their education. Further, most SOLS alumni were likely to reside in Arizona if previous alumni data served as a predictor, where an average of 1,600 jobs in the bioscience industry were available each year (Emsi, 2018; MassBioEd, 2018). This steady increase in life science undergraduate student enrollment at ASU and the growing life science job market in Arizona attested to the need for appropriate career development education to be woven into the curriculum.

This chapter has included an introduction of the purpose of higher education as it was related to career preparation, which offered a framework for this study. That section has been followed by an explanation and implications of theories/approaches guiding the development of this life science career development course including the theory of

vocational personalities and work environments, the cognitive information processing approach, and self-efficacy theory.

Higher Education and Career Preparation

Faculty members at colleges and universities have continued to debate the relevance of career preparation courses since early in the 20th century when career development courses became a part of undergraduate curriculum (Maverick, 1926). In the National Association of Colleges and Employers' (NACE) 2017-2018 Career Services Benchmark Survey Report for Colleges and Universities, 37.4% of the 583 NACE member respondents offered for-credit career development courses, with 59.2% of the 76 doctoral research 1 schools (Arizona State University's classification according to the Carnegie Commission on Higher Education) offering such classes (National Association of Colleges and Employers [NACE], 2018). Sometimes the content was integrated into a first-year seminar course, whereas standalone courses have been required for specific majors or offered as elective credit courses. Such courses varied in their length and when they were offered—upper or lower division classes. Course content has varied widely from learning about the job market and hiring companies to inwardly reflecting on career aspirations and skills assessments (Reardon, Leierer, & Lee, 2007; Reardon, Peace, & Burbrink, 2020). No standard has been established with respect to what career development courses were supposed to cover. Nevertheless, professional organizations such as the aforementioned NACE and National Career Development Association (NCDA) have provided resources and recommendations based on best practices and peer-reviewed research (NACE, 2018; NCDA, 1993, revised 2011).

Supply of and demand for career development courses. Support for offering career development courses has been consistent with a majority of first-year students polled by the Cooperative Institutional Research Program in 2014 saying they were going to college "to be able to get a better job" (cited in Rampell, 2015). Although financial and job security was a top priority, "non-economic factors," as Chan (2016) described, played a role in students' decisions to go to college, too. From seeking belonging and intimacy to growing as individuals, these intrinsic goals also have influenced students' reasoning for pursuing higher education (Chan, 2016). However, in an analysis of data from 1966-2015 related to college first-year students in the United States, Eagan, Stolzenberg, Ramirez, Aragon, Ramirez Suchard, and Rios-Aguilar (2016) found on average since 2010, 86% of polled students indicated that getting a better job was a key factor in their decision to go to college.

Arizona State University (ASU) has a four-pronged mission statement with aspirations focused on (a) "academic excellence and accessibility," (b) earning national rankings in "academic quality and impact of colleges and schools in every field," (c) becoming a global research leader, and (d) "enhanc[ing] our local impact and social embeddedness" (Arizona State University, n.d.). Nevertheless, nowhere in these public proclamations was an explicit goal related to graduates' employability or career readiness and/or development.

In 2018, ASU's Enterprise Marketing Hub collected qualitative data relating to the university's current students' and alumni's' affinities towards this institution (All-hands meeting, 2018). When asked why they stayed at ASU, current students responded with positive remarks on the institution's ability to prepare them for success, its

excellence, "responsive academic advisors," security of campus, the staff show care and compassion for students, as well as overall pride for the university (Enterprise Marketing Hub, 2018). The alumni expressed similar praise for the university's excellence and preparation for success. These strengths of the university did not focus on rankings or research expenditures, but highlighted the culture of preparation for life after college. Thus, there has been some disjunction between what students wanted and what ASU has focused on providing.

ASU was not alone in enacting these disjointed views, Chan's (2016) analysis arrived at the same conclusion. Many institutions appeared to operate on the basis of Michael Spence's (1973) signaling theory, which described how "individuals are rational and that they invest in education as long as the benefit of additional years of schooling exceeds the cost" (cited in Chan, 2016, p. 19). Under this philosophy, students understood that having a college degree made them look more attractive in the job market because of the value society placed on higher education. Nevertheless, when an institution like ASU has specific goals on increasing national rankings and status overall, these appear to be at odds with its charter, where the institution will be "measured not by whom it excludes, but by whom it includes and how they succeed" (Arizona State University, n.d.). The university leadership's desire for prestige shows a strong framework using signaling theory, when their stakeholders (i.e., students) are aiming for employability. In Maverick's foundational research on vocational education (1926), even in the early part of the 20th century was there explicit opposition towards vocational guidance. It appears that this debate about the value of providing career education has become embedded in higher education culture.

The discussion between traditional and progressive education ignited by John Dewey's (1938) seminal book *Experience and education* challenged readers to consider education as a life-long process, where experience should be valued and education was not imposed on the student. Even in the infancy stages of higher education there was a divide between institutions who focused on teaching students how to learn, as opposed to others whose programs were geared towards specific professions and eventual leadership in their communities (Chan, 2016). Some education leaders have operated with a primary goal of making students marketable for specific jobs, but typically they have been at the community college/sub-baccalaureate level, sometimes even in secondary education through vocational-centric initiatives such as the U.S. Department of Education's Career and Technical Education (2018). Thus, trade schools/technical colleges focused on training students for careers with skills-based curriculum, instead of a liberal arts approach of finding meaning and purpose through learning, which has been prevalent in higher education today (Roth, 2012). Nevertheless, technical schools have not always supported vocational guidance. In one of the first surveys of higher education systems related to career education, Maverick (1926) reported receiving this comment from a technical school, "This is a technical college, and the students have decided on their occupations before they enter; we have no need for occupational guidance" (p. 53). The existence of an Office of Career, Technical, and Adult Education (OCTAE) within the U.S. Department of Education in today's current climate signaled the Department's mission was not career-readiness or employability-focused; otherwise, the unique OCTAE would have been redundant (Career and technical education, 2016). This analysis was based on the name alone; it would be understandable to have a specific

office dedicated to adult education because of the differences in andragogy and pedagogy. Nevertheless, with the specification of an office dedicated to career, technical, and adult education separate from the other programs of the DOE, this reflected more fully the Department's stance on career education.

Within the School of Life Sciences (SOLS) at ASU, some dissension has arisen among faculty members as a result of development of the BioSpine initiative, where program and course outcomes were being created to ensure consistency in content delivery. In an anonymous interview, a SOLS leader spoke at length about how some faculty members were opposed to this course alignment initiative because they perceived it as being contrary to the university's current focus as a research institution. Some faculty members viewed the initiative as shifting the orientation towards a vocational school, which was perceived as less reputable (SOLS staff 1, 2018).

Implicit support of career preparation at ASU. Although ASU does not mention employability or career readiness within its mission statement, the concept of career preparation has been discussed in the section of the academic catalog on general studies where you will find the following quote:

> A baccalaureate education should prepare students for a particular profession or advanced study and for constructive and satisfying personal, social and civic lives as well. In addition to depth of knowledge in a particular academic or professional discipline, students should also be broadly educated, including knowledge of transdisciplinary solutions to address interdependent economic, environmental and social challenges, and develop the general intellectual skills they need to continue learning throughout their lives. (Academic catalog: University

26

undergraduate general studies requirement, 2020)

For a student in SOLS at ASU, 120 credits have been required for graduation, 29 were allotted for the pursuit of these lauded general studies and six for the College of Liberal Arts and Sciences' "Science and Society" requirements (which are required specifically for Bachelor of Science degrees). Then, in the biological sciences curriculum, 37 of the 62 minimum required credits were non-negotiable, the other credits have limited options for which students may select. If the credits do not satisfy multiple requirements such as a general studies requirement being completed by a major course, 97 of the 120 credits were accounted for, leaving 27 elective credits to be completely up to students' discretion. Students have been encouraged to use these elective credits, as well as the general studies courses, to explore the breadth of topics within the course catalog.

A problem has arisen depending on the structure and layout of the required courses in a particular major, such as in the life sciences. When a life science student enrolled at ASU, their first semester was more than likely comprised of the following courses:

- BIO 181 General Biology I: 4 credits

- CHM 113 General Chemistry I: 4 credits

- ENG 101 First-Year Composition: 3 credits

- STP 231 Statistics for Life Sciences: 3 credits

- LIA 101 Student Success in The College of Liberal Arts and Sciences: 1 credit

So far, this schedule already required 15 credits, which has been the suggested

credit load per semester to graduate within four years/eight semesters. Most students have preferred having a layout of their tentative four year degree plan, so ASU implemented a retention and academic planning program called "eAdvisor" that included a "major map" tracking tool for each term, in which "critical courses" were designated as being a "predictor of success in a specific major" (Glossary of academic terms, 2020). All five of these courses were critically tracked in the life sciences major, leaving no room until typically the third or fourth terms for courses for students to explore their interests and to evaluate other possible career options. Although the university's stance with respect to the baccalaureate degree has been to "prepare students for a particular profession or advanced study and for constructive and satisfying personal, social and civic lives as well," the rigor and structure of the life science curriculum did not allow for this personal exploration in the earlier semesters of life science students' education careers, where there was less risk in changing majors and still graduating "on time."

Further, ASU's process of admitting students and structure surrounding graduation requirements has been another implicit statement about the university's support for vocational preparation. When being admitted to the university, prospective students have been invited to choose a major field of study "to stay on track to graduate in four years" (Undecided majors at ASU. Innovative programs. Cool opportunities. Excellent students. Join us., 2020). If prospective students were struggling with deciding on a major, they were allowed to choose from one of four exploratory tracks (Math, physical sciences, engineering and technology; Humanities, fine arts, and design; Health and life sciences; and Social and behavioral sciences). Nevertheless, students were not allowed to be in the exploratory program indefinitely; they were required to choose a

major by the end of their first 45 credit hours (Academic catalog: College of Integrative Sciences and Arts Policies, 2020). The academic advising culture at ASU has guided students in the direction of choosing a major as soon as possible to ensure they graduate "on time" (i.e., within four years).

Although career exploration courses were not required within the SOLS' curriculum, students had the opportunity to enroll in UNI 150 (Major and Career Exploration) and/or CED 250 (Career Development) to supplement university general study requirements and the desire to receive guidance on the career decision-making process. These courses have been offered for the general student population, allowing students of multiple majors and colleges to comingle and exchange ideas during this formative process. Nevertheless, because these courses have not been specifically required, SOLS students typically have not availed themselves of these opportunities. As I introduced in Chapter 2, when surveyed about the option of taking a generalized or discipline-specific career development course, SOLS alumni and current students alike demonstrated a strong preference for the latter course type. Later in Chapter 4, the students interviewed for my study explained the benefits of a discipline-specific career development course, including a sense of relief of seeing peers from the same academic discipline wrestle with similar career planning struggles. Further, because these generalized career development courses were lower-division courses (100/200 level), as students advanced beyond their first year of college, they sought upper-division coursework (300 level or above) to complete the minimum upper-division credit threshold as well as other graduation requirements in a concurrent fashion.

As an undergraduate academic advisor, I have interacted with many students who

experienced conflict between switching into a major that they liked and prolonging their time to graduate, or choosing to stay in their current, less-desirable program and progressing through the requirements for the ultimate goal of simply earning a degree. For example, desired classes might have been offered at the same time as required courses, causing them to decide whether they wanted to extend their time in school to explore their own interests. Moreover, what if their interests changed because of exposure to a topic within a course? The complex graduation requirements did not allow much wiggle room for college students to change their major and graduate "on time" if this epiphany occurred in their third or fourth year. Many students feared the social and financial repercussions of changing their major and possibly delaying graduation because of the socially constructed expectation of completing a degree within a specific timeframe. Further, if they changed majors, they may have had to delay their career ambitions to complete these requirements. This complication had financial repercussions for college students who paid to take extra courses for personal satisfaction, while completing the large volume of required coursework. Notably, if the instructor or institution did not provide an explanation on the value of these required courses, students labeled those courses as irrelevant and became even more frustrated with the system.

For many students, college has felt like a game where students completed certain tasks to win the highly-valued prize of a degree. The arbitrary timeline of a four-year pathway to college graduation forced students to make sacrifices along the way to preserve time, money, energy, and their reputation. When students deviated from this timeframe, their intelligence and worth has been questioned. College students incurred more debt if they changed their minds on their declared majors; this 'swerve' also

30

extended the time to graduation and potentially missed career opportunities. For the majority of students who changed their minds, the education environment's design was at odds with the supposed aims of helping them fulfill their potential. Notably, these students were less likely to contribute to society, which is a part of ASU's mission statement, when they incurred diminished confidence and higher debt as a result of this cumbersome experience. Thus, frequently, there is a conflict between what students need with respect to career development as compared to the structure and culture outlined in the major and course selection.

Nevertheless, considering students' needs with respect to employment and given the strong job market providing a highly competitive area for all job seekers, alternative resources that can help our students compete should be considered (Bridgstock, 2009). Further, Ruth Bridgstock (2009), a career development researcher suggested, "a 'one-size-fits-all' student approach will not suffice, as there will be discipline-based variability in terms of the knowledge and level of development required" (p. 39).

Theoretical Perspectives Guiding the Research

In the following section, I have provided information about the three theoretical perspectives guiding the research in my project: Holland's (1985, 1997) theory of vocational personalities and their connections to work environments; Sampson, Peterson, Reardon and Lenz's (2003, 2004) cognitive information processing career decision theory (CIP); and Bandura's (1986) self-efficacy theory.

Holland's theory of vocational personalities and work environment (RIASEC). When applying for a job, people commonly have searched for jobs that matched their skills and interests *and* at the same time sought a place where they felt they

belonged. John Holland (1985, 1997) examined what led to job satisfaction over

individuals' lifetimes. Through his research, Holland created a practical typology of six

categories into which individuals were classified. In his model, the six vocational

interests, Realistic (R), Investigative (I), Artistic (A), Social (S), Enterprising (E), and

Conventional (C), generated a three-letter code that captured individuals' primary,

secondary, and tertiary career interests as a result of an assessment (Holland, 1985,

1997).

"Holland's ubiquitous RIASEC system has been touted for its practicality for

career counselors and professionals, providing clear categories to help individuals make

informed career-related decisions" (Reardon, Lenz, Peterson, & Sampson, 2019, p. 23).

The system has served as the foundation for the Occupational Information Network

(O*NET) Interest Profiler, a "family of self-assessment career exploration tools that can

help clients discover the type of work activities and occupations that they would like and

find exciting" (O*NET, 2018). Many career counselors and advising centers, such as

ASU's Career and Professional Development Services (CPDS), have used this source to

help individuals explore career options. Further, it has been viewed as the "primary

source of U. S. occupational information," because its data is used in many job and career

databases (Reardon et al., 2019, p. 32). On the site, careers have been sorted and can be

browsed according to the RIASEC typology. Also, users have been able to complete the

"Interest Profiler" to receive career suggestions and ideas categorized by Holland's

RIASEC codes.

This Interest Profiler has been viewed as "a self-scored interest assessment" that

measured Holland's six occupational typologies (Rounds, Su, Lewis, and Rivkin, 2010,

p. 3). This tool was developed in 1999 by "by the O*NET project of the U.S. Department of Labor, Employment and Training Administration, Office of Policy and Research (OPR)" (Lewis & Rivkin, 1999, p. iii). Extensive analyses on the reliability and validity of this vocational tool have been conducted, including when it was originally developed by Lewis and Rivkin (1999), which involved eight phases of research (Rounds et al., 1999). Further, "the DOL has established construct validity and reliability for the Interest Profiler, including high internal consistency across the RIASEC scales and high test/retest reliability" (JIST Works, n.d.). After reviewing the Interest Profiler, Rounds et al. concluded,

> The results from the internal consistency reliability analyses are comparable to other Holland-type interest inventories. The results from the stability analysis show that the O*NET Interest Profiler is very consistent over time … A principal components analysis indicated that the factor structures of the Interest-Finder and the O*NET Interest Profiler are similar to what has been found for other RIASEC inventories. These findings suggest that the O*NET Interest Profiler fits well into the constellation of other established vocational interest measures. (Rounds et al., 1999, p. vi)

In 2010, a team of vocational psychology and test construction experts created a shorter version of the profiler, condensing it from 180 to 60 items. The purpose of this exercise was to create another version of the Interest Profiler that was quick to complete and self-score, providing further time for discussion and analysis. Rounds et al. determined that this short form profiler had "acceptable levels of reliability" and the "scales show convergent and discriminant validity with the Interest Finder RIASEC

scales and structural properties that mirror the theoretical basis of the RIASEC model"

(Rounds et al., 2010, p. 6).

At ASU, the College of Integrative Sciences and Arts (CISA) has served as an

academic division with programs for students who were undecided on their majors when

they selected courses to explore their options. CISA's advising team developed a

resource dedicated specifically to the RIASEC codes, providing examples of majors

across the university related to each career interest type. For example, SOLS' biological

sciences major has been listed as an IAR code (Investigative, Artistic, Realistic), art was

identified as AER (Artistic, Enterprising, Realistic), and business was described as EAS

(Enterprising, Artistic, Social) (Arizona State University, 2019). CISA has partnered

with Kuder, Inc. to offer the Kuder Career Planning System free of charge for ASU

students. Kuder, Inc. has served as a "career guidance solutions provider" that has used

Holland's RIASEC's codes as the framework for their career exploration assessments

(Kuder, Inc., 2019). Notably, Holland referred to Frederic Kuder's interest-based

assessments (1938) when he was developing his theory of vocational choice (McGrew,

2019). This Kuder Career Planning System personalized for ASU allowed the matching

of students' interests to the univeristy's programs with RIASEC codes, as explained

above (Arizona State University, 2019). A challenge of using the Kuder Occupational

Interest Survey (KOIS), has been that the profile "contains 10 Vocational Interest

Estimate Scales (VIEs), with scores reported as percentiles: Scientific, Artistic, Literary,

Social Service, Musical, Outdoor, Computational, Clerical, Persuasive, and Mechanical.

The manual explains how to convert VIEs into the RIASEC typology" (Savickas, Taber,

& Spokane, 2002). Nevertheless, the KOIS was developed before Holland's RIASEC

typology and was revised in 1997, becoming the KCS (2004). When Ihle-Helledy, Zytowski, and Fouad (2004) studied the test-retest reliability and consequenctial validity of the Kuder Career Search (KCS) interest inventory, "the internal consistencies for all KCS activity preferences demonstrated adequate consistency " (2004). The KCS assessment has now been called the Kuder Career Interests Assessment and has been one component of the Kuder Career Planning System; its subtitle on the student-facing platform was "Connect your top interests with career paths" (Kuder, Inc., 2020). The other two components were the Kuder Skills Confidence Assessment ("What do you believe you're good at doing?) and Super's Work Values Inventory-revised ("Learn what is most important to you") (Kuder, Inc., 2020). Some career advisors have used multiple interest inventories such as the O*NET and Kuder inventories to show complementarity within the results. This has been advised by researchers, such as in Savickas et al. (2002), and was the motivation for using both in this study.

Realistic individuals have demonstrated "a preference for activities that entail the explicit, ordered, or systematic maniupation of objects, tools, machines, and animals and to an aversion to educational or therapeutic activities" (Holland, 1985, p. 19). A Realistic person has a tendency to be frank, genuine, practical, self-effacing, and materialistic, among other traits (Holland, 1985). Investigative people lean towards "observational, symbolic, systematic, and creative investigation of physical, biological, and cultural" activities (Holland, 1985). They could be described as analytical, complex, precise, intellectual, and reserved (Holland, 1985). The Artistic type prefers "ambiguous, free, unsystematized activities" where they can use "physical, verbal, or human materials to create art forms or products" (p. 20). Oftentimes they are described as complicated,

expressive, idealistic, introspective, and nonconforming (Holland, 1985). *Social*

individuals have a "preference for activities that entail the manipulation of others to

inform, train, develop, cure, or enlighten" and are typically cooperative, friendly,

generous, persuasive, and tactful (Holland, 1985, p. 21). Those with an *Enterprising* bent

enjoy "attain[ing] organizational goals or economic gain," with a disliking to

"observational, symbolic, and systematic activites" (Holland, 1985, p. 21).

Characteristics that typify Enterprisers include adventurous, ambitious, energetic,

extroverted, and self-confident (Holland, 1985). Finally, the *Conventional* type gets

pleasure from "explicit, ordered, systematic manipulation of data … keeping records,

filing materials, reproducing materials," and the like (Holland, 1985, p. 22). They

usually have been characterized as careful, conscientious, methodical, orderly, and

practical (Holland, 1985).

Holland also believed RIASEC types could be applied to environments as well.

In the hexagonal model, the closer the type results were to one another, the more similar

to they were, which Holland called a "consistent" result (Holland, 1997; Leung, 2008).

See Figure 6.

Figure 2-1. A Hexagonal Model for Defining the Psychological Resemblances Among Personality Types and Environments and Their Interactions

Figure 6: Hexagonal Model of John Holland's Theory of Vocational Personalities and Work Environments (Gysbers, Heppner, & Johnston, 2014, p. 31)

If someone's three-letter code involved letters that were across from each other, Holland suggested this person's career exploration would prove more difficult to find a job and environment that satisfied all three types (Gysbers, Heppner, & Johnston, 2014). Figure 7 provided an explanation of each personality type, including common traits life goals, values, identifications, aptitudes and competencies, self-ratings, and suggested vocational career clusters.

Table 2-1. Personality Types and Salient Characteristics

	Realistic	Investigative	Artistic	Social	Enterprising	Conventional
Traits	Hardheaded Unassuming Practical Dogmatic Natural Uninsightful	Intellectual Curious Scholarly Open Broad interests	Open Nonconforming Imaginative Intuitive Sensitive Creative	Agreeable Friendly Understanding Sociable Persuasive Extroverted	Extroverted Dominant Adventurous Enthusiastic Power-seeking Energetic	Conservative Unimaginative Inhibited Practical-minded Methodical
Life goals	Inventing apparatus or equipment Becoming outstand- ing athlete	Inventing valuable product Theoretical contribu- tion to science	Becoming famous in performing arts Publishing stories Original painting Musical composition	Helping others Making sacrifices for others Competent teacher or therapist	Being community leader expert in finance and com- merce Being well liked and well dressed	Expert in finance and commerce Producing a lot of work
Values	Freedom Intellectual Ambitious Self-controlled Docility	Intellectual Logical Ambitious Wisdom	Equality Imaginative Courageous World of beauty	Equality Self-respect Helpful Forgiving	Freedom Ambitious (–) Forgiving (–) Helpful	(–) Imaginative (–) Forgiving
Identifications	Thomas Edison Admiral Byrd	Madame Curie Charles Darwin	T. S. Eliot Pablo Picasso	Jane Addams Albert Schweitzer	Henry Ford Andrew Carnegie	Bernard Baruch John D. Rockefeller
Aptitudes and competencies	Technical	Scientific	Arts	Social and educational Leadership and sales Interpersonal	Leadership and sales Social and educational Business and clerical Interpersonal	Business and clerical
Self-ratings	Mechanical ability	Math ability Research ability	Artistic ability	—	—	Clerical ability
Most competent in	Mechanics	Science	Arts	Human relations	Leadership	Business

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Figure 7. Personality Types and Salient Characteristics (cited in Gysbers et al., 2014).

For example, in Figure 7, the Conventional type was most likely to find satistfaction in an accounting or finance related role because of their business and clerical aptitudes, whereas someone with an Artistic type would have disliked that career path because of their preference for creativity and expression.

Another major concept from Holland's RIASEC typology was *congruency*; specifically, the greater the similarity of the three-letter codes for both personality and environments, the greater was the likelihood of an individual enjoying and feeling appreciated in that environment (Holland, 1985, 1997). Thus, if there was "low congruence," this meant the environment and vocational personality type did not match, which led to "vocational dissatisfaction and instability" (Leung, 2008, p. 118).

Similar to other personality assessments, it was common for individuals to find

ways to relate to many of the types in the indicator. Notably, individuals had tendencies

and preferences towards certain types, which Holland labeled "differentiation." The

stronger affinity individuals had towards a few of the types, the stronger the

differentiation. Individuals who did not relate to any of the indicators demonstrated a

profile that had a moderately straight line between the types and their differentation was

low. Those who demonstrated more distinction between the types were more likely to be

ready to talk about career choice selection, as opposed to a low differentitation individual

who would still have been in the career exploration phase (Gysbers et al., 2014; Holland,

1985, 1997; Leung, 2008).

Holland's RIASEC theory has been regarded as one of the premier career theories

and assessments (Kennelly, Sargent, & Reardon, 2018). Terence Tracey (2008)

evaluated the usefulness of Holland's RIASEC theory in a career class with 283 students.

Results showed there were changes in career certainty, career decision-making self-

efficacy, and interest-occupation congruence when students adhered to this model,

leading Tracey to recommend that the RIASEC method be used in career counseling and

career development courses. In a longitudinal analysis of a career course taught at

Florida State University for 45 years (Kennelly et al., 2018), Holland's RIASEC theory

was part of the course's foundation, along with cognitive information processing career

decision theory (Sampson, Reardon, Peterson, & Lenz, 2004). The authors concluded

that such a course was aligned with a university's mission of education, research, and

service because students increased their knowledge about the job market and their

vocational preferences and skills, heightened career readiness, improved graduation and

retention rates, provided teaching opportunities for individuals interested in career

development, "supported at-risk or other student populations in their educational and career planning," and demonstrated other related benefits (Kennelly et al., 2018, pp. 14-15).

Implications. As the career development class, the intervention for this study, continues to be developed and the results are analyzed, using an assessment tool to create RIASEC profiles for students will inform the instructor of students' readiness for career choice specification or a need for career exploration and identity development. If the results show a clear delineation of students with high and low RIASEC profiles, it may be necessary to develop two different career development courses to address this difference. Ideally, students would complete Holland's "Self-Directed Search" assessment to receive their RIASEC codes, because it is the most robust and comprehensive RIASEC assessment in the industry (PAR, Inc., 2019). However, because of the financial cost of using this assessment, I elected to use CISA's Kuder Career Planning System because it is free for ASU students (Arizona State University, 2019). Because of the practicality of this career theory and the availability of the free Kuder assessment tool, Holland's RIASEC theory provides a relevant approach for working with students who are examining career alternatives. Thus, it was used during the course to facilitate students' exploration of careers and development of skills related to career exploration.

Sampson, Peterson, Reardon, and Lenz's cognitive information processing career decision theory (CIP). In 1971, Sampson and his colleagues developed an approach to delivering career services at Florida State University under the "assumptions that multiple staff members are involved in service delivery, a variety of career resources and services are available, and career resources and services are delivered both in a career

center and on an Internet web site" (Sampson, Peterson, Reardon, & Lenz, 2003, p. 3).

These features were evident at ASU as well. The aim of this framework was to help

individuals learn about the vast career opportunities in the job market, as well as teach

them how to prepare for the job search process (Sampson, Reardon, Peterson, & Lenz,

2004).

Key elements of this cognitive information processing (CIP) approach included

screening individuals to determine what services were appropriate, matching staff

assistance based on levels of career readiness, and using the appropriate career theory to

determine the amount and type of career development service. They also recommended

using a career services room and digital resources to deliver these career services in

addition to applying appropriate resources based on "verbal aptitude, motivation, learning

style, and physical ability" (Sampson et al., 2003, p. 6). Further, they suggested other

important elements such as creating a collaborative team of career service professionals

to assist the students, and providing common staff training to ensure consistency

regardless of whomever was delivering the career assistance (Sampson et al., 2020).

As part of the CIP approach, the proponents made four assumptions: (a) the career

decision process involved both cognitive and affective processes, (b) individuals'

capabilities to progress on career ambiguity was affected by cognitive abilities and

knowledge, (c) this career development process was ever-evolving, and (d) career

guidance was focused on improving students' skills in information processing (Hughey,

Burton Nelson, Damminger, & McCalla-Wriggins, 2003). Similar to Holland's RIASEC

theory, the CIP approach was recognized for its practicality and ease of use, which

aligned with the spirit of action research. Instead of a hexagon model (e.g. Holland's

RIASEC), the CIP approach used a triangle/pyramid configuration that served as a visual and sequential model for information processing with three distinct levels involving four components (Sampson et al., 2004, 2020). These four components focus on self-knowledge, knowledge about options, decision-making, and an executive processing domain or "thinking about thinking" (Reardon & Lenz, 2015, pp. 85-86). See Figure 8.
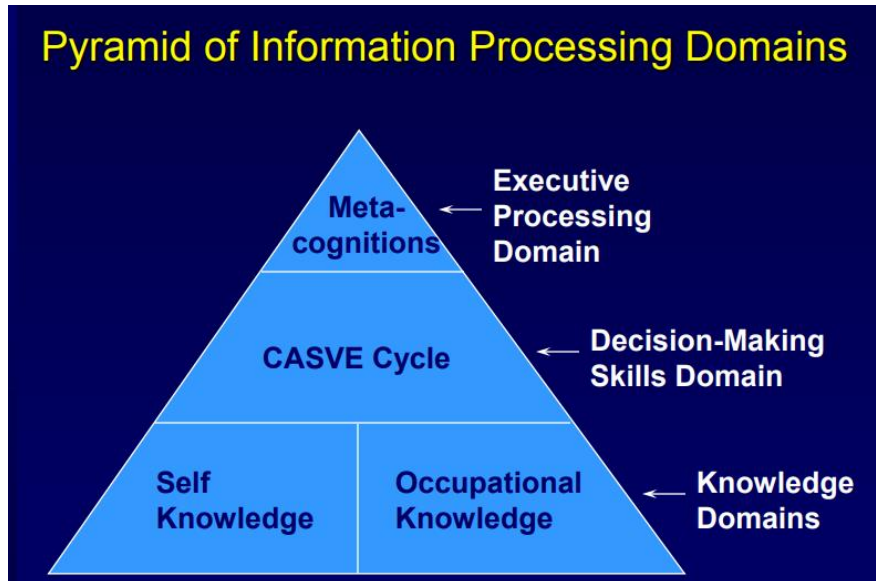
Figure 8. CIP Theory's Pyramid of Information Processing Domains (Peterson, Sampson, Jr., Reardon, & Lenz, 2003)

The Pyramid of Information Processing Domains (hereafter the pyramid) included various aspects involved in making a career choice. At the base of the pyramid, and the foundation component of this theory, was the *Knowledge Domain*. Individuals' knowledge domain was two-dimensional in nature and included (a) looking inward and (b) researching the career landscape. Individuals needed to understand themselves in terms of their values, interests, skills, beliefs, desires, and other related information with respect to occupational considerations related to Holland's RIASEC model. Frequently, students suggested this was the most uncomfortable aspect of career decision making

because it forced them to acknowledge their strengths and potential *and* their weaknesses and realities. Information about the knowledge domain was organized using Holland's RIASEC hexagonal framework as a tool for facilitating discovery of knowledge about themselves.

At the same time, individuals also needed to know about their career options, labeled in Figure 8 as *Occupational Knowledge*. Of course, this included salary information, outlook, trends, and necessary skills, certification/s, and education related to the specific role. Moreover, this domain also included information about how gender and ethnicity played roles in these occupations, as well as how individuals' lifestyle preferences affected career pathways–family roles, relationships, probability of participating in leisure activities, and vacations Reardon et al., 2019. Ultimately, the base of the pyramid was focused on motivating the student, whom the theorists referred to as "clients" in their writing, to think about knowing about themselves, self-knowledge, and their options, occupational knowledge.

The middle level of the pyramid, the *Decision-Making Skills Domain*, was focused on decision-making abilities and involved a cyclical model known as "CASVE" (kuh-SAW-vay) (Sampson et al., 2004, 2020). This domain was critical to the design of this theory and has been described at length later in this chapter.

At the top of the pyramid, the *Executive Processing Domain* controlled how an individual thought about their career decision making. As part of the control mechanism, individuals engaged in using metacognitive skills related to occupational decision-making including:

- Knowing when to get additional help

- Being aware of effective decision-making strategies

- Being clear about the specific problem that needs to be solved

- Monitoring how the process is going

- Give themselves positive self-talk

- Praise their good efforts

- Focus positively on desirable outcomes (Reardon, Lenz, Peterson, & Sampson, 2019, pp. 62-63).

Ultimately, it was critical for individuals to be aware of how these self-talk, self-awareness, monitoring, and control skills affected all domains of the career decision making process. How students viewed themselves and their career options was greatly affected by negative or positive metacognitions (Reardon et al., 2019). Notably, in SOLS advising, it was common for students to have a false sense of their ability to be accepted into medical school because they lacked self-awareness and thorough understanding of the realities of medical school acceptance criteria and processes. A career development and exploration course had the potential to provide a safe space to reframe these metacognitions *and* to expose students to the wide variety of career options in the marketplace.

The language used in Figure 8 can be confusing for students to understand, so the proponents of CIP created an outward-facing version of the pyramid, seen in Figure 9.
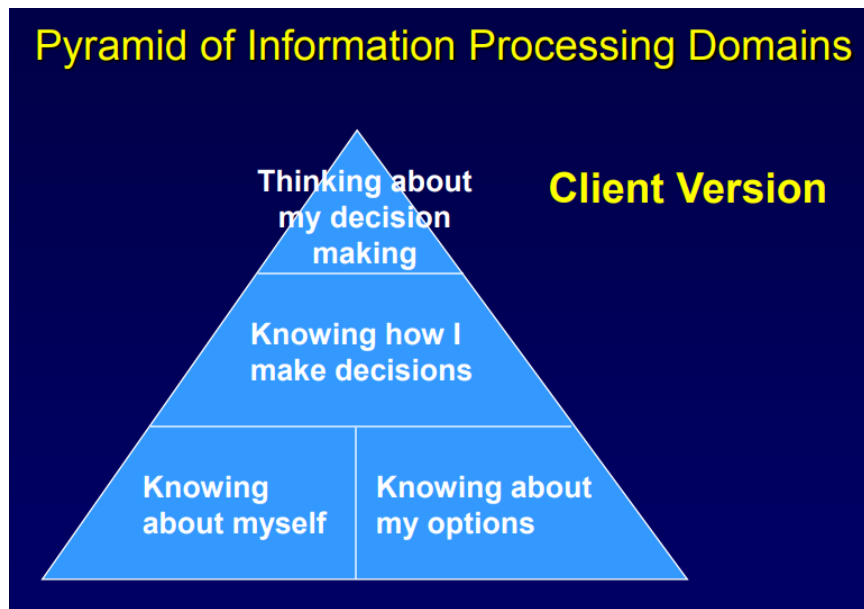
Figure 9. CIP Theory's Pyramid of Information Processing Domains–Client version (Peterson, Sampson, Jr., Reardon, & Lenz, 2003)

Figure 9 has demonstrated the same information exhibited in Figure 8, but in first-person language students can better understand. In the textbook used for the intervention in the study, *Career development & planning: A comprehensive approach* (6th ed.), these headings were used throughout the book, frequently as section and chapter titles (Reardon, Lenz, Peterson, & Sampson, 2019). The repeated use of this terminology helped students understand the CIP theory in a practical sense, rather than appearing like a technical, jargon-heavy approach.

The proponents of CIP theory described the three domains using a computer as a metaphor: the *Knowledge Domain* was similar to the "data files stored in the memory of a computer;" whereas, the *Decision-Making Skills Domain* was described as the "computer programs that use facts and data stored in the memory and files of the computer;" and the *Executive Processing Domain* was the "job-control function that tells the computer in what order the programs in the second level of the pyramid are to be run" (Reardon et al.,

2019, p. 11). With this in mind, the programs/*Decision-Making Skills Domain* was a critical component to making the computer run. This level, described as the "CASVE" cycle, was a tool to demonstrate how career decision making involved an on-going process, not a singular occurrence. See Figures 10 and 11 for the illustrated versions of the CASVE cycle. Similar to what was noted earlier, with Figures 8 and 9, the theorists created two versions of the CASVE cycle: one for practitioners' use, Figure 10, and another for student comprehension and guidance, Figure 11.
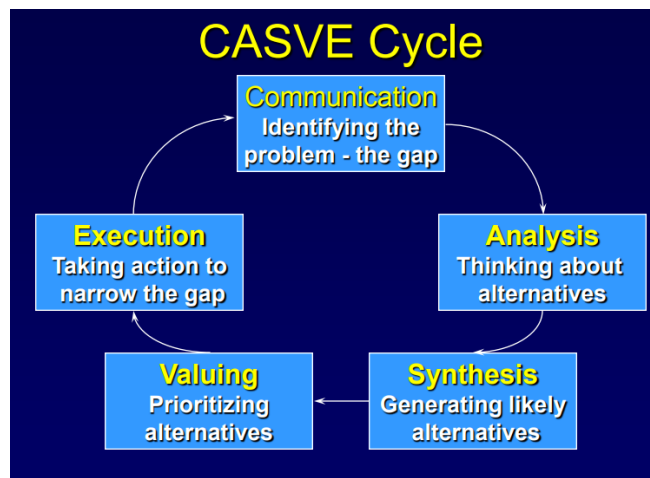
Figure 10. CIP Theory's CASVE Cycle (Peterson, Sampson, Jr., Reardon, & Lenz, 2003)
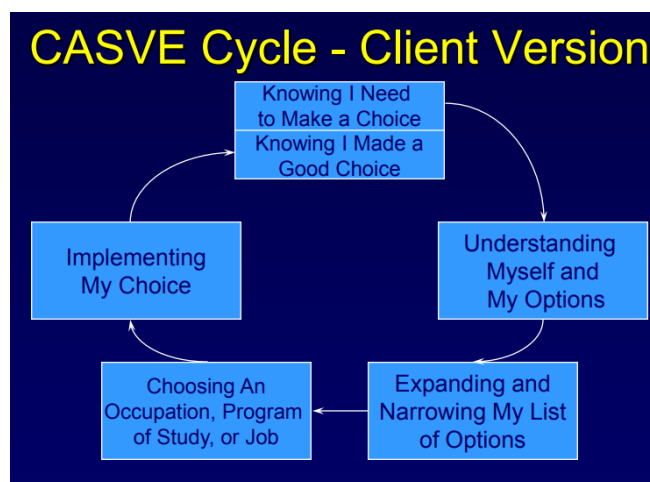
Figure 11. CIP Theory's CASVE Cycle – Client version (Peterson, Sampson, Jr., Reardon, & Lenz, 2003)

With respect to career decision making, "we overestimate what we know; we ignore facts that don't jibe with what we desire; we get distracted by our emotions; or we focus on information that is not relevant to the choice" (Reardon et al., 2019, p. 47). Thus, the entire CIP approach has provided a practical and relatable process to steadily remove these hindrances and guide individuals down a more suitable pathway. The CASVE cycle of the CIP approach involved the five phases: communication, analysis, synthesis, valuing, and execution.

In the first phase, communication, practitioners have challenged students to think of the process in terms of knowing they needed to make good career choices and holding the sometimes-uncomfortable conversation about how to make this good choice. Students learned how to identify "a gap between the ideal and current situation" as it was related to their job search (Reardon et al., 2019, p. 52). Students were shown how to analyze cues affecting their perception of career options and efficacy (Sampson et al., 2004, 2020). Internal cues included such things as emotions and physical symptoms, and external cues involved inquisitive family members and students' academic performances as compared to medical or graduate school requirements. Thus, communication played a critical role in students' review of information that was focused on increasing awareness of available resources, and importantly, educating them to seek resources to fill in the gap of what they did not know and needed to learn to inform better their career choices.

The second of five phases in the CASVE Cycle, analysis, required students to move on from "knowing thyself" to "information they did not know" (Reardon et al., 2019). This phase expanded on what students already knew about the available career-decision resources; introduced previously unknown resources and career options;

encouraged students to look inward at their values, interests, and skills; and fostered

discussions on self-awareness and its effects on career problem solving (Sampson et al.,

2004, 2020). Some questions the students might have asked during this phase included:

- What do I need to know about myself and my situation to solve this problem?

- What exactly do I need to do to solve this problem?

- Why am I feeling this way?

- What do my significant others think about my choice process?

- Where is the pressure coming from to make a choice? (Reardon et al., 2019, p.

   53)

The information learned during this phase strengthened and added to the

information in the self-knowledge segment in the *Knowledge Domain.* Results from

assessments, such as the aforementioned O*NET and Kuder Career Planning

assessments, provided data for students to review to better understand themselves during

this phase.

Synthesis served as the third phase, where students explored career options while

intentionally not becoming overwhelmed with the variety of options. Thinking of it as an

inverted pyramid, students started with a broad range of options they were considering as

career paths, then narrowed their focus to what seemed appropriate with the

recommendation from the authors that three to five roles were to be considered to ease

the transition into the next phase (Sampson et al., 2004, 2020). The goal of this phase

was to identify and create an action plan to resolve the previously identified problem/gap

as it related to their career. The synthesis occurred first by expanding the number of

options considered through activities such as self-reflection, investigation, research, and

informational interviews. These processes led to crystallization, which was the narrowing of possible options based on preferences and results from the analysis phase (Reardon et al., 2019).

Now that students had completed the phases of understanding who they were, what they offered, and what their options were, they began to find the value of the career paths they were deliberating. Strengths and weaknesses were evaluated, as they considered the stakeholders of this job choice—self, immediate family or loved ones, and possibly even looking at their cultural group/community or society at large (Sampson et al., 2004, 2020). Next, individuals come to a conclusion using a cost/benefit analysis or other process to judge each option. Then, the goal was to list the options by priority or some other kind of ranking mechanism (Reardon et al., 2019).

Closing the loop on the CASVE cycle was represented in creating a plan to execute, eventually leading to the desired career goal. Thus, students selected appropriate majors/courses, sought extracurricular experiences to provide training opportunities, and examined the need for securing financial aid, if necessary. The work at this stage included considering what applications needed to be completed, as well as any other materials required by the hiring organization (Sampson et al., 2004, 2020). Three specific activities assisted in this implementation phase (a) planning, (b) trying out, and (c) applying. As students explored what was required for each job option, it was important for them to gain insight and experience through courses, internships, volunteering, student organization involvement, and work. This "hands-on" experimentation approach was intended to direct the students to the ideal route of "applying" such as applying for jobs and registering for experiential education outlets

(Reardon et al., 2019).

This CASVE cycle served as the middle level of the information processing pyramid, improving students' ability to make career-related decisions and fostering their career self-efficacy. The top of the pyramid, the *executive processing domain*, was comprised of talking points on individuals' *meta-cognition*, that is to say, self-talk, self-awareness, monitoring, and control activities (Sampson et al., 2004, 2020).

In a conversation with noted career researcher and CIP co-author Robert Reardon, he expressed frustration with how the CIP approach has been dismissed because of its practical nature. Nevertheless, he emphasized the authors' focused on a triangulation of theory, research, and practice for the development of their approach, which mirrored the aims of action research (Reardon, 2018).

Related research. Analyzing retention in STEM majors from the first to the second year of college, Belser, Prescod, Daire, Dagley, and Young (2017) designed a career development course based on CIP theory. Data were collected between fall 2012 and spring 2015 from this 16-week class. The Career Thoughts Inventory (CTI) was administered as a pre- and post-intervention assessment for career readiness, and only students who completed both tests were included for the data analysis, $n = 315$ (Belser et al., 2017). Three different models were used to examine the data. The model that included career planning participation, the initial major—the major students selected upon entering college, and the CTI total score "had the highest number of accurate predictions" (Belser et al., 2011, p. 91). This STEM-specific career development class was seen as a noteworthy predictor for retention in all of the models, suggesting that having a discipline-focused, career-planning course influenced retention in the major.

Notably, the researchers emphasized discipline-specific career courses were not the sole predictor of those likely to leave the major.

Bullock-Yowell, Andrews, and Buzzetta (2011) conducted interviews and distributed questionnaires to 322 undergraduate, college students focusing on the (a) Big Five personality factors, (b) dysfunctional career thoughts, and (c) cultural mistrust at a university in the southern part of the United States. Instruments were selected based on their practicality in measuring those three variables as well as the theoretical perspectives of CIP theory and social cognitive career theory. Items on the CTI assessment tool were aligned with the CIP theory, which allowed the researchers to measure negative and/or dysfunctional career thinking. Bullock-Yowell et al.'s results substantiated that career readiness could be assessed and handled through CIP's framework and resources.

Implications. Students in SOLS' academic advising sessions often show openness and curiosity towards possible career outcomes when they ask the question "What can I do with this major?" Generally, this leads to a conversation about students' skills, aptitudes, and interests *and* how they can translate those into various career options. Using the RIASEC and CIP approaches and associated tools provides a framework on how to best facilitate career discovery. Further, having a career-planning course designed with CIP resources has the potential to influence the number of students who are retained in the life sciences and the university as a whole.

Both the RIASEC and CIP theories provide tangible, practical tools to implement in the classroom. Researchers use CIP to design and teach career-planning courses, test their outcomes with related tools, and refine their work over time. The creators of CIP have written textbooks and handbooks that discuss integrating RIASEC into the CIP

51

framework, as well as providing syllabi and class assessments to measure the effectiveness of implementation of this theory (Reardon & Lenz, 2015; Sampson et al., 2004, 2020). The intervention for this research will use both RIASEC and CIP resources as guiding frameworks for the course design and implementation.

Bandura's theory of self-efficacy. Albert Bandura (1986, cited in Hughey et al., 2009) introduced his landmark theory of self-efficacy about individuals' confidence and perceived ability to perform a task. Moreover, he cogently argued these beliefs shaped subsequent efforts and decisions. Bandura asserted that self-efficacy was influenced by four sources of information that included personal performance accomplishments or mastery experiences, vicarious learning, social persuasion, and physiological states and reactions.

Mastery experiences. Of the four sources of information affecting self-efficacy, mastery experiences were the most relevant and applicable in this research context. Bandura claimed mastery experiences were the most powerful way to improve individuals' self-efficacy (Bandura, 1986). Simply stated, repeated *and* successful practices of a skill/task/behavior increased self-efficacy. The concept of "success" in this scenario does not necessarily mean fame, wealth, or accolades, but instead refers to the development of career choices through guided facilitation of career development and exploration processes. Through such repeated behavior, confidence was developed because individuals realized they had the ability to do something like finding a realistic career path.

Implications. To implement the intervention in this study, I will coach students on how to analyze the suitability of career paths through the course activities surrounding

introspection, exploration, analysis, synthesis, and planning. This intentional and repeated practice of career exploration and analysis will help students to broaden their views of possible career options, enhancing their self-efficacy in their ability to find a career path. Also, the elimination of unsuitable career options will increase self-efficacy because the students will have a better sense of their strengths in their abilities, knowledge, skills, and potential.

When embarking on the career search process, individuals can ask themselves questions such as "Can I do this?" as a determining factor to proceed with particular career goals. In the life sciences, many students initially start with ambitions of going into health-related professional programs. Unfortunately, most have not attained these goals. For example, only 100 students from all of ASU were accepted into medical school in 2017-2018 (A. Rawls, personal email communication, November 14, 2018). This career development course and activities will provide opportunities for students to engage in mastery experiences in occupational related tasks, ultimately learning how to answer the question "Can I do this?" in a productive and constructive manner.

Previous Cycle of Action Research—Cycle 2

In the fall 2019, I conducted a cycle of action research, Cycle 2, in which I implemented my intervention by teaching a preliminary version of my career development course. Specifically, I offered an online course during the first 7.5 weeks of the fall semester. The class roster included 27 students from the School of Life Sciences: 22 students were from face-to-face programs and five students were from online programs. The course was designed in summer 2019 and received IRB approval prior to data collection. For analysis of the effectiveness of the Cycle 2 implementation, the

following types of data were collected:

- Retrospective, pre- and post-intervention surveys of knowledge, self-efficacy, and five Career Decision-Making Self-Efficacy Scale scores

- Career State Inventory pre-test and post-intervention surveys (Leierer, Peterson, Reardon, & Osborn, 2020)

- Interviews conducted after the course concluded

Retrospective pre- and post-intervention surveys. This 39-item survey was constructed using two sources: (a) items constructed specifically for the study by me and my dissertation chair and (b) items from the Career Decision-Making Self-Efficacy Scale (CDMSE) (Taylor & Betz, 1983). Of the seven constructs measured on this survey, two of them were created for the study to measure participants' confidence related to *knowledge of career exploration and development tasks,* and *self-efficacy for searching for alternative careers*. The other five career development constructs: *goal selection, occupational information, problem solving, planning,* and *self-appraisal*, came from the CDMSE (Taylor & Betz, 1983). The CDMSE, a widely-used assessment tool, included 50 items focused on gauging participants' confidence related to career development. For this study, the original CDMSE was reduced by half and included only 25 items, which were the most applicable and relevant items related to the research questions. See Chapter 3, which included a section on discussing the process of modifying the CDMSE. Examples of items selected from Taylor and Betz's CDMSE were: "Identify some reasonable major or career alternatives if you are unable to get your first career choice;" "Find information about companies who employ people with life science majors;" and "Decide whether or not you will need to attend graduate or professional school to achieve

your career goals" (1983, pp. 66-68). In all, the seven constructs were assessed using five

items for a total of 35 items. The survey employed a 6-point Likert scale ranging from

Very Low Confidence, A Little Confidence, Confident, Quite a Bit Confident, and

Extremely Confident. The additional four items on the survey were demographic in nature

(identifying which program in SOLS the student was currently studying, their anticipated

graduation date, and age). The complete survey has been provided in Appendix C.

       This survey was distributed to the students after the course concluded through

direct email messaging and announcements through Canvas, the course learning

management system platform. Of the 27 enrolled students, 10 individuals completed the

surveys using the Qualtrics-provided web addresses to participate in the surveys.

Unfortunately, 17 individuals did not fully complete the surveys, resulting in a 37%

response rate. To begin my analysis, I used IBM's SPSS statistical analysis software to

compute reliabilities and then conducted repeated measures analysis of variance

(ANOVA) procedures for each of the research questions.

       Research Question 1. Prior to conducting the repeated measures ANOVA,

reliabilities for the measures were determined. See Table 2.

Table 2

Retrospective, Pre- and Post-Intervention Reliabilities for Five Occupation Search Constructs from the CDMSE—Goal Selection, Occupational Information, Problem Solving, Planning, and Self-Appraisal

Construct	Retrospective, Pre-Intervention	Post-Intervention
Goal Selection	.92	.98
Occupational Information	.92	.96
Problem Solving	.87	.94
Planning	.87	.96
Self-Appraisal	.83	.95

*—Note: $n = 10$.

The repeated measures ANOVA for the CDMSE was not significant, multivariate $F(5, 5) = 4.54$, $p < .06$. Nevertheless, given the small sample size, $n = 10$, and the preliminary nature of this work, the individual ANOVA tests were conducted. For goal selection the effect of time was significant, $F(1, 9) = 21.54$, $p < .001$, partial $\eta^2 = .71$, which was a large within-subjects effect using Cohen's criteria (Olejnik & Algina, 2000). Thus, the means for goal selection were significantly different across the two times. In Table 3, I have provided the means and SDs for goal selection and the other CDMSE variables. See Table 3.

Table 3

Means and Standard Deviations for Five Occupation Search Constructs from the

CDMSE—Goal selection, Occupational Information, Problem Solving, Planning, and

Self-Appraisal

Construct	Retrospective, Pre-Intervention	Post-Intervention
Goal selection	2.12 (0.84)	4.34 (1.15)
Occupational Information	2.28 (0.97)	4.18 (1.36)
Problem Solving	2.42 (0.92)	4.46 (1.06)
Planning	2.42 (0.87)	4.38 (1.10)
Self-Appraisal	2.96 (0.86)	4.78 (0.92)

*—Note: Standard deviations are in parentheses and $n = 10$.

Similarly, for occupational information the effect of time was significant, $F(1, 9)$ = 19.23, $p < .002$, partial $\eta^2 = .681$, which was a large within-subjects effect. Thus, the means for occupational information were significantly different at the two times. Likewise, for problem solving the effect of time was significant, $F(1, 9) = 27.09$, $p < .001$, partial $\eta^2 = .751$, which was a large within-subjects effect. The means for problem solving were reliably different at the two times. For planning the effect of time was significant, $F(1, 9) = 37.00$, $p < .001$, partial $\eta^2 = .804$ which was a large within-subjects effect. Thus, the means for planning differed significantly at the two times. Finally, for self-appraisal the effect of time was significant, $F(1, 9) = 34.36$, $p < .001$, partial $\eta^2 = .792$, which was a large within-subjects effect. Thus, the means for self-appraisal differed significantly at the two times.

Research Question 2. Prior to conducting the repeated measures ANOVA, reliabilities

for the knowledge and self-efficacy measures were determined. See Table 4.

Table 4

Retrospective, Pre- and Post-Intervention Reliabilities for Knowledge of Career

Exploration and Development Tasks and Perception of Possible Professional and Career

Goals and Opportunities

Construct	Retrospective, Pre-Intervention	Post-Intervention
Knowledge	.97	.97
Perception	.98	.99

*—Note: $n = 10$.

The repeated measures ANOVA for knowledge of career exploration and development tasks (knowledge) and self-efficacy for searching for alternative careers (perception) was significant, multivariate $F(2, 8) = 17.78$, p < .001, with partial $\eta^2 = .82$, which was a large within-subjects effect using Cohen's criteria (Olejnik & Algina, 2000). Follow-up individual ANOVA tests were conducted. For knowledge, the effect for time was significant, $F(1, 9) = 39.26$, $p < .001$, partial $\eta^2 = .81$, which was a large within-subjects effect using Cohen's criteria (Olejnik & Algina, 2000). Thus, the means for knowledge were significantly different across the two times. See Table 5 for the means and SDs for knowledge and perception. Similarly, for perception, the effect of time was significant, $F(1, 9) = 35.10$, $p < .001$, partial $\eta^2 = .80$, which was a large within-subjects effect. Thus, the means for perception were significantly different at the two times.

Table 5

Means and Standard Deviations for Knowledge of Career Exploration and Development Tasks and Perception of Possible Professional and Career Goals and Opportunities

Construct	Retrospective, Pre-Intervention	Post-Intervention
Knowledge	2.14 (0.84)	4.38 (0.97)
Perception	2.26 (0.99)	4.50 (1.14)

*—Note: Standard deviations are in parentheses and $n = 10$.

Career State Inventory. The four-item "Career State Inventory" (CSI) was developed by Leierer, Peterson, Reardon, and Osborn of Florida State University. For the CSI, respondents were asked to provide a list of currently considered occupations, their first occupation choice from that list, satisfaction relating to that choice, and a True/False assessment of doubt, confusion, and difficulty with making a career choice. The complete survey has been provided in Appendix B. This instrument was distributed as an assignment at the beginning and conclusion of the course. All 27 students completed the survey at one of the two time points; 81.5% completed it both times ($n = 22$). Timestamps and unique identifiers confirmed the same individuals completed the CSI before and after the course.

Results. The CSI was used to calculate the Career Decision State score (CDS), a score tabulated from the sum of their *certainty* (knowing occupations they are interested in; 1 question), *satisfaction* (contentment with their job option list; 1 question), and *clarity* (confidence in their ability to make a career choice; 3 questions) scores according to the CSI's score key (Leierer, Peterson, Reardon, & Osborn, 2020). Most career exploration inventories, such as the O*NET and Kuder Interest Profilers analyze the

respondent's preferences and their traits, comparing them to a pre-determined number of possible career options and environments. The CSI, however, does not evaluate the respondent's traits; rather, it measures the respondent's current career decision-making state as a snapshot in time. Thus, it provided a complementary data source in this study because the retrospective pre- and post-intervention surveys measured constructs related to career decision-making self-efficacy, a *trait* measure, and the CSI conversely was a *state* measure. The CSI has been used to bring awareness to the respondent's current state and provide a basis for comparison and discussion when conducted multiple times, such as in the first and last week of this career course. Although it was a lean assessment, it was powerful in how it helped respondents to reflect and discuss their "certainty toward a career goal, satisfaction with the goal, and clarity and confidence in attaining the goal" (Leierer et al., 2020, p. 5).

Certainty scores were calculated in the following way: If the respondent provided their first choice listed as their occupation choice, they received 1 point. If they listed their first choice plus alternatives, they received 2 points. If alternatives only were listed, they earned 3 points. Satisfaction scores were calculated using a Likert scale format of *1 = Very Satisfied, 2 = Satisfied, 3 = Not Sure, 4 = Dissatisfied,* and *5 = Very Dissatisfied* as a response to the individual's satisfaction with the options they provided as their occupations they were considering, including their first choice. Thus, their response (1-5) equated to their Satisfaction score. The Clarity score was calculated by awarding one point for each "*true*" response on the three true/false questions. If all the responses were "*false*," the respondent's score was 0; by comparison, if all three were "*true*," the score would be a 3. Then, the Career Decision State score was simply a summation of all three

60

scores. As shown in Figure 12, the total scoring range for the CDS spanned 2 to 12 points. The lower students' scores, the more certain, confident, and satisfied they were with their career decision-making abilities.

Total Scoring Range 2 – 12

2	3	4	5	6	7	8	9	10	11	12

Goal-directed   Uncertain   Frozen
Satisfied   Doubts   Dissatisfied
Confident   Tentative   Confused
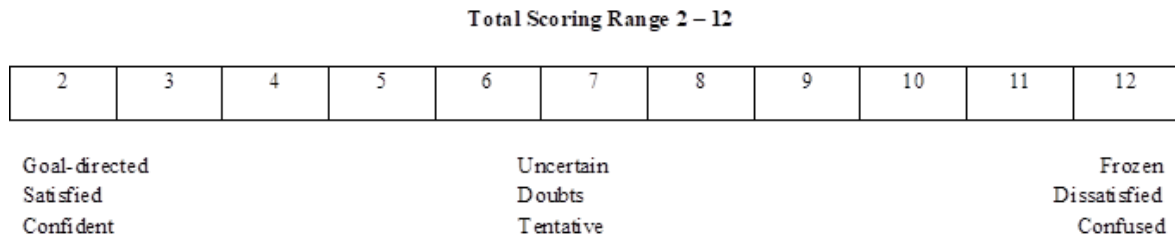
Figure 12. Career Decision State Score Scale

To analyze the pre- and post-intervention scores of the CSI, a repeated measures ANOVA was conducted. The overall test was significant, multivariate $F(3, 19) = 5.51$, $p < .007$, with partial $\eta^2 = .47$, which was a large within-subjects effect. As a result, individual follow-up ANOVAs were conducted. For certainty, the effect of time was not significant, $F(1, 21) = 3.40$, $p < .08$. See Table 6 for the means and SDs for certainty, satisfaction, and clarity with respect to occupational choices on the CSI. By comparison, for satisfaction, the effect for time was significant, $F(1, 21) = 11.34$, $p < .003$, partial $\eta^2 = .35x$, which was a large within-subjects effect using Cohen's criteria (Olejnik & Algina, 2000). Thus, the means for satisfaction were significantly different across the two times. Similarly, for clarity, the effect of time was significant, $F(1, 21) = 13.89$, $p < .001$, partial $\eta^2 = .40x$, which was a large within-subjects effect. Thus, the means for clarity were significantly different at the two times. Taken together, the significant decreases in satisfaction and clarity scores were important and were attributed to students' participation in the intervention, the course. These changes indicated students were more satisfied with their options and exhibited more clarity about career choice processes.

Table 6

Means and SDs for Three Constructs from the Career State Inventory*

CSI Construct	Pre-Intervention Scores	Pre-Intervention Scores
Certainty	2.50 (1.54)	1.86 (1.36)
Satisfaction	2.68 (1.13)	1.86 (0.71)
Clarity	1.95 (1.17)	1.18 (0.85)

*—Note: Lower scores are better scores. SDs are in parentheses and $n = 22$.

Interviews. A semi-structured interview consisting of nine items was developed to assess the students' understanding of career exploration and career development and the effectiveness of the course. For example, students were asked "After taking this course, have you changed personally? If so, how? If not, why not?" Follow-up questions were used during the interview based on the interviewee's responses. See Appendix D for the full set of interview questions. Students were invited to participate in this interview after final grades were submitted for the course.

Data sources and data analysis. Three students from the School of Life Sciences participated in the interviews; pseudonyms are used to preserve their confidentiality and anonymity:

- Amy was a junior, expecting to graduate in spring 2021. At the beginning of the course she was pursuing a Molecular Bioscience and Biotechnology major and changed it to Biological Sciences as a result of this course's reflective and exploration tasks.

- Billy was a senior, on track for spring 2020 graduation with a major in Biological Sciences (Neurobiology, Physiology and Behavior).

- Carol was a senior, expecting to graduate in summer 2020 also with a major in Biological Sciences (Neurobiology, Physiology and Behavior).

Data were analyzed using Straus and Corbin's (1998) constant comparative method. After initial coding, large categories of codes were created, which were then aggregated into themes. The major themes derived from these interviews were (a) expansion of perception of career options, (b) increases in confidence, and (c) overwhelming support for the course.

Expansion of perception of career options. All three students explained they enrolled in the course because they lacked knowledge about their career options. Two of them expressed the commonly held misconception that life sciences students more than likely could only go into medicine or lab research. They discussed how this course provided tools to explore their options, broadening pathways they believed they could pursue upon graduation. Amy stated she learned, "That there's a lot more broad [*sic*] jobs, and different fields in those jobs. If you want to do HR or something. Random stuff that still goes with biology, but you can do a job that fits to your personality." Billy discussed how the Strategic Academic/Career Planning project assignment helped him realize his options when he said,

Thinking about careers as in a career for myself? Yes, because you can go any, which route, but after this class I had my last paper. I had that huge epiphany while writing it. Then. 'Oh hey, I think it'd be really, I think I would really like PT' [personal training] and that's a change to grab the course that, because for my first paper I wrote biologists, right? As in a researcher or, yeah. So I think that changed. That definitely changed.

63

Similarly, Carol explained how the course changed her perspective of why she was interested in medicine, ultimately realizing it was because of the service aspect of the occupation. She discussed how the course helped her understand why her goal was medicine to begin with, and the reflective and analytical assignments led her to this realization as she explained,

> Part of the reason that I wanted to pursue medicine is I got involved with a humanitarian group and organization and it just so happened to be in the medical field. And I got my heart set on one aspect of it. I got my heart set on the medicine and maybe what brought me to it was the humanitarian work … but I didn't consider that. I didn't take a step back and think about what brought me to my goal, why I wanted to be there … On one of the projects when we were talking about other career options, it was totally accidental. When I was looking up different careers and looking about careers with my major, with my degree, careers within science and this job popped up on LinkedIn with this organization and I clicked on it, read on it more, and it ended up being this huge organization that does humanitarian work … And so they do humanitarian work in medicine, but they have a whole (silence) obviously, the aspect I would like would be aiding and helping, maybe not as a doctor, but in different ways.

All three students were emphatic about how this course changed their perspective of career options in the life sciences. They expressed appreciation that the course provided them with tools to explore career pathways, such as informational interviews, learning their Holland's codes, and the thought and reflective processes involved in the major writing assignments. Students reflected on feeling lost and/or confused on their

64

career options and this course helped to provide much-needed clarity.

Increase in confidence. The students were asked if they felt they had changed personally after taking this course, and Amy and Billy responded immediately with an affirmative answer. Billy described how, as a graduating senior filled with fear, he needed to make some career decisions, and "this class definitely opened doors" by teaching him how to explore and research career options. He also revealed that because of this course he gained the confidence to pursue a study abroad option in the next semester as illustrated in the following exchange during the interview.

Billy: …so this class definitely has taught me too, I need to get out there and start researching more and all that kind of, the whole study abroad thing. I never would have done that.

Serena C.: Really?

Billy: Yeah...what?

Serena C.: Oh my gosh, that's so cool. So, what was it about the class that changed your mind on study abroad? We didn't even talk about study abroad, I don't think.

Billy: Well just career development. Just the resume and how that would help my resume.

Serena C.: Okay.

Billy: And how that'd be a good experience.

The day preceding this interview, Billy came in for a scheduled advising appointment, where we discussed incorporating the study abroad experience into his upcoming schedule. He never commented on the course inspiring him to pursue this

activity; to me, it felt like any other study abroad conversation with a student. In fact, how he broached the topic led me to believe it was something he had always wanted to do. If we never had this interview, I am unsure whether I ever would have learned how participation in this course gave him the confidence to pursue studying abroad.

Carol stated the course did not necessarily change her personally, but did change her thinking processes when she claimed,

> No, I don't think I've changed. I think I've changed my thinking … I think I definitely am thinking a lot more in step-by-step and a lot more if I do this, then this happens … but I think I've really stayed the same … which I'm glad because I get so worried that I'm going to lose who I am and I think it just made me more passionate, more confident in myself.

Amy echoed these sentiments of gaining confidence in herself, helping her to face her anxiety surrounding making a career decision when she stated,

> I think I've definitely become more confident. I know over the summer, I was just like an anxiousness like, not knowing what I wanted to do and like calling my parents and being like, I don't know. I'm graduating soon, like I don't even know what I want to do after and now I'm like, confident that I can like find a career, like do informational interviews like I have like all the skills to do what I need to do.

She also discussed how her parents were influencing her career decisions and this course helped her gain the confidence to explore career options on her own when she commented.

> I learned a lot because, I think throughout my life. My dad's a pharmacist and he

pushed me to be a doctor and for, I guess, a lot of my life, I've been on autopilot

to be a doctor. And then I figured out I wasn't interested and I was totally lost. I

didn't even know what I wanted to do … So, because my mom's artistic and stuff.

So I have both of those things and it was hard to find a job that would fit both …

so definitely [the course] helped me explore my interests about the outside

environment, putting their thoughts on.

Ultimately, students described how they entered the course with unclear ideas

about which career options to pursue, and learning about themselves and career

exploration tools and resources calmed their anxieties. As they were learning how to

refine what their career ambitions were through the course activities, they gained

confidence in themselves.

Overwhelming support for the course. Students were asked if they would

recommend this course to others, and each quickly responded with a definitive "yes"

response. Carol's response nicely captured the emotion students exhibited: "100%. I

already have. I put it in on all my friend's lists. I told everyone to sign up for this class."

Students appreciated how the first autobiographical paper helped them learn about

themselves, as well as reviewing their interests through the Kuder Career Assessment and

Holland's codes. These outcomes were consistent with the results from the Career State

Inventory because the effect of time was statistically significant for both the satisfaction

and clarity scores. The students' interview comments showed an increase in clarity about

the career development, planning, and choice process, as well as increased satisfaction

with their choice of options. Amy agreed that this course would be beneficial for other

SOLS' students when she claimed,

67

Definitely if they don't have an idea of what they want to do or even if they do. It's good to know how to look at jobs and how to assess them; and look at your values and compare it; and do interviews and getting to know the organization and stuff. I think it's so important that I didn't even think about it before this class.

Billy repeated the sentiment of learning concepts he had never considered before this class, such as negotiating a salary and the importance of the cover letter. He emphasized how he learned a lot about himself through this course when he said,

Because [of] the readings, it definitely teaches you a lot about yourself. Questions that you don't usually ask yourself … And then also the Holland's code, module two and then also the essays because writing, so writing the seventh, not the seventh it was module seven, but writing the second essay was when I had that, epiphany to be, 'Oh hey, I think I'd really like PT [personal training]' … I think the whole class could just teach you a lot about yourself.

Billy also discussed at length how he really enjoyed learning about the career interest communities (CICs), suggesting that the course be extended from 7.5 weeks to the full 15 weeks to explore them further. He even suggested the idea of students exploring CICs in which they were not interested as a means to engage in self-exploration, "you want to learn all that you can about yourself, and so maybe [even] a CIC that you think you don't like [originally]. You could like, by researching it and all that kind of stuff."

Carol also expressed appreciation for the course because of the many lessons it taught her. She explained she took the class to assess her goals and came out learning

more about herself, including how to evaluate her own skills and abilities as she noted,

One of the reasons I did also take the class was to make sure that I wasn't creating a goal that wasn't reached, that wasn't something that I could reach … I think that this class definitely helped me create a step-by-step plan on what I can do to get to my goal, and it made it seem a little more reachable, approachable, realistic … But it also put it into perspective to me that maybe I can't and that's okay. I just need to take it down a notch and find something different that I fit better into.

An unexpected lesson Carol learned from the course was how to improve her writing ability. It had been quite some time since she used APA formatting (the required format for the written assignments in the course), and at first she was upset about it, but eventually realized the benefit of this challenge when she said,

So I think I struggled the most with the essay aspect. Not writing the essays, I loved writing them and I was really passionate about what I was writing; but the whole, this sounds silly because I'm a college student and I should know my APA format and everything, but I feel like working or majoring in science and taking all my science, math classes and stuff, I don't write papers ever … I don't format anything unless it's a lab report and I'm certainly not graded on it. So, that's really hard for me. I was so frustrated … So, I think I learned from that in my writing to hopefully help me with my writing in the future too. Because if I'm going to be writing any papers or any research, things like that, I think it is very important. I just think it's a skill that I did not practice and I don't learn anymore.

All of the students expressed concern for their peers who might not have the confidence to explore other options and believe in their own abilities. Carol, for

example, struggled with keeping her grades up, and this course helped her realize that she still had options as she indicated when she claimed,

> I think this is a really, really great class and I think that so many more people, especially sophomores need to know about because I feel like that's when people start to switch because they feel like I'm not cut out for science anymore and I think this class will help people not switch majors … I really do. It made me realize I didn't have to close the door and I think that's important.

All students expressed interest in promoting this course to others because of the positive benefits they experienced. They had their own suggestions for slightly modifying the course based on personal preferences. However, none of them would change the foundation of the course–the textbook and content, sequence of the readings, and tasks (discussion boards, readings, and assignments). All three students were very emphatic on how this course helped them find direction in their career choice. Ultimately, all three students were satisfied with their decision to enroll and participate in the course.

These interview themes were complementary to the results obtained from the quantitative data sources from this cycle of research including the retrospective pre- and post-intervention surveys and the Career State Inventory. Sometimes referred to as *complementarity* (Greene, 2007; Greene, Caracelli, & Graham, 1989), the results from one data source were enhanced, validated, and enriched by one other. The results from the retrospective pre- and post-intervention surveys included how the effect of time was statistically significant for all seven constructs of *knowledge of career exploration and development tasks, self-efficacy for searching for alternative careers, goal selection,*

occupational information, problem solving, planning, and *self-appraisal*. Moreover, students' comments about the course indicated how the students discussed an expansion of possible career options, discovered through refined career development skills and increased confidence. The results from the Career State Inventory, decreased scores in certainty, satisfaction, and clarity, which indicates a stronger state in each area, were also supported with the interview and retrospective pre- and post-intervention survey data. For example, students' comments concerning their increased confidence in themselves and job-searching skills was related to the improved satisfaction and clarity scores. Overall, the qualitative data was quite complementary to the quantitative data. The qualitative data provided a lens to better understand the quantitative data through the students' points of view.

Conclusion from Cycle 2 Action Research

From the childhood days of being asked, "What do you want to be when you grow up?" to determining a college major, students' decisions to know their future careers has been complicated by their abilities and perceptions of themselves and the career environment. Under the framework of higher education's purpose to provide adequate resources for career success, I designed a career development intervention and implemented it as a career planning course for life science students. Holland's RIASEC theory (1985, 1997) and Sampson et al.'s (2003, 2004, 2020) CIP theory guided the design of the course, with a focus on reducing negative thoughts towards developing career decisions and career aspirations. RIASEC, CIP, and the concept of mastery experiences were used to provide structure to expose students to the breadth of career resources and possible career paths. An initial offering of the course taught, which I

71

taught in fall 2019 showed an increase in skills and confidence measured across seven

constructs *knowledge of career exploration and development tasks, self-efficacy for*

searching for alternative careers, goal selection, occupational information, problem

solving, planning, and *self-appraisal*. Students who were interviewed demonstrated

immense appreciation for the course and claimed they would recommend it for others

because of how the course improved their confidence and expanded their knowledge and

perception of career options.

CHAPTER 3

METHOD

In this chapter, I have described the methodology of this action research project, including a brief review of the study and its context. As described in Chapter 1, the purpose of this project was to provide a continuum of job and career information to SOLS' students to ensure they have appropriate, complete information as they learned about and considered various career opportunities in the life sciences. The vehicle used to provide this information was a career development course designed for and offered to life science students.

Research Questions

This study was guided by the following research questions:

RQ 1: How and to what extent did a life science career development course affect students' abilities to

    a.   engage in goal selection related to career exploration and planning;

    b.   identify appropriate academic major, occupational information, and/or employment opportunities in the life sciences in relation to personal characteristics;

    c.   formulate action plans and strategies for implementing life/career goals;

    d.   conduct problem solving efforts related to career exploration; and

    e.   engage in self-appraisal with respect to career exploration and planning.

RQ 2: How and to what extent did a life science career development course affect students'

    a.   perception of possible professional and career goals and opportunities;

b.   knowledge about employment-seeking skills; and

c.   readiness for career problem-solving and decision making.

Setting

The School of Life Sciences (SOLS) is an academic unit housed within the College of Liberal Arts and Sciences (the College), Arizona State University's largest academic division. Since SOLS' inception in 2003, the size of its undergraduate populations grew from 1,591 to 3,661 by 2017, an increase of over 130%. From 2017 to 2018, enrollment for the fall semesters increased from 3,661 to 4,767 undergraduates, a 30.21% increase in only one year, due to the launch of the new online biological sciences program that academic year (L. Zafirakis, personal communication, December 4, 2018). As of August 22, 2019, SOLS expected to host a record 3,654 undergraduate majors on campus and 1,562 students in its online biological sciences program, with over 1,000 first-year students (K. Kusumi, personal communication, August 22, 2019).

There were very limited career opportunities in SOLS with only one seminar course for the School of Life Sciences Undergraduate Research (SOLUR) program, which was only available to students who were qualified for that program. This course reviewed career development content focused on success in the research career pathway for the sciences, not a more generalized curriculum that was intended for and taken by the majority of students.

Participants

Current students. SOLS has offered both undergraduate and graduate programs for students interested in the life sciences, but this research study was focused solely on the undergraduate population. As of August 22, 2019, there were 5,216 undergraduate

students in SOLS. These students came from a number of different majors and minors offered at the Tempe campus as well as through ASU Online. For example, students came from six different biological sciences majors, two microbiology majors, and four other program areas.

All students, both online and on-campus students, enrolled in BIO 394—Career and Professional Development for Life Sciences were invited to participate in this study. Of the 34 students enrolled in the course, 29 participated in the Career State Inventory survey, 12 participated in the retrospective pre- and post-intervention surveys, 8 participated in the interview, and 8 provided permission for their essays to be reviewed. All of the students were enrolled in the School of Life Sciences through their major field of study. For the 34* students who took the course the anticipated graduation dates have been depicted in Table 7.

Table 7

Anticipated Graduation Rates of Students Enrolled in BIO 394 Career and Professional Development for Life Science in Spring 2021

Spring 2020	Summer 2020	Fall 2020	Spring 2021	Spring 2023
22	1	3	5	1

*—Note: $n = 32$ because two students did not complete the first discussion board assignment where they were asked to provide their anticipated graduation date, among other items of discussion.

Role of the Researcher

With respect to this action research study, my role was two-fold: (a) career development course designer and instructor and (b) lead research designer and analyst. Through my role as an Academic Success Advising Coordinator, I have built rapport with

students, communicating with them by email and through our bi-monthly newsletter about career-related programming offered by our office and Career and Professional Development Services (CPDS). Often at events and in individual advising appointments, students expressed delight when they learned that I was "the" Serena Christianson who sent the numerous and self-reported beneficial emails, excited to meet the person behind the name.

Throughout the implementation process, I was the sole instructor for this career development course. In that role, I interacted with students in various ways throughout the course and graded their course assignments. As an action researcher, I collected the survey data, conducted the interviews, and analyzed the data.

Intervention

The foundation for this action research project intervention was derived from content related to career exploration and development strategies focusing on Sampson, et al.'s (2004) cognitive information processing (CIP) career decision theory. The course was designed around the paperback and electronic versions of the textbook *Career development & planning: A comprehensive approach* (Reardon, Lenz, Peterson, & Sampson, 2019). The authors wrote this book to be used in their variable credit course at Florida State University, where students can elect to enroll in 1-3 credits, and their required work was associated with the three units in the textbook. The Florida State course was designed to be offered over 15 weeks; unit I lasted 7 weeks, unit II was 2.5 weeks long, and unit III was covered in the remaining 5.5 weeks (Reardon et al., 2019). Because ASU's online courses are typically designed to be taught in 7.5 weeks, I restructured the intervention around that time frame. Using the textbook's syllabus as a

guide, I updated the course outcomes to align with the research questions of this study. By completing this course, students were expected to achieve the following learning outcomes:

1. Learn the importance of being purposefully responsible and active in the life/career planning process;

2. Understand how personal characteristics, e.g., interests, values, and skills, influence career development;

3. Become aware of the changing global economy and labor market and how it impacts individual and family career systems;

4. Be able to identify appropriate academic major, occupational, and/or employment opportunities in the life sciences in relation to personal characteristics;

5. Increase knowledge about and use a variety of information resources to explore academic major, occupational, and/or employment options in the life sciences;

6. Understand career development theories and use decision-making skills for life/career planning and management;

7. Learn about and use job search strategies and related employment-seeking skills;

8. Understand how to formulate action plans and strategies for implementing life/career goals (Reardon et al., 2019).

ASU's online education department (ASU Online) requested each course to be divided by the week, which were named as "modules." The textbook's chapters and

assignments, as well as the research questions, served as the driving forces behind each

module's construction. As stated previously, Reardon et al.'s (2019) text, *Career*

development & planning: A comprehensive approach, was used to structure the course.

The book was divided into three units: Career concepts and applications, Social

conditions affecting career development, and Implementing a strategic career plan

(Reardon et al., 2019). Because of the nature of the research questions, all three units

were assigned as readings in the course. A primary reason this book was selected for the

course was its continual application of the CIP theory and CASVE cycle at the

conclusion of each chapter, reinforcing the theoretical foundation of the book.

     In Module 1, the content was focused on introducing the students to career

planning in chapter 1, which included the first domain in the CIP's Pyramid: Knowing

about Myself. The content of chapter 1 introduced students to a history of what a

"career" has been and how it was presently defined, a broad overview of key career

theories, and concluded with a discussion of CIP. In chapter 2, the authors segue into

CIP's Pyramid, facilitating a discussion about what students need to know about

themselves to help with their career decisions. After reading these chapters, students

reflected on their values, interests, and skills and developed goals related to their current

and future career goals. They participated in a discussion board I named "Class Social!"

where students informally introduced themselves by describing their major, reason/s for

enrolling in the course, and any other information they wanted to share with the group.

Finally, they wrote about themselves in an assignment that first required completion of

both the O*NET Interest Profiler and Kuder Career Assessment. This career-oriented

autobiography included reflections on outputs from these assessments, the students'

childhoods and upbringing, education and work history, and current and future goals. Finally, students completed the Career State Inventory, which was used as a quantitative data collection tool to assess changes, if any, in their career decision state, prior to and after the course.

In Module 2, students continued the introspective reflection process as they read chapters on Knowing about My Options (chapter 3), Career Decision Making (chapter 4), and Alternative Ways to Work (chapter 9). The focus of this module was to expand on the students' intrapersonal reflection on their options for career pathways. After learning about the knowledge domain in chapter 3, students moved up the CIP Pyramid into an extensive discussion on the CASVE Cycle in chapter 4. Further, chapter 9 was moved ahead to this point in the course to encourage students to reframe their thinking around their work preferences by introducing them to various work formats such as part-time, flextime, telecommuting, the gig economy, and contract work. Students also participated in a discussion board activity in which they responded to a prompt that asked them to determine what their three-letter Holland code was and how their code applied to their career paths.

In Module 3, students continued learning about the CIP Pyramid, transitioning into the top level, the executive processing domain. Chapter 5's emphasis on introducing students to how they think about their career decisions included content on self-talk, self-awareness, monitoring, and control. Now that the students were introduced to the CIP Pyramid, chapter 6 shifted the focus to a description of how external forces influenced their career paths. The authors suggested students shift their views of general education courses towards finding value in how these courses can assist in the career decision

making process. The topic of "success" as it was related to a career was expanded upon.
The class also participated in a discussion board activity in which they reflected on what
they considered to be the three most pertinent concepts from the readings and how they
related those their own lives.

Module 4 was a critical juncture because it represented the halfway point in the
course. The week's readings included content about how to launch an employment
search campaign and the importance of written and interpersonal communications in
finding a job from chapters 11, 12, and 13. Similar to the previous module, the students
reflected on the three most important concepts from the week's readings in the discussion
board. This module was the only one in the course that included an assignment geared to
the life sciences in any specific way. A Career Field Analysis project required students to
research and reflect on two distinct occupations' outlook, salary potential, interests and
skills used, work and learning conditions, and necessary training and education. These
two occupations were selected from two separate Career Interest Communities (CICs),
which was how ASU's CPDS office described clusters of related careers. The ten CICs
are *arts, design and performance; business; communications and media; education;
entrepreneurship; health and wellness; public, social and human services; STEM;
sustainability, environmental and natural resources;* and *miscellaneous life science
careers* (ASU Career and Professional Development Services, 2019). In the online
course platform, each CIC was introduced with a sample list of life science-related
careers from each. The following books were consulted for this task:

- Belikoff, K. & Winter, C. (2004). *Opportunities in biological science careers*.
  Chicago, IL: VGM Career Books.

- Camenson, B. (2001). *Opportunities in forensic science careers*. Chicago, IL: VGM Career Books.

- DeGalan, J. & Middlekauff, B. (2002). *Great jobs for environmental studies majors*. Chicago, IL: VGM Career Books.

- Fasulo, M. & Kinney, J. (2002). *Careers for environmental types & others who respect the Earth*. Chicago, IL: VGM Career Books.

- Gotlieb, A. (2015). *Planning a career in biomedical and life sciences: making informed choices*. New York, NY: Academic Press.

- Kreeger, K. (1999). *Guide to nontraditional careers in science*. Philadelphia, PA: Taylor & Francis.

- McDavid, S. (2003). *Career opportunities in science*. New York, NY: Ferguson.

- Miller, L. (2001). *Careers for nature lovers & other outdoor types*. Chicago, IL: VGM Career Books.

- Morkes, A., Yehlin, C., Paterson, A., & Walsh, N. (Eds.). (2002). *Careers in focus*. Chicago, IL: Ferguson Publishing.

- Roth, C. (2006). *Alternative careers in science: leaving the ivory tower*. Burlington, MA: Elsevier Academic Press.

- Ruff, T. (2007). *How to break into pharmaceutical sales: A headhunter's strategy*. New York, NY: Waverly Press.

- Seltzer, B. (2016). *101+ careers in public health*. New York, NY: Springer.

The critical part of this assignment for Module 4 required students to select an occupation from two separate CICs. This prevented students from maintaining a tunnel mindset, for example, by doing research on being a doctor and a dentist. Instead, they

81

had to select an occupation from two unique CICs, such as STEM and Business. The

point was to expand students' perceptions of what their potential pathways could be, as

well as envisioning unique and personalized ways to apply their multidimensional skills,

interests, and talents in a career plan. Another component of this research required

students to conduct an informational interview for at least one of the two occupations.

The students were required to first identify a contact, initiative a conversation, and

transcribe the interview to complete this assignment. The objective of the informational

interview is to learn "insider" information regarding the occupation and industry in which

the professional worked, ultimately aiding students' educational and career planning

(Reardon et al., 2019, p. 195-198). This task was included to help students practice their

interpersonal communications in a job-seeking format, begin building their professional

network, and gain insight into their prospective careers as described in chapter 13 in

Reardon et al. (2019).

Throughout this course, students read and discussed matters related to the career

decision-making process, regularly looking inward at themselves and outward at

opportunities and options as they proceeded. In the previous module (4), they spent time

discussing the job-hunting process. In Module 5, students returned to the discussion of

social conditions affecting their career development, spending time reviewing issues

affecting one's career in the global economy, examining organizational culture and

effective work, as well as exploring the relation between one's career and family roles,

which drew upon information in chapters 7, 8, and 10. Similar to previous modules,

students reflected on three pertinent topics from the readings for this week's discussion

board activity.

Modules 6 and 7 were designed and introduced together to allow students time to complete the final tasks for the course. These modules concluded the course, challenging the students to think about life beyond the course, finding meaning in the past weeks' readings and activities. The final two chapters of the book, chapters 14 and 15, introduced the students to concepts surrounding negotiating and evaluating job offers, as well as what to expect in the first phase of their careers. Consistent with the work in previous modules, students reflected on three important concepts from the week's readings for the final discussion board. Also, students completed the Career State Inventory in this module, just as they did in Module 1. Finally, students completed a comprehensive reflection for the Strategic Academic/Career Planning project. This assignment required students to reflect on their journey in this course, with each phase of the CASVE cycle used as the basis for sections in this paper. Sample prompts included:

- What internal (feelings, emotions, hunches) and external (family, the university, news reports, grades, letter saying you had to declare a major, upcoming graduation) cues did you experience that alerted you to this need to reduce the gap between your situation and the desired state?

- What have you learned about the world of work that will influence your decisions?

- Where are you now in your educational and/or career decision making and where do you want to be in a year? (Reardon et al., 2019, pp. 294-295).

This assignment was selected for qualitative analysis for this research study because it concisely addressed the CIP theory in one data point. See Appendix E for full list of questions for this assignment.

The course outline has been provided in Table 8, which offered a comprehensive,

but compact way to demonstrate the course, overall. See Table 8 for the course

overview.

Table 8

BIO 394 Career and Professional Development for Life Sciences Weekly Objectives and Tasks

- Module 1:
  - By the end of this module, students will be able to:
    - Briefly explain the Cognitive Information Processing Theory and Pyramid of Information-Processing Domains,
    - Reflect on their values,
    - Explore their interests, and
    - Identify their skills and goals.
  - Assignments:
    - Discussion board: Class Social!
    - Autobiography and Goals reflective essay
- Module 2:
  - By the end of this module, students will be able to:
    - Identify their three-letter Holland Code
    - Reflect on how this code applies to their ideal career path
  - Assignment:
    - Discussion board: RIASEC – Holland's Codes
- Module 3:
  - At the end of this module, students will be able to:
    - Briefly explain the CASVE decision making cycle
    - Describe the four external, social forces that affect the ways individual careers are developing now and in the future
  - Assignment:
    - Discussion board: Readings from Reardon et al.
- Module 4:
  - At the end of this module, students will be able to:
    - Explain what an employment campaign involves
    - Discuss how written communications are used in a job campaign
    - Describe how interpersonal communication skills are needed in job hunting
    - Conduct a career field analysis of two separate job roles
  - Assignment:
    - Discussion board: Readings from Reardon et al.
    - Career Field Analysis project
- Module 5:
  - At the end of this module, students will be able to:

- Discuss changes in global and U. S. economies in relation to career development
- Describe concepts in an organizational context and their connection to career decision making
- Identify issues surrounding work and relationships
  - o Assignment:
    - Discussion board: Readings from Reardon et al.
- Modules 6 and 7:
  - o At the end of this module, students will be able to:
    - Describe how to negotiate and evaluate a job offer
    - Explain how to successfully start their career and what to expect in their first job
    - Create a strategic plan to reach their academic and career goals
  - o Assignments:
    - Discussion board: Readings from Reardon et al.
    - Strategic Academic/Career Planning project

The course modules were designed to provide content and activities that helped students learn and apply career search and decision-making skills. Further, the modules were developed to ensure students attained the following course outcomes:

1. Apply skills such as being purposefully responsible and active in the life/career planning process;

2. Evaluate personal characteristics, e.g., interests, values, and skills and how those influence career development processes;

3. Analyze career opportunities in light of the changing global economy and labor market and how it impacts individual and family career systems;

4. Evaluate appropriate academic major, occupational, and/or employment opportunities in the life sciences in relation to personal characteristics;

5. Apply a variety of information resources to explore academic major, occupational, and/or employment options in the life sciences;

6. Apply career development theories and use decision-making skills for life/career

planning and management;

7. Apply job search strategies and related employment-seeking skills;

8. Apply action plans and strategies for implementing life/career goals.

This course included a general introduction of Sampson et al.'s (2004, 2020) decision-making pyramid, which was comprised of four domains including (a) knowledge about self, (b) knowledge about career options, (c) decision-making skills, and (d) executive processing—thinking about decision making. See Figure 9 in Chapter 2.

With the increase in enrollment in our online biological sciences program, many classes that had previously only been offered in-person were now being made available for an online audience. Some of these online courses have been offered to both online and face-to-face students, known as an "iCourse" at ASU. Ideally, this career development class would have been offered in both face-to-face and online formats, but to ensure consistency of the content delivery, it was offered as an iCourse. The class was offered in a 7.5-week format to align with other online classes, as opposed to many face-to-face classes that have been offered for the full, 15-week semester. This course was taught during the first half of the spring 2020 semester. Each week or "module" focused on various aspects of the CIP theory, including the CASVE cycle as described above.

Prior to enrollment, the students were required to receive my permission. The only reason I required the instructor approval was to ensure only SOLS students enrolled in the course. For the only other pre-requisite to the course, students needed to be at least in the second year of college. First-year students have been required to participate in LIA 101, a course that introduced career development content and resources from Career and

Professional Development Services (CPDS). Further, because first-year students have been focused on simply finding the appropriate field of study to pursue, participating in this upper division course would be ill-advised for that population. In all, 34 students were allowed into the course. This number was determined to be the maximum for which the course could be effectively taught given my other job duties.

Mixed Method Action Research Methodology

The research design for this study was a "multistrand mixed method action research (MMAR)" study because of the use of concurrent quantitative and qualitative methods in a sequential fashion. This design was used to add further validity to the findings through a more comprehensive approach, as well as to minimize bias that could occur from interpretations in a purely qualitative design (Ivankova, 2015). It was also *action research* because I was looking for a practical solution in an environment with which I had direct interaction: the life sciences undergraduate academic unit at Arizona State University (Mertler, 2017). Data were collected from a full course implementation in fall 2019 and dissertation data were collected in spring 2020; hence, it was a "multistrand mixed method action research" study (Ivankova, 2015).

I chose to use a pragmatic approach to conduct the study (Mertens, 2015). Consistent with a pragmatic approach, I matched my methods to the purpose of my research study and the research questions I asked. Given the research questions, I used both quantitative and qualitative approaches to examine the effectiveness of this career development class on life science students' perceived career readiness (measuring their perception of possible career goals and opportunities), knowledge about employment-seeking skills, and career decision-making self-efficacy. The quantitative and qualitative

87

measures were collected and analyzed independently, then integrated to determine whether there were similar or dissimilar results. This research design has also been described as "triangulation mixed-methods" because of the simultaneous collection data and "equal emphasis given" to all the data (Mertler, 2017, p. 107). Quantitative data were collected using two different surveys. Qualitative data were gathered through student interviews and the Strategic Academic/Career Planning assignment.

Instruments

Survey 1—Career State Inventory (CSI). CSI pre- and post-course surveys were completed by 29 students from the course. This four-item CSI was developed by Leierer, Peterson, Reardon, and Osborn of Florida State University. Respondents were asked to provide a list of currently considered occupations, their first occupational choice from that list, satisfaction relating to that choice, and True/False statements about their assessments of doubt, confusion, and difficulty with making a career choice. Unique identifiers confirmed the same individual completed the survey before and after the course. The complete survey has been provided in Appendix B.

Survey 2—Modified Version of the Career Decision-Making Self-Efficacy Scale (CDMSE). The modified CDMSE was conducted as a post-course survey followed by a retrospective, pre-course survey that assessed seven constructs related to career exploration and career development. This 39-item survey was constructed using two sources: (a) items constructed specifically for the study, which assessed knowledge and self-efficacy and (b) items from the Career Decision-Making Self-Efficacy Scale (CDMSE, Taylor & Betz, 1983). Of the seven constructs measured in this survey, two of them were created specifically for the study to assess participants' confidence related to

knowledge of career exploration and development tasks and *self-efficacy for searching*

for alternative careers. The other five career development constructs: *goal selection,*

occupational information, problem solving, planning, and *self-appraisal*, came from the

CDMSE (Taylor & Betz, 1983). The CDMSE, a widely-used assessment tool, includes

50 items focused on gauging participants' confidence related to career development. The

original CDMSE was reduced by half and included only 25 items for this study, which

were the most applicable and relevant items related to the research questions, which were

examined in the study.

My dissertation chair and I trimmed the survey from 50 to 25 items because we

already had four demographic survey questions plus five questions each for the two

constructs we created (*Knowledge of career exploration and development tasks* and *Self-*

efficacy for searching for alternative careers), so we did not want the survey to become

too cumbersome or lengthy, resulting in incomplete responses. We thought each of the

CDMSE's five constructs (*Goal selection, Occupational information, Problem solving,*

Planning, and *Self-appraisal*) were applicable to this context and agreed that using five

questions per construct was sufficient for the quantitative analysis. For the CDMSE, we

used the following items.

Goal Selection	01, 21, 32, 39, 41
Occupational Information	02, 26, 27, 44, 46
Problem Solving	09, 15, 25, 31, 36
Planning	19, 33, 35, 40, 43
Self-appraisal	11, 18, 20, 30, 49

We evaluated each of the CDMSE's 50 items and selected the above items based

on mutual agreement of the best-fit for this study's context and research questions. We updated items for relevancy, such as *"find out the employment trends for an occupation over the next 10 years"* instead of *"find out the employment trends for an occupation in the 1980s"* (Taylor & Betz, 1983, p. 77) and *"find information about companies who employ people with life science majors"* instead of *"find information about companies who employ people with college majors in English"* (1983, p. 77). Further, we changed the items from second-person point of view to first-person point of view to better match the research questions (*"Identify some reasonable career alternatives if I am unable to get my first choice"* instead of *"Identify some reasonable career alternatives if you are unable to get your first choice"*). Thus, I was still able to assess each of the five constructs through the CDMSE in a modified and streamlined fashion. Examples of items selected from Taylor and Betz's CDMSE are: "Identify some reasonable major or career alternatives if you are unable to get your first career choice;" "Find information about companies who employ people with life science majors" and "Decide whether or not you will need to attend graduate or professional school to achieve your career goals" (1983, pp. 66-68). In all, the seven constructs were assessed using five items for a total of 35 items using a 6-point Likert scale. In the previous research cycle, the Likert scale ranged from *Very Low Confidence, A Little Confidence, Confident, Quite a Bit Confident,* and *Extremely Confident.* However, upon evaluation of that cycle's process and results, the scale was updated for consistency and clarity by changing the second item *A Little Confidence* to *A Little Confident.* The other Likert scale items remained the same. The additional four items on the survey were demographic in nature (identifying which program in SOLS the student was currently studying, their anticipated graduation date,

90

and age). The complete survey has been provided in Appendix C.

      Interviews. A semi-structured interview consisting of nine items was developed

to assess the students' understanding of career exploration and career development and

the effectiveness of the course. For example, students were asked "After taking this

course, have you changed personally? If so, how? If not, why not?" Follow-up

questions were used during the interview based on the interviewee's responses. See

Appendix D for the full set of interview questions. Before the conclusion of the course,

students were invited to participate in this interview. The interviews were conducted

after the course was completed and grades were submitted. Eight students volunteered to

participate in the interviews. The students' pseudonyms, gender, campus, academic

programs, cumulative GPA, graduation year, and abbreviated background are provided in

Table 9.

Table 9

Demographic Information for the Interview Participants (*n = 8)*

Pseudonym	*Gender*	*Campus*	*Academic Program of Study*	*Cumulative GPA*	*Graduation Year*	*Abbreviated synopsis of interview*
Susan	Female	Online	Biological Sciences	3.5	Spring 2020 grad	She knew about her strengths and weaknesses prior to the course, but needed help on how to find the right job. Course made her more confident to go after what she wanted, to dream bigger. She is interested in animal research.

| Molly | Female | Face-to-Face (Tempe) | Biological Sciences | 3.46 | | Spring 2020 grad | Never realized she was actually interested in education until this course. She was really concerned about others' opinions for her career choice and the financial burden. Didn't realize all of the different lifestyles and changes in the work world. |

| Chelsea | Female | Face-to-Face (Tempe), also Barrett Honors College | Biochemistry & Biological Sciences (Genetics, Cell, and Developmental Biology) | 4.0 | | Spring 2020 grad | Originally was bioengineering, shifted to bio because she wanted more bio than engineering, fell into a pathway of research. Thought she wanted her PhD right after college but realized she would rather go into industry first. Kept avoiding making a career decision and aimlessly went from one opportunity to the next, without really being intentional about it. Learned a lot about her priorities and the job search process. |

| Oaklie | Female | Face-to-Face (Tempe) | Biological Sciences, Spanish & Business minors | 3.79 | Spring 2020 grad | Originally was pre-med because of parents' suggestion to go to school to find a skill that employers need - based on what she saw on TV and experienced, her mind went to healthcare. Upon reflection and first-hand experience in PT, she realized she wanted to be in healthcare but not as a practitioner |
| Mariah | Female | Face-to-Face (Tempe) | Biological Sciences (Conservation Biology & Ecology) | 3.67 | Spring 2020 Grad | Transfer student, previous advisee of mine, added conservation junior year - felt behind and wanted to learn more to prepare for her career; lots of increased confidence |

Alexis	Female	Face-to-Face (Tempe)	Biological Sciences (Genetics, Cell, and Developmental Biology)	3.06	Spring 2020 grad	Older than average, started school, then took time off; previous advisee of mine; had lots of career experience but not in the sciences - was looking for resources on how to find a job and gain some confidence

Sophie	Female	Online now Face-to-Face (Tempe)	Biological Sciences (Biomedical Sciences)	2.78		Spring 2021 grad	Went to community college, then ASU Online through Starbucks College Achievement Plan, then moved to Face-to-Face (Tempe) because of biomed program (before it was available online) and now leaving Starbucks for job with Microsoft. Started as pre-health, switched to KIN, then back to BIO because of perfusionist career aspirations

| Oscar | Male | Face-to-Face (Tempe) | Biological Sciences | 2.42 | Fall 2020 grad | Originally was biomed with a film studies minor; kept the minor and switched to general BIO over the summer to help him graduate because the requirements in the biomed concentration were holding him back. Very passionate about teaching. Didn't pass the class but wanted to talk about it. |

Course assignments. In an effort to triangulate the results, students were asked

for permission to use their Strategic Academic/Career Planning project for qualitative

analysis. The Strategic Academic/Career Planning project was an essay that required

students to reflect on what they learned from the class, using the CASVE cycle terms as

section headers, and also accompanied by corresponding reflective and analytical

questions. Eight students volunteered to share their final assignment for this study. The

assignment was coded for concepts and later analyzed.

Table 10 has been provided to demonstrate the alignment of these data sources

with the study's research questions. For example, data from all the sources were used to

determine answers to Research Question 1, Part a. See Table 10. The remainder of

Table 10 can be interpreted in the same way.

Table 10

Alignment of Data Sources with Research Questions

RQ 1: How and to what extent did a life science career development course affect students' abilities to …	Career State Inventory	Modified CDMSE	Student Interviews	Strategic Academic/ Career Planning project
a. engage in goal selection related to career exploration and planning	X	X	X	X
b. identify appropriate academic major, occupational information, and/or employment opportunities in the life sciences in relation to personal characteristics	X	X	X	X
c. formulate action plans and strategies for implementing life/career goals	X	X	X	X
d. conduct problem solving efforts related to career exploration	X	X	X	X
e. engage in self-appraisal with respect to career exploration and planning.	X	X	X	X
RQ 2: How and to what extent did a life science career development course affect students'	Career State Inventory	Modified CDMSE	Student Interviews	Strategic Academic/ Career Planning project
a. perception of possible professional and career goals and opportunities	X	X	X	X
b. knowledge about employment-seeking skills; and career decision making self-efficacy.	X	X	X	X
c. readiness for career problem-solving and decision making.	X	X	X	X

Procedure

The paperback and electronic versions of *Career development & planning: A comprehensive approach* text were used in the course (Reardon et al., 2019). The timeline and procedures for the research study have been presented in Table 11. For example, I read Reardon's book, created the course shell, and developed the instruments during the summer of 2019. Because the course was first offered during the fall semester of 2019, I prepared the course in advance of the fall term. A parallel timeline was used for the dissertation research cycle in spring 2020. The information about the spring 2020 implementation for the dissertation, including implementation of instruction, data gathering, and data analysis has been provided in Table 11. See Table 11.

Table 11

Timeline and Procedures for this Research Study

Timeframe	Actions	Procedures
1. July - August 2019	Prepare for intervention	• Read Reardon et al.'s textbook • Create canvas course shell • Design survey instrument and interview questions through collaboration with dissertation chair
2. Module 1: Spring 2020 Session A (January 13-19)	Pre-intervention assessment	• Distribute Career State Inventory instrument
3. Spring 2020 Session A (January 13 – March 3)	Intervention	• Instruct BIO 394: Career and Professional Development for Life Sciences
4. Modules 5-7: Spring 2020 Session A (February 10 – March 3)	Recruit students	• Invite students to be a part of the research part of the study

5. Modules 6-7: Spring 2020 Session A (February 17 – March 3)	Post-intervention assessment	• Distribute Career State Inventory instrument • Students complete "Strategic Academic/Career Planning Project" as final assignment
6. After grades have been submitted (early March 2020)	Data collection	• Distribute retrospective pre- and post-course surveys • Conduct interviews
7. April 2020 and beyond	Data analysis	• Conduct qualitative and quantitative analysis methods • Revise course as needed based on results

Recruitment of participants and data collection. During modules 5, 6, and 7, I sent messages through the Canvas course shell and a direct email to the students, informing them of my research study and recruiting them for participation in the (a) surveys, (b) interviews, and/or (c) approving use of their written assignments. If students expressed preliminary approval to use their three written assignments for analysis, I sent the IRB-mandated consent form to the students. Students sent the completed consent forms to me via email.

After grades were posted, the retrospective pre-course and post-course surveys were distributed through Canvas as well as direct email. To reduce the number of communications sent to the students and prevent any kind of email fatigue of my own doing, I sent both survey links in the same message to recruit survey participants. The surveys were developed and distributed using Qualtrics software. The previously mentioned Career State Inventory (CSI) was administered as an assignment at the beginning and end of the course. The CSI was developed and distributed using Google

Forms software.

Similar to the survey instruments, the students were invited to participate in the interview process. Students who expressed interest were interviewed. The interviews were conducted face-to-face in my private office after the conclusion of the course and grades were posted. They ranged from 45 - 60 minutes in length. One interview was conducted on the phone, whereas the other seven interviews were conducted using Zoom video conferencing software. These conversations were recorded using the Otter mobile app and Zoom software, and transcribed for analysis through Rev, an online transcription service. For the Strategic Academic/Career Planning assignment, students were asked for permission to use this as a data source for the study. Per the requirements of the Institutional Review Board, a separate permission form was generated for these data and distributed to the students.

The following data were collected during the dissertation:

1. Career State Inventory: distributed at the beginning and conclusion of the course

2. Retrospective Pre-Course and Post-Course Surveys at the conclusion of the course

3. Interviews at the end of the course

4. Strategic Academic/Career Planning project, which was due at the conclusion of the course.

CHAPTER 4

DATA ANALYSES AND RESULTS

In this chapter, I have presented results from this study based on quantitative and qualitative data. The first section included results from the quantitative data. In the second section, results for qualitative data have been presented. The analysis procedures for both types of data have been described. For the qualitative data, assertions were presented and reinforced with themes, theme-related components, and quotes from participants.

Quantitative Data Analysis

The quantitative data from all of the surveys were analyzed using IBM's SPSS statistical analysis software. Sufficient response numbers from the surveys allowed for inferential statistical methods to be conducted and presented. Specifically, using Cronbach's alpha procedures, I conducted reliability analyses to determine whether the quantitative instruments were reliable prior to further analysis. Based on the Cycle 2 data, it appeared data would meet the necessary levels to be considered to be reliable. Subsequently, repeated measures analyses of variance (ANOVAs) were conducted to determine whether there were differences in retrospective, pre- and post-intervention scores.

Results from Quantitative Data

Retrospective pre- and post-test surveys. Quantitative data were analyzed using SPSS version 25. Prior to conducting data analyses of the quantitative variables, reliability coefficients were determined using Cronbach's alpha. The reliability coefficients ranged from .75 to .97. All the Cronbach's alpha reliability coefficients

exceeded .70, which is considered to be an acceptable level. See Table 12.

Table 12

Retrospective, Pre- and Post-Intervention Reliabilities for Five Occupation Search

Constructs from the CDMSE—Goal Selection, Occupational Information, Problem

Solving, Planning, and Self-Appraisal

Construct	Retrospective, Pre-Intervention	Post-Intervention
Goal Selection	.96	.94
Occupational Information	.87	.89
Problem Solving	.89	.95
Planning	.84	.93
Self-Appraisal	.75	.91

*—Note: $n = 12$.

    Research Question 1. For Research Question 1, to determine the effect of the

intervention on goal selection, occupational information, problem solving, planning, and

self-appraisal, a multivariate repeated measures analysis of variance was conducted. The

multivariate test for time of assessment was significant, multivariate-$F(5, 7) = 11.24$, $p <$

.003, with $\eta^2 = .889$, which is a large within-subjects effect size using Cohen's criteria

(Olejnik & Algina, 2000). Because the multivariate test was significant, univariate

follow-up, repeated measures ANOVAs were conducted. For goal selection, the effect of

time of assessment was significant, $F(1, 11) = 22.25$, $p < .001$, with $\eta^2 = .669$, which is a

large within-subjects effect size. Moreover, for occupational information, the effect of

time of assessment was significant, $F(1, 11) = 32.66$, $p < .001$, with $\eta^2 = .748$, which is a

large within-subjects effect size using Cohen's criteria (Olejnik & Algina, 2000).

Likewise, for problem solving, the effect of time of assessment was significant, $F(1, 11)$ = 23.08, $p < .001$, with $\eta^2 = .677$, which is a large within-subjects effect size. Similarly, for planning, the effect of time of assessment was significant, $F(1, 11) = 65.23$, $p < .001$, with $\eta^2 = .856$, which is a large within-subjects effect size. Finally, for self-appraisal, the effect of time of assessment was significant, $F(1, 11) = 33.52$, $p < .001$, with $\eta^2 = .753$, which is a large within-subjects effect size using Cohen's criteria (Olejnik & Algina, 2000). Thus, for all five constructs on the CDMSE the means differed significantly across the two times of assessment with the post-intervention means being larger. As a reminder, the options for each of the items in CDMSE were *Very Low Confidence, A Little Confident, Slightly Confident, Confident, Quite a Bit Confident,* and *Extremely Confident*, meaning the higher the score, the better the result. The means and standard deviations have been provided in Table 13.

Table 13

Means and Standard Deviations for Five Occupation Search Constructs from the CDMSE—Goal Selection, Occupational Information, Problem Solving, Planning, and Self-Appraisal

Construct	Retrospective, Pre-Intervention	Post-Intervention
Goal Selection	2.32 (1.32)	4.23 (1.28)
Occupational Information	2.67 (1.10)	4.50 (1.01)
Problem Solving	2.92 (1.11)	4.43 (1.21)
Planning	2.57 (1.03)	4.53 (0.98)
Self-Appraisal	2.68 (0.89)	4.50 (1.06)

*—Note: Standard deviations are in parentheses and $n = 12$.

Research Question 2. Prior to conducting the repeated measures ANOVA, reliabilities for the measures were determined. See Table 14.

Table 14

Retrospective, Pre- and Post-Intervention Reliabilities for Knowledge of Career Exploration and Development Tasks and Perception of Possible Professional and Career Goals and Opportunities

Construct	Retrospective, Pre-Intervention	Post-Intervention
Knowledge of Career Development	.97	.94
Perception of Possible Opps.	.93	.97

Note: $n = 12$.

For Research Question 2, to determine the effect of the intervention on knowledge of career development and self-efficacy for alternative career analysis, a multivariate repeated measures analysis of variance was conducted. The multivariate test for time of assessment was significant, multivariate-$F(2, 10) = 13.24$, $p < .002$, with $\eta^2 = .726$, which is a large within-subjects effect size using Cohen's criteria (Olejnik & Algina, 2000). Because the multivariate test was significant, univariate follow-up, repeated measures ANOVAs were conducted. For knowledge of career exploration and development tasks, the effect of time of assessment was significant, $F(1, 11) = 25.94$, $p < .001$, with $\eta^2 = .702$, which is a large within-subjects effect size. Moreover, for perception of possible professional and career goals and opportunities, the effect of time of assessment was significant, $F(1, 11) = 28.70$, $p < .001$, with $\eta^2 = .723$, which is a large within-subjects effect size using Cohen's criteria (Olejnik & Algina, 2000). As a reminder, the options for each of the items in CDMSE were *Very Low Confidence, A Little Confident, Slightly*

Confident, Confident, Quite a Bit Confident, and *Extremely Confident*, meaning the

higher the score, the better the result. The means and standard deviations have been

provided in Table 15.

Table 15

Means and Standard Deviations for Knowledge of Career Exploration and Development

Tasks and Perception of Possible Professional and Career Goals and Opportunities

Construct	Retrospective, Pre-Intervention	Post-Intervention
Knowledge of Career Devel.	2.63 (1.06)	4.73 (0.79)
Perception of Possible Opps.	2.48 (0.80)	4.70 (0.94)*

*—Note: Standard deviations are in parentheses and *n* = 12.

  Career State Inventory. To examine whether there were differences in the mean

scores across time, the pre- and post-intervention means of the spring 2020 CSI were

analyzed using a repeated measures analysis of variance (ANOVA). The multivariate

repeated measures ANOVA was significant, $F(3, 26) = 10.01$, $p < .001$, $\eta^2 = .536$,

indicating a large within-subjects effect using Cohen's criteria (Olejnik & Algina, 2001).

Next, individual, follow-up repeated measures ANOVAs were conducted for each of the

three scores on the CSI. The effect for the occupational certainty score on the CSI was

significant, $F(1, 28) = 5.24$, $p < .03$, $\eta^2 = .158$, indicating a large within-subjects effect.

The effect for the occupational satisfaction score was significant, $F(1, 28) = 14.66$, $p <$

.001, $\eta^2 = .344$, indicating a large within-subjects effect using Cohen's criteria (Olejnik &

Algina, 2001). Similarly, the effect for the occupational clarity score was significant, $F(1,$

$28) = 27.22$, $p < .001$, $\eta^2 = .493$, indicating a large within-subjects effect. Thus, the three

CSI scores (occupational certainty, occupational satisfaction, and occupational clarity)

decreased significantly (lower scores are better scores) across the course. Means and standard deviations for the scores have been presented in Table 16.

Table 16

CSI Survey Means and Standard Deviations for spring 2020 Students*

	Pre-intervention Scores	Post-intervention Scores
Occupational Certainty	2.45 (0.74)	2.17 (0.66)
Occupational Satisfaction	2.31 (0.93)	1.72 (0.70)
Occupational Clarity	2.07 (1.19)	1.14 (0.83)

*—Note: Lower scores are better scores. SDs are in parentheses and *n* = 29.

Qualitative Data Analysis

Qualitative data were analyzed using Straus and Corbin's (1998) constant comparative method. First, a round of initial coding was conducted using *process coding* (Saldaña, 2016). For the first cycle, I listened to the audio recordings of each interview while reading along with the transcripts. I used the provided tutorials with the HyperResearch coding software to begin my coding process. I created codes as I read through each interview transcript and student essay. Transitioning into the second cycle of coding, I instinctively moved towards the *tabletop* approach, physically manipulating the codes cut out from sheets of paper (Saldaña, 2016, pp. 230-231). Looking through the most commonly used codes through the *tabletop* method, the second cycle method of *pattern coding* seemed to be the best fit (Saldaña, 2016, pp. 236-238). I created six categories and gathered the 63 codes into the categories. Wrapping up this first coding approach, I used the *codeweaving* method (Saldaña, 2016, p. 276) combined with the *code landscaping method* (Saldaña, 2016, pp. 223-226). I examined the word cloud (or

108

code landscape) of the codes to help me conceptualize how these categories fit together. Then I was able to go through the *codeweaving* process to narrow these to three categories. At each step of the process, the new levels of interpretative outcomes were carefully reflected on to ensure the data supported the new interpretations. Moreover, analytic memo procedures were used throughout the coding and interpretive processes to guide the interpretive processes and direct the qualitative data analysis steps. Employing careful, systematic reflection at each step of the process and using analytic memos contributed to the credibility of the findings.

Results from Qualitative Data

In this section, I have presented results from qualitative data. First, in Table 17, I have displayed the themes and their associated theme-related components and assertions. Then, each of the themes is discussed, including quotes from the data to support the assertions.

Table 17

Themes*, Theme-related Components, and Assertions

Themes and Theme-related Components	Assertions
Balancing tensions relating to career choice 1. Seeking balance between financial stability and personal wellbeing 2. Alluding to the concept of socially acceptable jobs 3. Feeling pressure and urgency to make a career decision 4. Avoiding starting a job search	1. Students were motivated to enroll in the course for reasons such as determining a career choice that meets their needs and preferences while managing expectations and pressures from external sources.
Broadening perception of career options 1. Describing jobs believed to be available for life sciences majors 2. Appreciating discussion and practice of soft skills 3. Broadening views on lifestyles	2. Participation in this course provided a space for students to be exposed to varying types of careers to apply their life science knowledge, and to learn about the world of work.
Developing career exploration and planning	3. Engaging in the structured

skills	CASVE cycle helped students
1. Appreciating resources from class and seeking their own career planning resources	mitigate their negative self-talk related to career planning and
2. Learning about one's values and desires	development. The intervention
3. Showing increased confidence in oneself	introduced resources and techniques for students to conduct an effective job search campaign. The course helped develop the students' career exploration and planning skills, resulting in increased self-confidence and self-efficacy.

*--Note: Themes are in italic font.

Balancing tensions relating to career choice. *Assertion 1 - Students were motivated to enroll in the course for reasons such as determining a career choice that meets their own needs and preferences while managing expectations and pressures from external sources.* Post-intervention interviews and analysis of the final Strategic Academic/Career Planning (SACP) assignment provided insights into their motivations for enrolling in the courses and a general overall feeling of balancing tensions relating to choosing a course. The following theme-related components comprised the theme led to Assertion 1: (a) Seeking balance between financial stability and personal wellbeing, (b) Alluding to the concept of socially acceptable jobs, (c) Feeling pressure and urgency to make a career decision, and (d) Avoiding starting a job search.

Seeking balance between financial stability and personal wellbeing. Students repeatedly discussed how they felt pressure to find a financially stable career, yet wanted to pursue a route that met their own desires, interests, and values. Many science careers involved extensive education including commitment of time, financial, and other resources to stay on this pathway. As a result, students exhibited stress about this burden. This was a common concern among life sciences students, as depicted by Oaklie's (all

110

names are pseudonyms) comments when she said,

> I just had that mindset that I would do more school. But then as I got through
> more, after junior year, probably, I just started getting tired. I was like, "I don't
> know if I want to go to four plus more years of school." That's when I think I
> started doubting it, too. I knew that everything that I had planned on required a lot
> more school. So, I needed to start thinking seriously if that was worth the time
> and money that I was going to put into it, if that was even going to make me
> happy. Because I didn't want to spend another three or four years, and hundreds
> of thousands of dollars, without being sure that, that's what I wanted to do. That's
> when I think I started getting stressed about it.

As discussed in Chapter 1, many life sciences students believed the only career
options available to them involved something in the medical field or research; both paths
involving further education beyond a baccalaureate degree. However, as Tina explained
in her final essay for the course, there was a focus on the return on investment for
students' time and energy towards a particular career path when she stated,

> I would be open to pursuing higher education for a health-related career, though I
> think that for me, weighing the cost is very important. The financial cost of higher
> education can be significant depending on the type. With this in mind, I would
> want to make sure that the investment in my education would have a payoff in the
> future and that I would really enjoy that occupation.

Students openly discussed how they wanted to select careers that provided
financial security as well as a stable outlook for longevity. Despite these pragmatic
views towards selecting a career, the students discussed a desire to be in a career that was

also personally satisfying. Susan almost described this verbatim as her outlook towards finding a career path when she noted, "I wanted to have a balance between something that would, of course, pay the bills and also something that I would be personally fulfilled doing."

The idea of personal fulfillment was common among the students, which I have also noticed as an academic advisor in many advising appointments – life science students typically expressed a desire to help in some way. Nevertheless, because they honed their critical thinking abilities in their science courses, they learned to calculate risk and loss while embarking on various experiments and studies. The students discussed the challenges of balancing the pragmatic need to find a secure and stable job while also enjoying it at the same time. They did not want to sacrifice one need for the other, and this course helped them to navigate these tensions. Sophie discussed this challenge as a motivating reason to enroll in the course when she acknowledged,

> I thought, 'Okay, and then how do I narrow down the options that are best for me without having to compromise having the case of Anna,' in one of our textbooks, she kept just accepting jobs just because she thought, 'Oh, this is the only option I have.' And I don't want to ever think that when I'm looking for a job. I don't ever want to think, 'Oh, this is the only option I have so let me settle.' I don't want to settle unless I know it's what's best for me. My friends and family have said it's best, I feel that its best, I feel that it's right. And I wanted those skills to know how to narrow those things down or to hone in on those things.

I did not encounter any student who felt pressure from their family to pick a certain pathway. In fact, most of the students directly mentioned the immense support

they have from their families to choose whatever career they desired. However, this generation of scientists has been living in a world with immense economic, social, political, and psychological challenges. It was clear they felt compelled to pick a career that was stable and easy to attain and maintain.

Alluding to the concept of socially acceptable jobs. Besides the challenges of finding career pathways that allowed them to achieve both financial security and personal satisfaction, students commented on facing tensions related to employment in socially acceptable careers. I participated in an exchange on this topic with Molly, who described how this used to be a very prominent concern in her mind before the course, but she was not as concerned with pleasing others now that she felt more confident in her career selection.

Serena Christianson: "Did you ever think about personality types and those kind of ... the idea of environment preferences having an impact on your career and work? Did that ever come to your mind?"

Molly: "I didn't really ever think of ... When I thought of location and environment, I only ever really thought of the physical place that you're at ..., would I want to move to a different state for a job? I think a lot of, when I thought about what I want to do in life it was never really, I would think about a concept of a job. It was always, I had this mindset of, if my parents were telling their friends or family members what their daughter does for work, how would they talk about it? So, if I thought about, say, being a janitor, which, there's nothing wrong with being a janitor. But when I think in my mind about my parents saying, 'Oh, she's a janitor,' and the response that people would give them, I would never

113

think, 'That's something I want people to be talking about me in relation to.' So all the jobs that I considered were very ... what is socially acceptable? To have this job that my parents would talk about and people would be like, 'Wow, that's so cool.'"

Serena Christianson: "Interesting. Okay. So, you said socially acceptable for your parents to talk about. Was there ever, or even today, do you still think about what is socially acceptable, even for you? Where if someone asks you, 'What do you do?' Is that something that comes across your mind?"

*Molly: "*I think it's a bit better now. Because I think now that I've kind of looked at different options for careers I don't feel so much ... For example, there's that whole situation of, you go into a bar or a dinner party or something, and someone says, 'What do you do?' And you respond. I can't think of many jobs that I would actually take at this point that I would be ashamed to say, like, 'Oh, well, I'm a this, but don't tell anybody.' Because I think, now thinking about it, if I did take a job, it wouldn't be because it was a socially acceptable job. It would be because this is a job that fits my needs for a salary, fits my needs for location, for personal satisfaction. All of that kind of stuff. And so if it fit all of my needs, or at least most of my important needs, then I don't think I would be ashamed to have that mentioned in a social setting … I don't feel like there's a social stigma when it's something that fits my needs.

Similar to finding a socially acceptable career, there were discussions on why life science students tended to gravitate towards only the medical or research career pathways. Some students speculated this might have to do with fear of doing something

not as prestigious as a medical doctor. For example, Chelsea wondered whether some students lacked initiative to find an ideal career path, falling into a career path because of others' recommendations as she noted,

> I feel like I have this perception ... Ah. Yeah, I'm just going to say it. There's [*sic*] some people I feel like are pre-med, and I feel like they're robotically pre-med, and they don't think about other things. They never weigh pros and cons, and they might just do it because other people tell them to. I really feel like I used to be more that way, where I would just try and do things because I was told I was smart or I was told I should do these things, like with engineering or with the time I thought I wanted to go to medical school really briefly because other people told me to. I really feel like now I don't value the same things I used to value. I don't value a title as much as I care about my work-life balance or these other things that I decided are more important to me.

In the essays and interviews, students commented often on the increased abilities to pursue whatever their career path was without fear of judgment or criticism. Nevertheless, it was clear that students often began their career development process with this hovering thought of meeting others' expectations, including society's construction of a prestigious or respectable occupation.

   Feeling pressure and urgency to make a career decision. When asked about their reasoning to enroll in the course, many of the students discussed their impending graduation and the need to make some kind of decision about their future. In her final essay for the course, Nancy discussed how she was using this course to assist with both her academic and career planning when she wrote, "I had felt an urgency to make a

115

career decision immediately upon starting my undergraduate degree in biological sciences because I knew that may determine some extra classes I would need to take." In fact, as previously discussed, life science community participants held a commonly accepted perspective that further education beyond a baccalaureate degree was needed. Nancy's comment echoed that sentiment, as well as a questioning whether further education was necessary for her.

With graduation looming for some of the students, they noticed some of their peers securing employment, receiving admission into graduate programs, or simply appearing to have a plan to meet their goals. Oaklie explained that her personal career theory changed as a result of these external factors and motivated her to take charge of her own future when she said,

> But then, after, I think what really changed it was when my roommates started getting full-time job offers with the companies that they interned for. Not even my roommates; just most of my friends. Or, my other friends that did want to do medicine were taking the MCAT, and doing all this preparation stuff, and I didn't want to do that, either. I just know that I don't think that's what I wanted to do. So, I was stuck in this place where half of my friends are applying to graduate school, half of my friends are getting full-time jobs, and I'm sitting here with no plans yet.

Similar to the need of balancing financial needs and personal pressures, some students discussed how they were not the only ones in their families in college, so they wanted to ensure their time in college was not a waste of time, money, or energy. Molly described this pressure to graduate in four years for her family's sake, not just for herself,

when she asserted,

I think it's kind of ... it's technically financial, but not in a sense that I couldn't

afford to do an extra semester or two. My dad's paying for half of my college, and

I feel really kind of responsible to make sure he spends the least amount of money

possible. So, the idea of me going to five, six semesters ... or five, six years of

school when he would have to be paying half of that for my inability, not

necessarily, but my inability to graduate in four years when I knew I could, I felt

like I just really had to ... I can graduate in four years, and so I'm going to

graduate in four years, because that's going to make my dad not have to pay as

much, even though he technically could. And that's going to make me proud of

myself for having managed that.

No matter the source of the urgency or pressure to make a decision related to their

careers, the students expressed these factors motivated them to take a more committed

step in their career development and planning process through enrolling in this course.

Avoiding starting a job search. Undoubtedly these students faced many

challenges and pressures related to their career planning. Thus, a common theme resulted

in them delaying their job search to avoid feelings of incompetence, failure, or stress.

Chelsea represented the views of many students who were undecided on their career

paths when she declared, "My mentality was like, 'Oh. I'll figure it out later.' It

[biological sciences] still is something that interests me ... But I never really sat down and

defined anything." She later described that she enrolled in the course to confront this

avoidance by attaining skills to help her define her career interests.

I just really wanted a more methodological approach to kind of handle all the

different ways I was steering myself. I had so many different interests, and I didn't really know how to narrow it down. I really didn't know, and it was really intimidating to deal with that myself. I thought taking a class would kind of motivate me and give me resources to sit down and deal with it.

Other students mirrored Chelsea's lack of clarity with career choice leading to avoidance of the whole career decision-making process. In her interview, Mariah commented on this overwhelming feeling about her impeding career search process when she stated,

I think a lot of the overwhelming part of it made me avoid it a little bit, because avoiding that anxious feeling I guess. But it was more the not knowing that made me anxious, and then it was just a cycle. Like I don't know so that I'm anxious and then I avoid it. Then I don't take the steps to figure it out.

Oaklie discussed how seeing her peers advance further along in their career development journeys helped her realize that she could not avoid starting her job search any longer:

I knew that I had chosen what I did choose [her career path] based on habit and comfort. I was comfortable in it. I didn't need to change anything. I was doing fine grade wise, so I saw no reason to switch majors. But then, after, I think what really changed it was when my roommates started getting full-time job offers with the companies that they interned for. Not even my roommates; just most of my friends. Or, my other friends that did want to do medicine were taking the MCAT, and doing all this preparation stuff, and I didn't want to do that, either. I just know that I don't think that's what I wanted to do. So, I was stuck in this place where

half of my friends are applying to graduate school, half of my friends are getting

full time jobs, and I'm sitting here with no plans yet. So, I think that's when I

really realized I need to make a decision.

The students discussed in their interviews and essays how enrolling in this course

was a way to mitigate these tensions of balancing their needs of financial stability and

personal wellbeing, determining whether they cared about finding socially acceptable

jobs, feeling pressure and urgency to make a career decision, and avoiding starting a job

search.

Broadening perception of career options. *Assertion 2 - Participation in this*

course provided a space for students to be exposed to varying types of careers, to apply

their life science knowledge, and to learn about the world of work. The post-intervention

interviews and final assignment revealed students appreciated this course because it

provided a venue to browse and be introduced to a variety of career options, as well as

learning about what it means to be in the "real world." The following theme-related

components comprised the theme that led to Assertion 2: (a) Describing jobs believed to

be available for life sciences, (b) Appreciating discussion and practice of soft skills; and

(c) Broadening views on lifestyles.

Describing jobs believed to be available for life sciences majors. Because one of

this study's themes was a broadened concept of possible career paths, it was logical that

students discussed their lack of knowledge of possible career options. A primary

challenge with which students contended was examining careers that they believed were

available for life science students. The students admitted to having a myopic view of

career options, such as Alexis's statement that indicated,

119

I had ideas about the lab technician and that was about it. I didn't really have any

idea. I just knew that it would get me to the sciences and I really liked science and

I only knew that the lab tech option might work, because I had internships and I

was like 'Oh it's like a lab tech.' That was everything I knew.

Molly expressed a similarly clouded perspective about career options when she said,

Most of what I thought you could apply for was basically medical type of jobs.

Just things within the medical field, or research. And then because I'd taken a lot

of classes in environmental sciences, I knew that that was also an option. But

most of the jobs that I knew were there were, I knew park rangers was an idea. I

knew that environmental research, field research, research conservation type of

jobs were available. But most of it was research or medical hospital kind of

positions.

Sophie also believed that medicine or research were her only options, and she

appreciated how this course provided a wider array of possible career paths with a life

science education when she maintained,

For life sciences, honestly, it was just medicine. It was all about medical related, I

mean medical research or nursing physician, occupational therapist, that type too

for life sciences or I thought for life sciences, conservation, research and

conservation, so protecting endangered species, things of that nature. All I really

thought that a life sciences degree could get me and I thought, 'All right, well, this

is still a cool degree path, let me continue to go here,' but that's all I thought the

careers were, I didn't think that science journalism was one, that's still something

I can't get over.

120

Susan expressed similar sentiments when she declared,

> Consider not necessarily unprecedented, but careers that aren't the obvious. One
> of them that I thought was really, really interesting was a scientific illustrator. I
> would have never thought of that as a career in my whole life. So I think the
> opportunity to explore the breadth of careers that are available to those of the life
> science education was really valuable.

With external factors such as an approaching graduation, students realized they
were unaware of what options they could pursue. Oaklie addressed this specifically when
she said,

> When I read the description, I know it had talked about options for work that
> aren't directly related to heath care, which was my main thing, because I had gone
> all this time thinking I wanted to be a doctor. So, it was interesting to me to see. I
> didn't realize that people would hire you with a biology degree, with something
> not exactly related to biology. So, I was hoping to find options that weren't
> necessarily exactly biology jobs.

In her final essay, Tina discussed how students were encouraged to engage in
internships and other experiences to further define their career preferences. She realized
she was at a deficit because "I do not have the experience to know if I would enjoy a
career in medicine, and at the beginning of the semester, I did not know what my other
options were beyond this" and she saw this course as a way to help solve that problem.

Students discussed that they knew there were more opportunities outside of the
binary options of medical school and research for career paths, but were unsure of what
existed beyond those choices. There was some debate among the students about what a

"life science career" meant; however, they agreed that the individual would need to apply their life science knowledge in some capacity for it to be considered in this area. Susan showed an expanded view of what a "life science career" meant as a result of the course when she declared,

I think having a degree in life sciences, you've shown that you have research skills and that you can apply those research skills, any life sciences degree, but biology is a rigorous degree. So you show that you can handle that workload. Communication is kind of ... As long as you have a university education, that is kind of some evidence that you do have some kind of communication skills. And just the skills that I think you learn in the life sciences degree, like research. I think that was a big one. Analysis and being able to interpret data specifically for a marketing position, where you need to figure out what content to use to get the most clicks and being able to analyze that data and more or less come up with a hypothesis for why that content is getting the most clicks and how to replicate that experiment.

Appreciating discussion and practice of soft skills. As they reflected on the course, students expressed appreciation for the discussion assignments because these opportunities opened their eyes to other possible career paths and helped them expand their skills beyond the scientific, technical skills that were the focus of their courses in their major. Alexis mentioned this in her interview when she maintained,

Someone else had sort of similar top three's [for their Holland RIASEC score] as me and had chosen very different careers and when we talked about this I think one of them was working with animals or something and I was like 'I never even

122

had thought about working with animals? I wonder if there is micro-technicians or something for different veterinary things?' I think I'd never thought about that, so it's like really listening to other people's reasoning for things can really show you something you never knew about.

Frequently, I would ask a follow-up question relating to whether they liked the discussions because it fostered a sense of community. Susan did not necessarily agree with this sentiment, and her feedback echoed other students' comments, as well.

Susan: "Actually, I do have to say, for this course, I did think the discussion board was more helpful than it is for some of my other courses where I do have those mandated discussion posts."

Serena Christianson: "Would you say in this situation with the discussion board ... Correct me if I'm wrong. Do you think it creates a sense of community, or if anything, it helps you understand how to process what you're thinking because either you're seeing someone else who's a SOLS student think that way, or you feel like, 'Oh, okay, there is someone who is a little bit different?' Was there anything like that, would you say?"

Susan: "Yeah. So I think what you said about kind of processing what you're thinking and seeing how other people are processing … I didn't really get any sense of community, but I think being able to process both my own thinking and then see how others were thinking and whether it was the same or differing from my own, I did think that was beneficial."

In other words, students did not feel alone in this career process and appreciated the opportunity to discuss this with other students in an accepting and welcoming

environment. In the same way, students appreciated how this course provided

opportunity to practice their soft skills, or "social skills" as (Villiers, 2020) would define

them. Some students expressed hesitation to engage in social networking with others, but

when this was a required task for the midterm assignment (Career Field Analysis research

paper), they appreciated the nudge. Mariah admitted, "Having us do our informational

interview, that was really hard to get myself to do, but once I did it; it was really

rewarding, and I gained a lot from it." This assignment required the students to connect

with a professional in one of their two careers they were researching as a way to learn

more about the realities of that career. Mariah's sentiment was exhibited by many

students; instead of having this be an optional activity, attaching some kind of

punishment for *not* doing it motivated the students to engage, and the intrinsic rewards

greatly outweighed the importance of simply doing it for an assignment. For example,

Tina said,

> Researching jobs I could get with a certain degree led me to discovering new jobs.
> I have also asked people about their jobs to get some first-hand knowledge to see
> if it would be a good fit for me. I would share some things about myself and some
> possible concerns and it would be helpful to get feedback from someone who has
> experience in the career.

Besides improving interpersonal skills through online discussion boards and

informational interviews, the students remarked on the importance of refining their

written communication abilities they used for their resumes, cover letters, and thank you

notes. The course required students to produce a resume and cover letter for two

prospective careers, and the students offered appreciation for a subtle nudge to get these

useful deliverables created.

   Broadening views on lifestyles. The course material described how to apply for and be hired for a job *and* also what the world of work was like. Given these students were enrolled at a research university, they were unaware of the variety of employment opportunities working adults had beyond the traditional pathways of full-time work. Chelsea expressed relief at being introduced to the notion of many ways to thrive in the workplace and actually putting herself in the job marketplace when she affirmed,

> Applying for jobs, I applied for titles I would never have thought of, but they
> definitely fit my skillset or my interests, even if they didn't necessarily seem that
> way at first glance. I guess I was really deeply rooted in the idea that everything
> had to have a side or role to think that it was something I could achieve. Just
> based on my resume, I was just barely worried before the class that I wouldn't be
> able to branch out into other areas related to life sciences and that I would be
> stuck on a work bench. Now, after the class, I feel like I understand that when
> you're interviewing, applying, and searching for a career, you do have flexibility.
> That has been really relieving.

Molly expressed a commonly encountered epiphany that shattered long-held conceptions of working when she said,

> So the biggest thing that really affected my thinking was how many different
> lifestyles [employment alternatives] there are. I think I mentioned it in the first
> part, but there was that one chapter about the alternative ways of working that
> talked about just the different ways that people work besides 9:00 to 5:00. And
> that kind of, because I think I mentioned before about how that really influenced

125

what kind of jobs I could get. But it was more than just what kind of jobs I could get. And a lot of it, too, was what I could do in a job that might seem really strict and, 'You did this and only this,' but you can actually change things up a little bit depending on what jobs you have. So if you have a job that is only, you're food packaging, and you sit there and package food all day and that's it, as opposed to jobs I've been looking at—teaching, for example, where you do have the same job all day but there's all kind of ways to do it, no matter what kind of person you are. You can always do it a little bit differently.

She also commented on changes of her perceptions of careers in life sciences being broader and not as limiting when she said, "Instead of just, do this and there's the goal at the end, it's, there's all these different paths that get you to your goal." Stated differently, the course provided a space for students to challenge their ideas of what it meant to succeed in the workplace, as well as correcting some assumptions and broadening possibilities for life beyond college.

Oaklie revealed how this course helped her shift her focus on back to her initial values of flexible hours so she could someday have her own family:

Oaklie: I knew I wanted, I've always thought about family, and where I want to live, and how many hours I want to work. I want to someday have a family, so I wanted to have a job that has that flexibility. So, I started thinking more about not working anything where you'd be on call overnight, and stuff like that. So, I was trying to think about careers that had that flexibility in work hours.

Serena Christianson: So, that was something you thought about prior to the course, that you were aware of this?

126

Oaklie: I was aware of, yeah. But the course definitely opened my mind up to that

more.

Alexis explained how valuable she felt the discussion boards were in realizing

how diverse people can be, even if they share a certain characteristic (in this case,

pursuing a life science degree):

It might sound kind of corny but I really did learn to listen to what other people's

opinions are about things, because in the discussion some people would have such

different views on stuff than me. That gave me new ways of approaching a topic

... I think they [discussion boards] are necessary for the course, because …

almost as important as the reading was, was really reading some of the responses

… It was just really interesting to see how there were so many different types of

people than me. People with totally different ideas on careers and totally different

places and people with some crazy internships and it's like it was just really

interesting.

Students commented that they had not seriously considered working situations

where they could work from home, had flexible hours, and other alternatives outside of

the traditional 40-hour work week. Students reflected upon learning about these

alternatives through the informational interview assignment, where misconceptions about

career paths were corrected and clarified. It appeared the course gave the students a

sense of peace through expanding their perception of possible options and lifestyles.

Developing career exploration and planning skills. *Assertion 3 - Engaging in*

the structured CASVE cycle helped students mitigate their negative self-talk related to

career planning and development. The intervention introduced resources and techniques

127

for students to conduct an effective job campaign. The course helped develop the

students' career exploration and planning skills, resulting in increased self-confidence

and self-efficacy. In addition to introducing students to possible career paths, the

interviews and final assignments revealed students perceived that the course provided

opportunities to learn how to initiate and complete a job search campaign (in other words,

the process of finding a job – determining one's goals, finding resources, specifying

employers, preparing and submitting application materials, completing interviews,

determining which offer to accept [Reardon, Lenz, Peterson, & Sampson, Career

development & planning: A comprehensive approach. Student edition, 2019]). This

process involved completing tasks related to introspection, conducting research and

analysis of career options, engaging in the workspace through internships and applying

for jobs, and assessing their possible job and goal selections and prior activities. The

following theme-related components comprised the theme that led to Assertion 3: (a)

Appreciating and seeking resources from class, (b) Realizing next steps to take, (c)

Learning about one's values and desires, and (d) Showing increased confidence in

oneself.

  Appreciating resources from class and seeking their own career planning

resources. When reflecting on the course, students commonly expressed an appreciation

for the course's resources, such as Alexis' comments on the textbook when she said,

> I loved the textbook and I wish that I would read more of it, because I see it's
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> extremely valuable. It's one of those books that I actually will keep and hope that
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> I read, but I might not. I really liked the textbook and there's a lot of really eye-
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> opening things in there. I think it was really well written. It was probably one of

the best textbooks.

The textbook provided the map for the course, and introduced students to career theories including Holland's RIASEC Codes and the CASVE cycle. The students repeatedly discussed how they appreciated that the course introduced them to these concepts, *and* reinforced them repeatedly through the readings, discussion posts, and writing assignments. It was these sorts of resources students were seeking when they enrolled in the course, and they expressed satisfaction with participating in it.

In her final essay, Nancy described one of her reasons to enroll in the course was to be informed on the career planning process as she noted,

> I also wanted to learn about the process of searching for and securing a job, as I believed my lack of confidence and hesitation had a lot to do with my lack of knowledge on this and how difficult I perceived it would be.

Some students discussed that they realized they could engage in these career planning activities on the side, but the course served as a guiding force and structured plan to help get them started. Chelsea mentioned she was seeking out these sorts of resources for this exact reasoning when she claimed,

> I just really wanted a more methodological [*sic*] approach to kind of handle all the different ways I was steering myself. I had so many different interests, and I didn't really know how to narrow it down. I really didn't know, and it was really intimidating to deal with that myself. I thought taking a class would kind of motivate me and give me resources to sit down and deal with it.

Students did not realize how much power and control they had in the career process, describing the course opened their eyes to the notion they did not necessarily

129

have to accept every career offer that came their way as Molly mentioned when she said, "Figuring out if the job is right for you. And figuring out whether or not you want to take it, personally, in your own opinion, instead of just, 'I need to take it because I need a job.'"

Some students described how they originally lamented about needing to complete the weekly assignments for the course, but once they completed them, they understood the rationale and recognized the benefits they gained from the experience. For example, Molly described this realization during the last reflection paper when she wrote,

> So that final paper that we did, I wrote the entire paper. And then when I was rereading it just for corrections, I was so surprised and a little bit upset, almost, because I looked at it and realized that I had made an entire plan for my next couple years without even realizing that I'd made this plan for myself. And I was so upset, I was like, she [the teacher] tricked me! This is totally unfair. I can't believe that she made me do this without even realizing what I was doing. But I'd made a whole plan, and I knew what I was going to do, and ... it was just, it was such a good feeling to have it, but such an annoying feeling to realize I hadn't realized it [earlier].

Learning about one's values and desires. The course was designed to incorporate a reflective experience, which was a tenet of the CASVE Cycle and CIP theory. Although students had the opportunity to reflect on their efforts informally, the course's guided process was helpful in guiding students' journeys, such as in Mariah's case when she affirmed,

> When we were asked to reflect on our childhood or experiences, I think [I was]

130

influenced like, 'Oh, this makes sense why I like this, or why I want to do this.' And reflecting on the type of work environment you want to be in, I think influenced a lot on what kind of decisions I want to make for a career in terms of like how many hours you want to work, if you want to be indoor, outdoor, if you want it to be 9:00 to 5:00, if you want it to be various hours of traveling and that kind of thing.

Notably, Chelsea made an observation related to STEM students' ambition and drive, but without being equipped with the knowledge of oneself, which helped in the discovery of career possibilities when she declared,

I think a problem a lot of people in STEM have is they want to be good students, and they have all these ambitions for what they think would be a really successful career, based on professors or doctors, but I don't think that's really ... Just thinking about that kind of career oriented and achieving mentality doesn't take into account everything else in your life. I think that's really what was important to me and a new thing to gain from the class.

Throughout the course, students engaged in activities to learn more about their preferences for their work environment, such as completing the O*NET interest profiler. The students showed excitement for understanding their individual nuances and how to find careers to satisfy those characteristics. Molly described finding clarity regarding her own career decision making process through the course when she stated,

There was, I remember, I think this was in the career decision making section. Because it was talking a lot about how you make that decision. And there was a lot of focus on how you make the decision for yourself. And I kind of have

always had the mentality with most of the jobs that I've had in the past have been, this is available to you so you should take it. And I've never really considered, 'Okay, but, is this the best job for you individually?' And so the emphasis they had on that was really helpful to me, and really changed my opinion. Because I know that there's a lot of jobs I've had in the past that I wouldn't have taken if I'd gone into it thinking, 'Okay, they want me now, but do I want them?' I probably wouldn't have taken it if I'd considered that aspect of things. So that really helped me kind of figure out how to prioritize career decisions.

As students engaged in the self-discovery process, this meant coming to terms with their own limitations and the realities of their options. Nancy touched on this in her final essay when she wrote,

I have learned some very valuable things about myself throughout the duration of this class when it comes to making academic and career decisions. I have been able to critically think about what my actual skills are, despite being different from the skills I would like to think of myself as possessing. For example, many of the jobs I was interested in, and thought were exciting, were high stress jobs that I knew I would not be able to handle well due to me already being an anxious person. This was a hard but necessary realization to come to, and I am glad that I was able to recognize that those types of jobs would not be the best fit for me prior to becoming too invested in them.

However, this self-realization was not always a smooth process, because at times students continued to feel confused or overwhelmed regardless of learning more information about themselves. Oaklie discussed this in her interview when she affirmed,

All of the RIASEC code stuff that was something that I definitely found helpful. But at the same time, at first, it overwhelmed me, because I thought that the three that I got were all opposite of one another.

Ultimately, students were able to gain further clarity about who they were as individuals with respect to their strengths, weaknesses, and work preferences. This assisted them as they progressed through the various job-exploration tasks, even if they were still unsure which path they wanted to pursue. Sophie's feedback was a great example of optimism with lack of direction when she asserted,

I feel like after taking this course, it's [her anxiety and fear of the unknown] clarified. It's brought to light many different avenues of approach when it comes to seeking a job, choosing what job you want, what to do if you don't get the job you want. It's clarified a lot of those things. And so the fear of the unknown has decreased dramatically. The only reason the fear of the unknown is still there, is because I'm not there, yet. So I don't know exactly what's going to happen, I don't know how my last classes are going to go or applying for graduation, if they're going to accept my petition to graduate, blah, blah, blah, things of that nature. So that's why the fear of the unknown is still there. But when it comes to choosing careers, narrowing it down, no, there's no fear of the unknown anymore.

Showing increased confidence in oneself. In the final essays and interviews, students were explicit in how this course improved their self-talk, which led to increased confidence and perception of their abilities. Susan explained how this course motivated her to apply for a graduate program she would not have applied for prior to taking this course when she indicated,

133

So it was actually a program that I was kind of 'iffy' about applying to before the course. After the course, part of it was I figured there's no harm in applying. Then another, and I think a larger part of it was that through using the tools in the course, weighing those factors, the RIASEC codes, I decided that it would be something that would help me attain a career that through weighing those factors I think would be a good fit for me. So I decided to kind of bite the bullet and send them my application for that. … I would say in terms of odds, before the course, there was probably a one in ... there was probably a 25% chance of me applying. But then after the course, it was a 100.

After completing the course, Chelsea's personal career theory changed in a positive direction from how she began the course, "there's a lot of opportunity out there if you look for it, and you do have a lot of skills that are translational even if they don't necessarily seem that way right away." Oaklie showed a similar optimistic outlook on her career decision process,

So, I think I've done a lot of communication with people. I've talked to family friends and family about what they do, and how they approach their jobs and found success. I think my attitude, too. I'm trying to be more positive and not talk down as much, even applying for jobs that I might not necessarily meet all the requirements for. I've started doing that more than I would have before, because that was one thing we learned in the course. Even if you don't meet the qualifications, still apply.

Students discussed how participating in these assignments revealed traits and qualities that they did not realize they had, motivating them to treat themselves better and

to trust in their capabilities. For example, Oaklie stated,

>I learned that I do have skills that are important, or that I've learned more through my courses than I thought I did. Not in terms of necessarily the course information, but my thought process toward problem solving and analyzing work and data.

Alexis reflected a similar sentiment when she said,

>I've learned about myself I can be more resourceful than I thought. Again for writing that final paper, when I read just the outline in the book of what to write, the first thing I thought was like 'Oh, okay this is some of the stuff we did, but oh what am I going to—what am I going to put down there?' and then when you actually started writing it, I realized I do know more than I thought and I should give myself credit.

>Although some of the students were still undecided on their pathways, they felt

better equipped to navigate the world of work through the resources and activities in the course. There was an air of optimism among the students, a conviction that someday they would find a career that met their needs, even if that destination was unknown to them now. Nevertheless, what was different now was how the course changed their perception of dealing with this unknown and providing tools that increased their own self-efficacy to complete the CASVE cycle. Mariah's statements represented these sentiments as she indicated,

>I feel more confident in what I want to do. While I'm not 100% sure on the specific job, I have an idea of the work environment I want to be in, or things I can base the job off of and decide if that's for me or not, and just being more

135

aware of myself and how that will reflect into my career.

Mariah continued on this same theme, showing a reconceptualization of what she had to offer future employers when she claimed,

Well, like what you were just saying with the negative thoughts, I think that was a big contributor to how I was avoiding the career planning process, because in the back of my head I know I have these skills, but I didn't know how to present them on a paper or acknowledge to myself that I have them. It was kind of just like, 'Yeah, I worked for four years, but what did I get from it? I don't know.' Now I can say like, 'I have the soft skills. I have the hard skills.' Things that are actually valuable to employers that I didn't realize were before. I gained a lot of appreciation with what I have done, whereas previously I was like, 'I haven't done anything. I need to be more ready for this.'

Despite these steep challenges and strong influences, it was evident from the interviews and essays that there was an increase in perceived abilities to find and plan for one's career trajectory, as well as expanded perceptions about possible career pathways. All students exhibited an increase of confidence in themselves to select an occupation, although not all of them finalized their career decision just yet. They showed appreciation for the career exploration and planning resources, as well as knowledge about what it meant to be a working professional in today's job market.

A contrasting viewpoint on the course. Despite the overwhelming positive results for the course from the quantitative and qualitative data, I conducted an interview with a student, Oscar, who failed the course. His was the only interview where we did not follow the interview questions from Appendix D because of his performance in the

136

course. Instead, we had an hour-long conversation on how the course did not meet his expectations or his needs. Although he appreciated the intention of my course design, he did not find it useful for where he was in his career journey. He shared how he thought the course was going to be more of a small-group discussion format, as opposed to the online discussion board that was quite passive in its demonstration of a "discussion." Oscar admitted that he did not feel it was necessary to engage in the introductory assignments related to building self-knowledge and was looking for more of an opportunity to discuss the challenges and pitfalls of negotiating the job search process as a life sciences student. He admitted that he was not entirely passionate about science, but chose biological sciences as a major because he knew STEM jobs were more financially secure and stable during shifts in the economy.

Although many students opposed the idea of breaking this class into multiple classes to allow deeper discussion of the chapters and topics, Oscar was a proponent of this suggestion. He felt that this course was an introduction to the career development conversation and he was seeking more depth than breadth. Other students felt that if the course was divided, they might not be able to enroll in each iteration, thus missing out on valuable and critical information. Oscar understood these feelings, but respectfully disagreed.

Oscar attributed his poor performance in the course to his own lack of motivation and was quick to comment that my teaching style was not the catalyst for his absence,

> I think you as a personality really lends itself to creating what could be a really
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> good teaching environment because it's not at all judgmental or rigorous in the
>
> sense that like, 'You need to do this or you're going to fail out of college,' and

things like that.

Interpretation. He appreciated my outreach when I was concerned about his lack of activity, and he took responsibility for not fully giving the course material a chance. This conversation was refreshing, because although it was pleasurable to hear positive feedback about my work, hearing constructive criticism has most often been useful in fueling further improvements. Oscar's feedback reminded me that sometimes online classes were not the best medium for certain types of content and subjects. Alternatively, synchronous delivery that included face-to-face interaction might have been beneficial for students' learning and understanding. Although he was an outlier in this specific study, his viewpoints might have represented a segment of the student population and should be considered in determining the effectiveness of delivery of this course.

CHAPTER 5

DISCUSSION

Providing adequate resources for undergraduate students' career development is of utmost importance to meet demands from national agencies and industry leaders. A steady increase of life science undergraduate student enrollment at ASU attests to the need for appropriate career development education to be woven into the curriculum. The purpose of this project was to provide a continuum of job and career information to SOLS' students to ensure they have appropriate, comprehensive information as they learn about and consider various career opportunities in the life sciences. The study was designed to examine the use of a life science career development course intervention to determine its influence on students' career decision-making self-efficacy, perception of possible professional and career goals and opportunities, knowledge about employment-seeking skills, and readiness for career problem-solving and decision making.

Complementarity and Integration of Quantitative and Qualitative Data

In Chapter 3, I indicate the research design for this study is a "multistrand mixed method action research (MMAR)" because of the use of concurrent quantitative and qualitative methods in a sequential fashion. In such a study, researchers collect and analyze the quantitative and qualitative measures independently, then compare them to determine whether there are similar or dissimilar results. In this study, I use mixed methods to explore the complementarity of the quantitative and qualitative data. As Greene, Caracelli, and Graham (1989) discuss in their article on mixed methods evaluation designs, the concept of "complementarity" relates to whether and how the data lead to the same conclusions based on the outcomes. Other researchers call this

139

"triangulation mixed-methods" because of the simultaneous collection data and "equal emphasis given" to both kinds of data in the interpretation process (Mertler, 2017, p. 107). When assessing the outcomes, one can view the rich, descriptive nature of qualitative data as a way to tell the story of the numerical data from the quantitative research methods.

Recall that in RQ1, I focus on career decision-making self-efficacy including the following five constructs: *goal selection, occupational information, problem solving, planning, and self-appraisal.* In RQ2, I focus on students' perceptions related to *possible professional and career goals and opportunities, knowledge about employment-seeking skills,* and *readiness for career problem-solving and decision making.* Thus, for RQ1, results from the quantitative data, the retrospective pre- and post-intervention surveys show statistically significant increases for all constructs on self-reported scale scores in the five career development areas. On the other hand, for RQ2, the quantitative data for the Career State Inventory (CSI) (*readiness for career problem-solving and decision making from RQ2),* indicate the constructs of *occupational certainty*, *occupational satisfaction, and occupational clarity* are statistically significant. Notably, for the CSI, the significant decreases in certainty, satisfaction, and clarity scores are important (recall lower scores are better) and are attributable to students' participation in the course. These changes indicate students are certain about their selection; content with their job option list, satisfaction; and confident in their ability to make a career choice, clarity.

Upon reviewing the qualitative data, the interviews and Strategic Academic and Career Planning final essay, all of the themes complement the results from the surveys. Specifically, themes from the qualitative data such as *Broadening perception of career*

options and *Developing career exploration and planning skills* elaborate and explain the quantitative results related to quantitative data in the constructs of increases in *goal selection, occupational information, problem solving, planning, and self-appraisal*. Additionally, themes from the qualitative data are consistent with and help to explain the CSI data including the decreases, i.e., improvement on *occupational certainty, occupational satisfaction,* and *occupational clarity*, which is also reflected in the qualitative interview data.

Notably, students' descriptions of their reasons for enrolling in the class based on the qualitative data also reflect the quantitative data about occupational information, solving problems related to options about their career choices, and planning for their careers. Specifically, students express that before the course they feel unprepared to begin a job search campaign, but the course provides resources and activities that increase students' perceived capacity to start and finish a job search, which is consistent with quantitative constructs such as *goal selection, occupational information,* and *problem solving*. Frequently, students describe how the course inspires them to reflect and honestly assess themselves, which leads to refined visions of possible career options and increases in readiness to make a career decision, which reflect quantitative constructs like *planning*, *self-appraisal*, *occupational satisfaction*, and *occupational clarity*.

Taken together, the qualitative data exhibit high levels of complementarity to the quantitative data. The qualitative data help to explain the quantitative data statistically significant results, that is to say, the qualitative data provide rich explanations that help in "unpacking" and understanding the quantitative data.

Discussion of Findings and their Relation to the Literature

In this section, I connect the findings of the study to the theoretical perspectives and previous research providing a framework for this project. Specifically, I connect the outcomes related to higher education and career preparation; the theory of vocational personalities and work environments; the cognitive information processing approach; and self-efficacy theory.

Higher education and career preparation. At this point, our world is entrenched in the COVID-19 pandemic for almost an entire year. In the United States, this unfortunate event forces us to consider a number of injustices and weaknesses in our country because the virus caused havoc in so many ways including economic, political, educational, and medical areas. Notably, how people experience the pandemic is greatly affected by their occupation. In difficult times, people reflect on their career choice, as is natural when a life-altering event occurs (Reardon et al., 2019). How can we capitalize on this momentum related to career development?

Results from the study, particularly from the qualitative data continue to reflect the career preparation orientation that students hold with respect to attendance at higher education institutions. Because many of them were approaching graduation, students tend to take a very pragmatic perspective about their needs. Many are interested in career search, career placement, and obtaining that initial job, which is consistent with the need for universities to prepare them for career searches and all the matters related to that issue. This pragmatic orientation is reflected in their perceptions about college, more generally, as noted in the following section.

From my perspective as an advisor, current college students tend to view the

college journey as a social contract in which they jump through the necessary hoops and meet the required benchmarks so they can earn a coveted degree, which is supposed to expedite their job search campaign. Offhand, I cannot recall any conversation with a student where they chose to enroll in college for the pursuit of knowledge; rather, they were seeking a pathway to financial stability and if possible, a route that would meet their personal interests and skills, too (Strada-Gallup, 2018). The data shine a light on the need for further resources and conversations about career planning and development. The effects of the pandemic are far-reaching, including the devaluing of many economies and increasing numbers of unemployed individuals. Current and future college students are witnessing thousands of people lose their jobs, and some students experienced this first-hand. During my recent advisement of life science students, they have come to realize through this pandemic that they are either not as interested in pursuing a life science pathway, thus they are unsure of how to proceed, or they recognized they are validated and excited about their career possibilities with a life science education, but still desire guidance for their career development.

Despite the tragic pandemic serving as a catalyst, I am delighted to hear about increasing awareness and discussions about career development in the education space. Nevertheless, this research study highlights the continuing clash of interests and motives between higher education leaders and faculty members and the interests of the general public, including students, with respect to the primary purpose of higher education. No matter the field of study or size of the institution, colleges and universities must carefully consider how to expand their focus to ensure they are not simply preparing students to re-enter the world of education as an academic, but to prepare students for entry into the

world of work. Thus, there is an ongoing, important opportunity for universities and academic departments alike to be intentional about providing career development for their students (Busteed, 2020).

Holland's theory of vocational personalities and work environment (RIASEC). Recall that Holland's theory relates to how people can be classified into six vocational interests (Realistic [R], Investigative [I], Artistic [A], Social [S], Enterprising [E], and Conventional [C]) based on the results of an assessment. In this study, after completing the O*NET Interest Profiler and Kuder Career Assessment, students use the RIASEC results to aid their exploration of career options. During the course, students reflect on these results in their online discussion posts, as well as their writing assignments. In almost every interview, students demonstrate considerable appreciation for this tool because it helps them correct and clarify their own self-perceptions, as well as raise awareness of strengths and interests they tend to overlook.

Together, the quantitative and qualitative results show an increase in self-appraisal, which is a helpful and necessary component of an individual's career development journey. Notably, in the interviews, some students mention that although all of the students in the course are from the School of Life Sciences, it is inspiring and reassuring to see a variety of RIASEC results from their peers. This outcome affords students with occasions to broaden their perception of possible career opportunities, as they realize that being a "life science student" did not have to mean fitting into a specific career typology.

Sampson, Peterson, Reardon, and Lenz's cognitive information processing career decision theory (CIP). Results are consistent with Sampson et al.'s (2003, 2020)

CIP theory and become clearer when the CIP theory is used to help explain them. For example, students discuss how they draw upon the parts of the theory as they learn to navigate the career exploration process. Specifically, outcomes from the study are consistent with the four assumptions of the CIP theory: (a) the career decision process involves both cognitive and affective processes, (b) the individuals' progress on career ambiguity is affected by cognitive abilities and knowledge, (c) the career development process is ever-evolving, and (d) career guidance focuses on improving students' skills in information processing (Hughey et al., 2003). Further, the CIP theory is comprised of a triangle model, including four components of self-knowledge, knowledge about options, decision-making, and an executive processing domain or "thinking about thinking" (Reardon & Lenz, 2015, pp. 85-86). Specifically, in the interview data, students mention learning new skills to (a) consider themselves and possible careers; (b) gain new knowledge to aid them in their thinking about careers; (c) expand their perspectives about careers while engaging in a developmental process in this area; and (d) employ these new skills as well as monitoring their use.

Notably, the textbook for the course is based on the CASVE cycle, a component of the CIP theory, which represents the "decision-making" component of the theory. Students are introduced to the communication, analysis, synthesis, valuing, and execution phases, the CASVE phases. Moreover, they are reassured that it is expected students to be at various points on this continuum.

In the student interviews and final essays, most of the praise for the course centers on how the textbook and course guide students through this process by allowing time and space to learn about themselves and possible career options through the course activities

145

(Sampson et al., 2003, 2020). Students comment on how they appreciate the opportunity to learn about the world of work through the Career Field Analysis midterm project, as well as receiving information on how to analyze and prioritize their career options. The general sentiments regarding the course are appreciation, excitement, and relief related to the career decision process (Sampson et al., 2003, 2020). Frequently, students describe how they did not realize their own meta-cognitive notions are affecting their career journey, and this intervention opened their eyes to being more aware of this process.

  Bandura's theory of self-efficacy. Bandura's (1986) theory can be used to aid in understanding much of the quantitative and qualitative data. Specifically, this theory focuses on individuals' confidence and perceived ability to perform a task. In this study, students' self-efficacy was analyzed using the constructs from the career decision-making self-efficacy (CDMSE) scale (Taylor & Betz, 1983) and a self-efficacy construct specific to this study. Moreover, self-efficacy is assessed in the quantitative and qualitative data. For the quantitative data, the effect of time is statistically significant for all of the measured constructs such as goal selection, occupational information, problem solving, planning, and self-appraisal from the CDMSE and the knowledge and self-efficacy measures devised for this study, leading to the conclusion that this course had a positive effect on students' career decision-making self-efficacy. Moreover, students reveal in their interviews and final essays how this course affords opportunities for them to learn about themselves, as well as resources to assist with their career planning process. They mention that having a dedicated time and space through a course helps them build and refine their career planning activities. This dedicated time and space affords students with opportunities to achieve small "mastery experiences" with respect to career

146

searching skills. Notably, Bandura (1986) claims mastery experiences are the most influential experiences in developing self-efficacy. Thus, the course provided students with small mastery experiences that contribute to their increased self-efficacy.

Taken together, results from the study show life science students are able to engage in the self-reflection, research, and analytical tasks that comprise the career development process. As job markets tend to shift and various occupations' availability and requirements tend to constrict, this study indicates college students need to be introduced to these career planning activities to improve their own self-efficacy, which will lead to a more efficient and appropriate job search process and the potential for increased job satisfaction.

Limitations

As with any research study, particularly an action research project, threats to validity must be considered and acknowledged. One primary threat is *history*. As Smith and Glass (1987) describe, this threat is the concept that some events other than the treatment occur at the same time and influence the dependent variable. For example, students may become extraordinarily interested in career planning activities and they spent additional time and effort outside the scope of the study, which may influence their scores.

An additional threat to validity is the *experimenter effect* (Smith & Glass, 1987). It is possible that the researcher's "charm and energy" could "motivate their research subjects to perform particularly well" (p. 149). This is especially challenging in action research, where delivery of the intervention is carried out by the researcher/instructor and can be very dependent on the skills and personality of that individual. This was a major

threat in my research because I was the only one teaching the course. Further, some students possibly sought permission to enroll simply because I was the instructor and they held a positive opinion of me through first-hand experience in advising or referrals.

Moreover, the issue of coercion is a matter that warrants some consideration. In coercive situations, students may feel it is necessary to participate because as the instructor I exert power over them or their grades may be affected. By providing assurances in the recruitment letter and by conducting much of the data collection near the end of or following the course, I have mitigated this concern. Further, I emphasized to the students that their data is being collected, analyzed, and stored while maintaining anonymity and confidentiality.

To build validity and trustworthiness, I employed the triangulation research method of collecting multiple data sources including surveys, interviews, and course assignments (Mertler, 2017). When triangulation is used, if similar conclusions are drawn from various data sources, this increases trustworthiness of the study. Notably, results indicate there is complementarity in the data as noted in the first section of the discussion. That is to say, results from these different kinds of data supported one another and pointed to the same conclusions about the effectiveness of the intervention.

To build credibility, I engaged in a systematic process of coding and interpreting the qualitative data. I completed two cycles of coding through careful examination and reflection according to Straus and Corbin's (1998) and Saldaña's (2016) methodology and techniques. I employed multiple coding methods (constant comparative, process coding, tabletop approach, codeweaving, code landscaping, and codeweaving), reflection at each step of the process, analytic memos to guide my efforts, and systematic processes

to ensure the data supported the interpretations.

Implications for Practice

Upon the conclusion of this study, it is natural to think "Now what?" and "Where do we go from here?" Although considerable change can occur through the actions of one individual, I realize that the implications for this study actually are at a systemic level: (a) a need for higher education leaders to revisit and hopefully prioritize the importance of career development in their institutions' strategic planning; and (b) a possibility for increased dialogue surrounding career development in the academic advising community.

Prioritizing career development in higher education strategic planning. Early in this study's lifeline, I explored the theoretical perspectives related to the purpose of higher education. Based on those early efforts *and* the results of this study, I realize a major implication is that higher education leaders should revisit their institution's views on and activities related to career preparation and development. As I discuss in Chapter 2, there appears to be a divide in higher education regarding the explicit prioritization of students' career development. Although ASU does not indicate specifically a stance with respect to career development in the mission or vision statements, many processes and organizational structuring points indicate a strong commitment of students' career development. Nevertheless, from my personal experience in the School of Life Sciences, there is more that could be done on a systemic level to ensure consistency in terms of promotion and implementation of career development resources and education.

At many universities, including ASU, career development courses are taught, but are not offered in a major/discipline-specific format. As I mention in Chapter 2, results

of a survey with SOLS alumni about this very topic indicate 67% of the alumni agree with requiring a generalized career development course, whereas almost 87% of the alumni support a discipline-specific course. This feedback is also prevalent in the interviews I conducted as part of the dissertation. Only one student indicates ASU offered career development courses under the "CED" (counselor education) prefix and all seven students say they would prefer a life science-specific career development course as compared to a generalized one. Further, students are aware a career advising office exists, but data from Chapter 1 indicate it is uncommon for SOLS' students to utilize those resources.

Moreover, if you recall, the intervention is life science-specific in only two ways: (a) only SOLS' students are allowed into the course and (b) the midpoint Career Field Analysis assignment includes supplementary resources that focus on the life sciences. Otherwise, the course materials are readily geared for all college students. All of this points to the recommendation that career development activities are appreciated by students when offered in a tailored format. In other words, I suggest higher education leaders should move away from large, catch-all career development activities and provide resources and support for academic units to manage career development activities for their own student populations. This could be done readily by offering a class, such as in this study, or workshops, or materials inserted into the curriculum.

In summer 2018, the College of Liberal Arts and Sciences at ASU, the SOLS' administrative unit, led a research and development process to "to create solutions for integrating career readiness in the broader College student experience" (Podany, 2019, p. 3), also known as the "Futures Collective" self-study. Six committees have been created

to discuss and review the "pillars of excellence in career integration": philosophy, career development in the classroom, career development outside of the classroom, the student life cycle, the partnership network, and measurement and storytelling (Podany, 2019, p. 3). Beginning in August 2018, 85 faculty and staff members from the College met throughout the academic year to discuss their committees' specific topics and make recommendations for the College leadership's consideration. Ideally, one representative from each unit's department was represented in this project; my supervisor lobbied to add me to this process because of my research on career development. I was added to the Partnership Network committee and participated in this unique action research project.

All of our committees convened in April 2019, reporting out our committees' recommendations and discovering much overlap, demonstrating the interconnectedness of these excellence pillars. From my vantage point, nothing was addressed regarding the Futures Collective throughout the 2019-2020 academic year. In October 2020, my supervisor notified me that the College leadership was ready to address the Futures Collective again through discussions with each of the College's 19 academic units. In early December 2020, members from SOLS, including myself, participated in this small group meeting with College leadership. Of the eleven individuals at this meeting, only I and three others participated in the original Futures Collective process, so much of this initial meeting was orienting the remainder to the spirit and intention of this process. I shared my results from this study, as well as implications I have noted here with the result of the group. As of this point, it is up to SOLS leadership to determine how they want to embed the recommendations from the Futures Collective; it cannot be overstated the immense opportunity for academic units to manage and implement their own career

readiness programming.

Throughout this research process, I have shared my journey with others in my department and the SOLS leadership. There are many reasons individuals pursue college-level education, and this study affirms my belief that college students should broaden their horizons through a combination of general education and major courses, but the college and university should provide resources and a space to learn how to apply those concepts and skills after they graduate. In other words, I believe it is our duty in higher education to proactively prepare students for life after graduation – not through passive suggestions to attend career exploration events and advising sessions, but deliberate immersion using career development materials in the curriculum and programming.

Increased dialogue surrounding career development in the academic advising community. As an academic advisor, I have learned through review of academic advising training materials, attendance at conferences, and conversations with peers how the topic of "students' career development" is a polarizing topic. Either advisors relish the opportunity to discuss career planning activities or heavily doubt their capacity to facilitate this conversation. Advisors in the latter category tend to feel uneducated about the possibilities for students in that specific discipline, are unsure how to navigate conversations surrounding self-efficacy, or lack knowledge about the career planning process because of their own life's trajectory. Thus, these advisors would rather introduce the students to the career advising resources on campus and avoid this more complex conversation altogether. There are a variety of possible solutions for this aversion to career advising.

First there is a need to hold a conversation about counseling skills. Some institutions require academic advisors to be formally trained in counseling, whereas others (such as ASU), do not. For example, my education does not include any counseling, but through informal and professional experiential education, I have gained many skills related to counseling with students. This intervention and study are rooted in career psychology, so one implication could be to require academic advisors to learn about advising related to career advising/counseling.

Second, another way to mitigate this anxiety is to revisit the organizational structure related to academic and career advising. Some institutions actually merge their career and academic advising units into one advising department, instead of having them separated. ASU's philosophy is that academic and career advising are separate entities; there is nothing problematic per se about this structural choice, but it does provide opportunities for discussion and internal professional development. There is an opportunity for discussions comparing and contrasting the roles of academic and career advisors, as well as providing resources on how the two advising types overlap and can assist one another. Specifically, it seems that academic advisors may benefit from professional development in this domain in the same way that students' anxiety decreases through guided exposure to career development resources.

Implications for Future Research

As noted above, an implication for practice is increased dialogue surrounding career development in the academic advising community, which provides an opportunity for future research. Academic advisors could be included in a study where an intervention guides them through the CASVE cycle and the other resources from the

course, measuring the advisors' own self-efficacy and perceptions surrounding facilitating career development advising conversations.

Another implication for research could be applying this intervention (or a variation of it) to other academic disciplines. The studies could focus on how students from various majors receive this material and perceive its utility in their lives. Other studies could focus on justice, equity, diversity, and inclusion (JEDI) in the realm of career development – how do race, gender, sexual identity and other JEDI factors affect students' career perceptions, aspirations, and behaviors? Robert Reardon and his team have shown that career interventions are successful (see Chapter 2), so I believe the next level of career research could focus on specific fields of study or JEDI issues.

Finally, related to my threat of experimenter bias I described earlier, a possible research study could expand on the effect of an academic advisor or someone in a similar advising/counseling role instructing a career development course. While interviewing participants from my course, some of them noted how my direct, daily experience with life science students provided me further insight in how to approach designing and teaching this course. They explained how my connection to the department and the student life cycle greatly benefitted my performance as a course designer and teacher. Future studies could be conducted to analyze the composition of an ideal career development practitioner.

Personal Lessons Learned

For as long as I can remember, it has been a personal goal of mine to pursue a doctoral degree because it is the highest level of education possible. I wanted to see if I could push myself mentally and did not anticipate how much I would grow and be

challenged through this program. Throughout this research study, I learned that "career development" is not simply the journey of one's professional career – it encompasses both professional *and* personal development because of how the two areas are interconnected. Thus, in this section, I will reflect on how I grew *personally*, as those lessons affected my performance both as a doctoral student and as a professional.

In the first semester of the program, I can say that my emotional and psychological stamina dropped. My friends, family, and acquaintances know me for my optimism, enthusiasm, and strong work ethic, yet they did not realize that even those who appear confident need support, too. I was reminded of the importance of advocating for oneself, as well as the importance of both mental and physical health. This served me well in this program and in my development as a scholarly practitioner.

When I visit with others about this journey, I often discuss how in the early part of the program I reprioritized my physical health. I actually noticed that by increasing my physical activity that my focus and overall intellectual performance improved. At an annual eye check-up, when I shared about my doctoral journey, my ophthalmologist reminded me to take care of my eyes by being intentional about breaks, allowing my eyes (and mind) to rest on a periodic basis. This anecdote might sound superficial, but mental and physical health are very important to the effectiveness and overall performance of an action researcher. It is possible that I am influenced by the events of the pandemic of 2020, but prioritizing one's health should be everyone's concern and should be addressed regularly in all graduate programs.

When I completed my master's degree, I did not write a thesis; instead, we were required to write a business plan, which was a foreshadowing of my pragmatic bent I

155

realized in this program. This program was my first real introduction to being a scholarly practitioner. I completed research papers previously, but nothing to the extent that is required of this kind of action research project. This study and program validated my beliefs about my work ethic, time management, and networking abilities. I am forever thankful for the assignment that required us to attempt to connect with researchers outside of ASU because that led me to meeting Dr. Robert Reardon and the beginning of a relationship I treasure so dearly. I was reminded of the importance of social skills as well as technical skills when it comes to being a successful scholarly practitioner. I sometimes battle with imposter syndrome, believing that I am not working as hard as my peers in this program because of how easy (my perception) everything fell into place. Nevertheless, I am reminded by close friends and family that because I am intentional and tend to look for efficient pathways, those characteristics helped streamline my journey.

This study and program introduced me to a breadth of topics, studies, and research methods for which I am forever grateful. There are many times where was I annoyed at the process that we were required to complete, but later had an epiphany on the rationale behind it all. There were many of these "aha" moments, leading me to remember that it is good to question things, but also important to trust the process.

I found my love again for quantitative data methods, something I missed from my undergraduate career (I started as a mathematics education major and switched out of it for a number of reasons). I relished being able to use my mathematics abilities, as well as my creative and social intelligences in many different ways in this program. Sometimes, I felt like an outlier among my cohort, because my formal education is not in education

156

itself, but in business, communication, and leadership. This program helped me realize

the value of my personal and professional history, as well as how business,

communication, and leadership skills are desperately needed in higher education. In

other words, to be innovative and make effective change, you have to be comfortable

with being different.

Although I do not foresee a long career in academic research for myself, I can

already see my thought processes and behaviors change as a result of this action research

study and program as a whole. I am more confident in my ability to consume and discuss

research and am a big proponent of understanding context before anything else. Despite

my anxiety surrounding qualitative data analysis, my self-efficacy surrounding this

activity has increased very much. I appreciate the richness that comes through mixed

methods studies–qualitative data really do explain and bring quantitative data to life. I

am excited to see what the future holds for me and my peers, knowing that we are

equipped with the skills and knowledge to find and ask the right questions, understand a

context, develop and implement a research plan, and find meaning and inspiration from

the results. I am forever changed because of this program and will be eternally grateful.

Conclusion

My study demonstrates today's students are experiencing anxiety and

ambivalence about the career development process and that by participating in career

development programming such as my intervention of a major-specific online career

development course, the students showed statistically significant increases in their career

decision-making self-efficacy. Internal and external factors serve as stressors in this

process, as students oftentimes feel conflicted about determining a career choice that

157

meets their own needs and preferences while managing expectations and pressures from those external sources. As I often share with anyone who will listen, "students don't know what they don't know" when it comes to career possibilities and the career planning process in general. The course I developed serves as a vehicle for students to wrestle with that vulnerability of being unaware how to navigate the career development process and witness peers experience the same emotions, setbacks, and celebrations. Engaging in the structured CASVE cycle helps these life science students mitigate their negative self-talk related to career planning and development. Overall, the course helps students to develop career exploration and planning skills, resulting in increased knowledge, skills, and self-efficacy with respect to career exploration. Ultimately, this study reveals that career development programming is needed for and appreciated by college students, affording many opportunities for academic units and universities to reconsider their prioritization of career development activities.

If universities are committed to the notion that "A baccalaureate education should prepare students for a particular profession or advanced study and for constructive and satisfying personal, social and civic lives as well," (Academic catalog: University undergraduate general studies requirement, 2020) then more needs to be done in each academic discipline to make these laudable goals a reality. Looking forward, although there has been much loss through the COVID-19 pandemic, so many great innovations and advances have emerged, too; I am optimistic that universities will attend to these on-going discussions about higher education and students' career development, leading to meaningful and long-lasting change.

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APPENDIX A

QUANTITY OF STUDENT UTILIZATION OF CAREER AND PROFESSIONAL

DEVELOPMENT SERVICES, 2012-2017

- School of Life Sciences = Biological Sciences, Microbiology, Molecular Biosciences and Biotechnology, Neuroscience

- School of Molecular Sciences = Biochemistry, Chemistry

- Department of Psychology = Psychology

'12-'13	Advising	Workshops	Events	Applications	Totals
Biochemistry	1	18	126	102	247
Biological Sciences	0	41	217	190	448
Chemistry	0	5	23	42	70
Microbiology	0	5	22	7	34
Molecular Biosciences and Biotechnology	0	2	9	5	16
Neuroscience	0	1	2	0	3
Psychology	1	86	298	711	1096
'13-'14	Advising	Workshops	Events	Applications	Totals
Biochemistry	2	14	114	276	406
Biological Sciences	1	44	181	354	580
Chemistry	2	12	42	90	146
Microbiology	0	4	18	7	29
Molecular Biosciences and Biotechnology	0	0	11	102	113
Neuroscience	0	1	3	0	4
Psychology	0	91	275	925	1291

'14-'15	Advising	Workshops	Events	Applications	Totals
Biochemistry	0	40	124	140	304
Biological Sciences	0	50	215	181	446
Chemistry	0	13	33	33	79
Microbiology	0	8	32	16	56
Molecular Biosciences and Biotechnology	0	2	13	4	19
Neuroscience	0	0	2	0	2
Psychology	1	74	332	1106	1513
'15-'16	Advising	Workshops	Events	Applications	Totals
Biochemistry	66	27	132	145	370
Biological Sciences	69	41	227	80	417
Chemistry	17	8	29	25	79
Microbiology	19	4	24	0	47
Molecular Biosciences and Biotechnology	2	1	19	4	26
Neuroscience	0	0	1	0	1
Psychology	253	88	349	636	1326
'16-'17	Advising	Workshops	Events	Applications	Totals
Biochemistry	52	29	121	95	297

Biological Sciences	57	58	224	77	416
Chemistry	11	12	25	31	79
Microbiology	14	7	27	5	53
Molecular Biosciences and Biotechnology	6	2	18	8	34
Neuroscience	1	2	0	0	3
Psychology	126	85	363	374	948

APPENDIX B

PRE- AND POST-COURSE SURVEY: CAREER STATE INVENTORY

Career State Inventory (CSI)*
Research Version 7.0
Florida State University

Stephen J. Leierer, PhD; Gary W. Peterson, PhD; Robert C. Reardon, PhD; Debra S. Osborn, PhD

Middle Name + last 4 of your phone number:_____

Date_____

1. List all occupations you are considering right now.

_____   _____

_____   _____

_____   _____

Which occupation is your first choice? If undecided, write "undecided."

_____

_____

CER (1 – 4)

2. How well satisfied are you with your responses to No. 1 above? Place a check next to the appropriate statement below:

____Very satisfied

____Satisfied

____Not sure

____Dissatisfied

____Very dissatisfied

_____

SAT (1 – 5)

3. Please circle True (T) or False (F) to the statements below

a. T   F   If I had to make an occupational choice right now, I'm afraid I would make a bad choice.

b. T   F   Making up my mind about a career has been a long and difficult problem for me.

c. T F   I am confused about the whole problem of deciding on a career.

_____

CLA (0 – 3)

_____

TOT (2 – 12)

Overall Career Decision State Profile

Total Scoring Range 2 – 12

2	3	4	5	6	7	8	9	10	11	12

Goal-directed   Uncertain   Frozen
Satisfied   Doubts   Dissatisfied
Confident   Tentative   Confused

Scoring Key

Certainty (1 – 4)
1 = First choice only
2 = First choice plus alternatives
3 = Alternatives only
4 = No options or blank

174

Satisfaction (1 – 5)

1 = Very satisfied, 2 = Satisfied, 3 = Not sure, 4 = Dissatisfied, 5 = Very dissatisfied

Clarity (0 – 3)

One point for each TRUE response. All FALSE = 0, All TRUE = 3.

Total Career Decision State (2 – 12)

CSI Total = Subtotal Certainty + Subtotal Satisfaction + Subtotal Clarity

APPENDIX C

STUDENT RETROSPECTIVE PRE-COURSE AND POST-COURSE SURVEY

Please select the item that best describes you for each question.
1. What is your major/minor in SOLS?
   Biological Sciences
   Online Biological Sciences
   Biological Sciences (Biology & Society)
   Biological Sciences (Biomedical Sciences)
   Biological Sciences (Conservation Biology & Ecology
   Biological Sciences (Genetics, Cell, & Developmental Bio)
   Biological Sciences (Neurobiology, Physiology, & Behavior)
   Microbiology
   Microbiology (Medical Microbiology)
   Molecular Biosciences & Biotechnology
   Neuroscience (only select if your other concurrent major is not in SOLS)
   Biological Sciences (minor)
2. When do you anticipate you will graduate?
   ○ Spring 2020
   ○ Summer 2020
   ○ Fall 2020
   ○ Spring 2021
   ○ Summer 2021
   ○ Fall 2021
   ○ Spring 2022
   ○ Summer 2022
   ○ Other:_____
3. What is your gender?
   ○ Female
   ○ Male
   ○ Non-binary/third gender
   ○ Prefer to self-describe: _____
   ○ Prefer not to say
4. What is your age?
   ○ 18-24 years old
   ○ 25-34 years old
   ○ 35-44 years old
   ○ 45-54 years old
   ○ 55-64 years old
   ○ 65 years and above

Sections 1 and 2 were written by Ray Buss and Serena Christianson. Sections 3-7 are adapted from the Career Decision-Making Self-Efficacy Scale (CDMSE). Buss said that permission to modify the assessment for this study was unnecessary.

Taylor, K. M., & Betz, N. E. (1983). Applications of self-efficacy theory to the understanding and treatment of career indecision. Journal of Vocational Behavior, 22(1), 63-81. http://dx.doi.org/10.1016/0001-8791(83)90006-4

To protect your identity, please enter your Middle Name + last 4 of your phone number:_____

1. Knowledge of career exploration and development tasks.
   For each item below, please indicate whichever option best reflects your perspective on your knowledge of career exploration and development tasks.

   Prior to this course, how much confidence did I have that ... / After this course, how much confidence do I have that ...

1.1. I have the knowledge needed to conduct a search of varied opportunities in life science careers.

Very Low Confidence	A Little Confidence	Slightly Confident	Confident	Quite a Bit Confident	Extremely Confident

1.2. I possess the necessary knowledge to search for career options.

Very Low Confidence	A Little Confidence	Slightly Confident	Confident	Quite a Bit Confident	Extremely Confident

1.3. I understand how to conduct a search with regard to a life science-related career.

Very Low Confidence	A Little Confidence	Slightly Confident	Confident	Quite a Bit Confident	Extremely Confident

1.4. I know what must be done to carry out a search for career opportunities in the life sciences that utilizes my life science education.

Very Low Confidence	A Little Confidence	Slightly Confident	Confident	Quite a Bit Confident	Extremely Confident

1.5. What I know about exploring careers in the life sciences will allow me to conduct appropriate searches.

Very Low Confidence	A Little Confidence	Slightly Confident	Confident	Quite a Bit Confident	Extremely Confident

2.Self-efficacy for searching for alternative careers
For each item below, please indicate whichever option best reflects your perspective on your confidence in searching for life science-related careers.

Prior to this course, how much confidence did I have that ... / After this course, how much confidence do I have that ...

2.1.I am certain I can implement a search for life science-related careers.

Very Low Confidence	A Little Confidence	Slightly Confident	Confident	Quite a Bit Confident	Extremely Confident

2.2.I am self-confident that I can engage in a search of careers that utilize skills developed from a life science curriculum.

Very Low Confidence	A Little Confidence	Slightly Confident	Confident	Quite a Bit Confident	Extremely Confident

2.3.I am certain that I can successfully explore career pathways in the life sciences.

Very Low Confidence	A Little Confidence	Slightly Confident	Confident	Quite a Bit Confident	Extremely Confident

2.4.I can definitely conduct a search for life science-related careers.

Very Low Confidence	A Little Confidence	Slightly Confident	Confident	Quite a Bit Confident	Extremely Confident

2.5.I feel confident that you can conduct a search for life science-related careers.

Very Low Confidence	A Little Confidence	Slightly Confident	Confident	Quite a Bit Confident	Extremely Confident

3.Goal Selection
For each item below, please indicate whichever option best reflects your perspective on your goal selection abilities.

Prior to this course, how much confidence did I have that ... / After this course, how

much confidence do I have that ...

3.1. Make a career decision and then not worry about whether it was right or wrong.

Very Low Confidence	A Little Confidence	Slightly Confident	Confident	Quite a Bit Confident	Extremely Confident

3.2. Select one occupation from a list of potential occupations I am considering.

Very Low Confidence	A Little Confidence	Slightly Confident	Confident	Quite a Bit Confident	Extremely Confident

3.3. Choose a career that will fit my preferred lifestyle.

Very Low Confidence	A Little Confidence	Slightly Confident	Confident	Quite a Bit Confident	Extremely Confident

3.4. Choose a major or career that will suit my abilities.

Very Low Confidence	A Little Confidence	Slightly Confident	Confident	Quite a Bit Confident	Extremely Confident

3.5. Choose a major or career that will fit my interests.

Very Low Confidence	A Little Confidence	Slightly Confident	Confident	Quite a Bit Confident	Extremely Confident

4. Occupational Information
For each item below, please indicate whichever option best reflects your perspective on your ability to find occupational information.

Prior to this course, how much confidence did I have that ... / After this course, how much confidence do I have that ...

4.1. Find information about companies who employ people with life science majors.

Very Low Confidence	A Little Confidence	Slightly Confident	Confident	Quite a Bit Confident	Extremely Confident

4.2. Find information in the library about occupations I am interested in.

Very Low Confidence	A Little Confidence	Slightly Confident	Confident	Quite a Bit Confident	Extremely Confident

4.3. Find out the employment trends for an occupation over the next 10 years.

Very Low Confidence	A Little Confidence	Slightly Confident	Confident	Quite a Bit Confident	Extremely Confident

4.4. Find information about graduate or professional schools.

Very Low Confidence	A Little Confidence	Slightly Confident	Confident	Quite a Bit Confident	Extremely Confident

4.5. Ask a faculty member about graduate schools and job opportunities in my major.

Very Low Confidence	A Little Confidence	Slightly Confident	Confident	Quite a Bit Confident	Extremely Confident

5. Problem Solving
For each item below, please indicate whichever option best reflects your perspective on your career development-related, problem-solving skills.

Prior to this course, how much confidence did I have that ... / After this course, how much confidence do I have that ...

5.1. Change occupations if I am not satisfied with the one I enter.

Very Low Confidence	A Little Confidence	Slightly Confident	Confident	Quite a Bit Confident	Extremely Confident

5.2. Identify some reasonable career alternatives if I am unable to get my first choice.

Very Low	A Little	Slightly	Confident	Quite a Bit	Extremely

Confidence	Confidence	Confident		Confident	Confident

5.3.Apply again to graduate/professional schools after being rejected the first time.

Very Low Confidence	A Little Confidence	Slightly Confident	Confident	Quite a Bit Confident	Extremely Confident

5.4.Persistently work at my major or career goal even when I get frustrated.

Very Low Confidence	A Little Confidence	Slightly Confident	Confident	Quite a Bit Confident	Extremely Confident

5.5.Resist attempts of parents or friends to push me into a career or major I believe is beyond my abilities.

Very Low Confidence	A Little Confidence	Slightly Confident	Confident	Quite a Bit Confident	Extremely Confident

6.Planning
For each item below, please indicate whichever option best reflects your perspective on career planning abilities.

Prior to this course, how much confidence did I have that ... / After this course, how much confidence do I have that ...

6.1.Find and use the Career and Professional Development Services office on campus.

Very Low Confidence	A Little Confidence	Slightly Confident	Confident	Quite a Bit Confident	Extremely Confident

6.2.Plan course work outside of my major that will help me in your future career.

Very Low Confidence	A Little Confidence	Slightly Confident	Confident	Quite a Bit Confident	Extremely Confident

6.3. Identify employers, firms, institutions relevant to my career possibilities.

Very Low Confidence	A Little Confidence	Slightly Confident	Confident	Quite a Bit Confident	Extremely Confident

6.4. Decide whether or not I will need to attend graduate or professional school to achieve my career goals.

Very Low Confidence	A Little Confidence	Slightly Confident	Confident	Quite a Bit Confident	Extremely Confident

6.5. Get involved in a work experience relevant to my future goals.

Very Low Confidence	A Little Confidence	Slightly Confident	Confident	Quite a Bit Confident	Extremely Confident

7. Self-appraisal

For each item below, please indicate whichever option best reflects your perspective on self-talk and self-awareness as it relates to your self-appraisal.

Prior to this course, how much confidence did I have that ... / After this course, how much confidence do I have that ...

7.1. Accurately assess my abilities.

Very Low Confidence	A Little Confidence	Slightly Confident	Confident	Quite a Bit Confident	Extremely Confident
Very Low Confidence	A Little Confidence	Slightly Confident	Confident	Quite a Bit Confident	Extremely Confident

7.2. Figure out what I am and am not ready to sacrifice to achieve my career goals.

Very Low Confidence	A Little Confidence	Slightly Confident	Confident	Quite a Bit Confident	Extremely Confident

7.3. Determine what my ideal job would be.

Very Low Confidence	A Little Confidence	Slightly Confident	Confident	Quite a Bit Confident	Extremely Confident
Very Low Confidence	A Little Confidence	Slightly Confident	Confident	Quite a Bit Confident	Extremely Confident

7.4. Decide what I value most in an occupation.

Very Low Confidence	A Little Confidence	Slightly Confident	Confident	Quite a Bit Confident	Extremely Confident

7.5. Determine whether I would rather work primarily with people or with information.

Very Low Confidence	A Little Confidence	Slightly Confident	Confident	Quite a Bit Confident	Extremely Confident

Thank you for participating in this research study. If you have any questions, please contact the researcher, Serena Christianson (serena.christianson@asu.edu), or her dissertation chair Ray Buss at ray.buss@asu.edu.

APPENDIX D

INTERVIEW QUESTIONS FOR CLASS PARTICIPANTS

1. Why did you choose to take this course?

2. What were you looking to gain or learn from this course?

3. Before this course, for which jobs did you believe someone with a life science education could apply?

4. What key ideas from the course affected your current thinking about careers?

5. What was your personal career theory like prior to taking this course?

    a. How is your personal career theory different after taking the course, if at all?

    b. What influenced this change in your personal career theory?

6. How has information from the course affected your career decision process?

7. What are the three (3) most important things you learned from taking the course? (Note: I did not say "in the course" on purpose.)

8. What things have you learned about yourself because you took the course?

9. After taking this course, has your thinking about careers in life sciences changed? If so, how? If not, why not?

10. Would you recommend this class to other SOLS students? Why/why not?

11. What modifications would you make to this course, if any?

APPENDIX E

FULL DESCRIPTION OF STRATEGIC ACADEMIC/CAREER PLANNING

PROJECT

Strategic Academic/ Career Planning Project

Directions: This project is the culminating activity of the course. It is designed to help you pull together all that you learned in the class. You should use *all* of the papers, assignments, activities, and reports you have completed to prepare this paper. Think of this project as the "open-book, take-home, cumulative final exam" for the course. There are 100 possible points available for this project.

Specific Requirements

1. Use the CASVE Cycle phases (see following pages) as section headings to structure your paper. Use the questions for each CASVE cycle phase to help structure the paper's content. Read the material in each of the six sections below *before* you begin to write and refer to them again while preparing your paper.
2. If you are still unsure of your academic and/or career plans, discuss this situation with your instructor, advisor, or counselor and specify the processes and resources you will use to make your academic/career decisions. Use the CASVE Cycle model.
3. This is a formal paper and should follow appropriate academic style. It should be **prepared with a cover page** and a **table of contents**. If you make reference to specific sources of information, those must be properly cited and a reference list included. **Staple** the pages together in the upper left corner, DO NOT USE A BINDER OR COVER. If you adequately cover the categories outlined, your paper will be at least **six typed pages** not including the cover page and table of contents.

Summary

Remember that the purposes of this project are to help you pull together what you have learned about yourself and the academic and career options available to you, and to use that information to develop a plan for yourself. This paper should represent your highest level of academic work and career thinking. If you have any questions—or get stuck—work with your instructor.

Strategic Academic/Career Planning Project Outline

Cover Page
Table of Contents (include page numbers for each of the six topics below)
Contents:

1. Communication
2. Analysis
3. Synthesis

4. Valuing
5. Execution
6. Communication

Evaluation Form

Your paper and table of contents should include the following **six** sections:

1. **Communication**
   a. *What was the concern that prompted you to begin the academic/career decision-making process at the beginning of the class*? What was the gap between your situation at that time and the situation you wanted to be in? (Example: "I began this class not having any idea about a major beyond that it should have no additional math requirements." OR "Ever since I was a small child I wanted to be a physician, but after taking biology and chemistry courses, I know that I cannot do well enough in those courses to get into medical school. I wanted to know what careers might better suit me.").
   b. *What internal (feelings, emotions, hunches) and external (family, the university, news reports, grades, letter saying you had to declare a major, upcoming graduation) cues did you experience that alerted you to this need to reduce the gap between your situation and the desired state*? (Examples: "I had just begun to realize that I will graduate in the spring and really have no idea about what I will do when school is over. My family keeps asking me about my plans and I am seeing my friends getting jobs and moving away. This made me nervous and anxious.")
   c. *What did you want to learn from this class*? (Examples: "I wanted to find out about occupations that I might enjoy." OR "I wanted to decide on a major."). What were your learning goals?

2. **Analysis**
   a. *What have you learned about yourself in this class that is important in making your academic and/or career decisions*? Examine your values, interests, skills, and experiences. Refer to assignments from the first part of the class Self-Directed Search (SDS, autobiography, computer printouts, skills activity, CTI, etc.) in addressing the "Analysis" topic.
   b. *What have you learned about the world of work that will influence your decisions*? In a broad sense, what kinds of occupations/majors/jobs seem most attractive? What types of organizations? What kind of activities? What scheme did you learn about for organizing options?
   c. *What have you learned about your decision-making processes that will relate to your future choices*? In general, which CASVE Cycle phase or phases are you in? What evidence can you provide to support your thinking about this? Do your CTI results apply, for example decision-making confusion? Commitment anxiety? External conflict?

3. **Synthesis**
   a. *What have you done (or what do you plan to do) to generate educational and/or occupational alternatives for yourself*? This might include getting suggestions from others, the media, online and resources in the career center (computers, inventories, books). Be specific about resources and learning activities that have helped you explore options.

189

    b. *Identify three to five educational, occupational, or employment alternatives that you have considered, are considering, or plan to consider.* What options have you eliminated in the process of reducing this number to 3–5?

4. Valuing

    a. *What factors were/are/will be important to you in making this decision?* Consider factors internal to yourself (interests, values), practical factors (you can enter the field/major with your current preparation), or factors that relate to others (e.g., "My parents would pay for that major." OR "My friends have jobs in Denver and I want to work near them.").

    b. *What are the costs and benefits of <u>each</u> alternative to yourself, your significant others, and society?* How would the effort and expense (costs) of each alternative compare to the potential benefits to yourself and others? Clearly specify in the narrative the <u>pros</u> and <u>cons</u> for each option.

    c. *Based on these questions and your answers to them, prioritize (rank) the alternatives identified in your synthesis section.*

5. Execution

    a. *What would you need to do to implement your first choice?* Be as specific as you can; lay your plan out step-by-step (it is okay to number the steps). Who will you talk with? Where will you go? What new behavior will you undertake? What resources will you use? How will you implement your chosen options? This is your strategic plan. It may involve educational, occupational, and employment activities. **Include a time frame for when you hope to accomplish each step, e.g., month/year.**

    b. *How much effort do you think it will take to implement your top-ranked alternative?*

6. Communication

    a. *Where are you now in your educational and/or career decision making and where do you want to be in a year?* By thinking about the difference between where you are now and where you would like to be in the near or far future you can better anticipate and plan for the next decision that may have to be addressed.

    b. *How do you feel about your current academic and/or career situation?* What are your internal and/or external cues telling you about your current situation? How satisfied are you with your career situation?

    c. *What are the next questions or issues that you will need to address?* If you are currently satisfied, what do you think might be the next issue that you will need to address ("I'm happy with my major, now it is time to find some experiences related to possible occupations or jobs."). If you are not currently satisfied, what do you need to focus on now?

Note: Remember to attach the Evaluation Form on the following page to your paper.

Note: the students were specifically told not to complete the evaluation form as specified

in the above image.

APPENDIX F

UNIVERSITY HUMAN SUBJECTS INSTITUTIONAL REVIEW BOARD (IRB)

APPROVAL DOCUMENTS

IRB Template

<table>
<tr><td colspan="2">
Instructions and Notes:

Depending on the nature of what you are doing, some sections may not be applicable to your research. If so, mark as "NA".
When you write a protocol, keep an electronic copy. You will need a copy if it is necessary to make changes.

</td></tr>
</table>

1. Protocol Title

Include the full protocol title: School of Life Sciences Career Readiness and Professional Development Course – Surveys and Interviews

2.   Background and Objectives

Provide the scientific or scholarly background for, rationale for, and significance of the research based on the existing literature and how will it add to existing knowledge.
- Describe the purpose of the study.
- Describe any relevant preliminary data or case studies.
- Describe any past studies that are in conjunction to this study.

The purpose of this mixed methods study is to survey and interview students enrolled in BIO 394: Career and Professional Development for Life Sciences to answer the following research questions:

RQ 1:   How and to what extent did the intervention affect students' abilities to
a.   engage in goal selection related to career exploration and planning;
b.   identify appropriate academic major, occupational information, and/or employment opportunities in the life sciences in relation to personal characteristics;
c.   formulate action plans and strategies for implementing life/career goals;
d.   conduct problem solving efforts related to career exploration; and
e.   engage in self-appraisal with respect to career exploration and planning.

RQ 2:   How and to what extent did the intervention affect students'
        a.   perception of possible professional and career goals and opportunities;
        b.   knowledge about employment-seeking skills; and
        c.   career decision making self efficacy.

3.   Data Use

Describe how the data will be used. Examples include:
- Dissertation, Thesis, Undergraduate honors project
- Publication/journal article, conferences/presentations
- Results released to agency or organization
- Results released to participants/parents
- Results released to employer or school
- Other (describe)

Data collected will be used in my dissertation, publications, and presentations. Results may be released to organizations, participants, and the relevant staff (College of Liberal Arts and Sciences, School of Life Sciences, and/or Career and Professional Development Services) as appropriate.

4.   Inclusion and Exclusion Criteria

Describe the criteria that define who will be included or excluded in your final study sample. If you are conducting data analysis only describe what is included in the dataset you propose to use. Indicate specifically whether you will target or exclude each of the following special populations:
- Minors (individuals who are under the age of 18)
- Adults who are unable to consent
- Pregnant women
- Prisoners
- Native Americans
- Undocumented individuals

192

Data will be collected from students from the School of Life Sciences. No minors, adults who cannot consent, prisoners, and undocumented individuals will be included. Pregnant women and Native Americans will not be excluded, but not specifically recruited, either.

5.   Number of Participants

Indicate the total number of participants to be recruited and enrolled: The 36 students from the School of Life Sciences enrolled in BIO 394: Career and Professional Development for Life Sciences for the fall 2019 term.

6.   Recruitment Methods
- Describe who will be doing the recruitment of participants.
- Describe when, where, and how potential participants will be identified and recruited.
- Describe and attach materials that will be used to recruit participants (attach documents or recruitment script with the application).

The Co-PI will be doing the recruiting for this study. Students enrolled in the course will receive an email. The email addresses will be obtained from the course, which requires students in the online to use a valid ASU email for communications as part of the course. Advising staff members recommended this course for students based on discussions regarding job search self-efficacy in advising sessions. The recruitment letter is attached.

7.   Procedures Involved

Describe all research procedures being performed, who will facilitate the procedures, and when they will be performed. Describe procedures including:
- The duration of time participants will spend in each research activity.
- The period or span of time for the collection of data, and any long term follow up.
- Surveys or questionnaires that will be administered (Attach all surveys, interview questions, scripts, data collection forms, and instructions for participants to the online application).
- Interventions and sessions (Attach supplemental materials to the online application).
- Lab procedures and tests and related instructions to participants.
- Video or audio recordings of participants.
- Previously collected data sets that that will be analyzed and identify the data source (Attach data use agreement(s) to the online application).

The duration of the intervention (the course) is 7.5 weeks in the fall 2019 term at Arizona State University. It is being held as an online course through the Canvas platform. Please refer to the attached document for the course objectives.

The following five (5) instruments will be used in this study:
1. The Career State Inventory, a four-question survey, will be administered two times in the semester: at the beginning and end of the semester; 2 minutes each time. A copy is attached.
2. An adapted version of the Career Decision Making Self Efficacy Scale (CDMSE). Five (5) constructs are measured in this instrument: (i) goal selection, (ii) occupational information, (iii) problem solving, (iv) planning, and (v) self-appraisal. To maintain the integrity of this scale and to better align with this study's research questions, four (4) items from each construct were selected for use in this study. Furthermore, two additional, new constructs, (vi) Knowledge of career exploration and development tasks and (vii) Self-efficacy for searching for alternative careers, were written in relation to this study's research questions. This survey with the CDMSE and new constructs will be administered at the end of the course in post-test (week 6) and a retrospective pre-test format (week 7) to prevent response shift bias (students change criteria for their judgments about career search strategies from less stringent to more stringent because they are more knowledgeable about career choice); 9-12 minutes each time. .
   Note: Items 3-5 will be gathered with permission after grades have been submitted.
3. Autobiography and Goals Assignment: in the first week of the course, students w asked to create an autobiography, reflecting on areas of their life that influenced their present life and career goals (family experience, educational experience, work experience), and then they are asked to present their current life and career goals.

4. Career Field Analysis Assignment: At the midpoint of the course, the students will complete an occupational and educational information search on two different occupations they are considering. They will be researching the following for each occupation: interests and skills used, work or learning conditions, training/educational/licenses required, and outlook for the job including the salary.

5. Strategic Academic/Career Planning Project: to close the course, the students will write a paper reflecting on the following questions, desired from the CASVE cycle that is a part of the Cognitive Information Processing framework used in this study:

a. What was the concern that prompted them to begin an academic/career problem-solving and decision-making process?

b. What internal and external cues did they experience that altered them to this need to reduce the gap between their situation and desired state?

c. What did they want to learn from the course?

d. What have they learned about themselves in this class that is important in making their academic and/or career decisions?

e. What have they learned about the world of work that will influence their decisions?

f. What have you learned about your decision-making processes that will relate to their future choices?

g. What have they done or plan to do to general educational and/or occupational alternatives for themselves?

h. Identify 3-5 educational/occupational/employment alternatives that they have considered, are considering, or plan to consider?

i. What factors were/are/will be important to them in making their decision?

j. What are the costs and benefits of each alternative to themselves, their significant others, and society?

k. What would they need to do to implement their first choid?

l. How much effort do they think it will take to implement your top-ranked alternative?

m. Where are they now in their educational and/or career decision making and where do they want to be in a year?

n. How do they feel about their current academic and/or career situation?

o. What are the next questions or issues that they will need to address?

6. Interviews will be conducted individually with 4-5 randomly selected participants for 20-25 minutes as a one-time occurrence. After consent of the participant, audio recording will occur to allow us to look at the data more closely.

8.	**Compensation or Credit**
	• **Describe the amount and timing of any compensation or credit to participants.**
	• **Identify the source of the funds to compensate participants**
	• **Justify that the amount given to participants is reasonable.**
	• **If participants are receiving course credit for participating in research, alternative assignments need to be put in place to avoid coercion.**
There will be no compensation for participation in the study. The other bullets do not apply.	

9.	**Risk to Participants**
	List the reasonably foreseeable risks, discomforts, or inconveniences related to participation in the research. Consider physical, psychological, social, legal, and economic risks.
There are no risks for participating in this research.	

10.   **Potential Benefits to Participants**
Realistically describe the potential benefits that individual participants may experience from taking part in the research. Indicate if there is no direct benefit. Do **not** include benefits to society or others.
The benefits of participating in the research include the opportunity to share insights on how the School of Life Sciences can provide better career readiness programming for future students.

11.   **Privacy and Confidentiality**

Describe the steps that will be taken to protect subjects' privacy interests. "Privacy interest" refers to a person's desire to place limits on with whom they interact or to whom they provide personal information. Click here for additional guidance on ASU Data Storage Guidelines.

Describe the following measures to ensure the confidentiality of data:
- Who will have access to the data?
- Where and how data will be stored (e.g. ASU secure server, ASU cloud storage, filing cabinets, etc.)?
- How long the data will be stored?
- Describe the steps that will be taken to secure the data during storage, use, and transmission. (e.g., training, authorization of access, password protection, encryption, physical controls, certificates of confidentiality, and separation of identifiers and data, etc.).
- If applicable, how will audio or video recordings will be managed and secured. Add the duration of time these recordings will be kept.
- If applicable, how will the consent, assent, and/or parental permission forms be secured. These forms should separate from the rest of the study data. Add the duration of time these forms will be kept.
- If applicable, describe how data will be linked or tracked (e.g. masterlist, contact list, reproducible participant ID, randomized ID, etc.).

If your study has previously collected data sets, describe who will be responsible for data security and monitoring.

To connect post-intervention survey scores with the same student's retrospective, pre-intervention scores, participants will be asked to use a unique identifier known only to them. The unique identifier will consist of the first three letter of their mother's name and the last four digits of their phone numbers. This identifier will also be used for the Career State Inventory.

Please note that coursework will not be linked to other data such as the survey or interview data.

Students will grant permission to use their coursework in a separate consent form by providing their name and a date to the Co-PI indicating their permission to use their coursework (three papers). See the separate consent form.

The data will be stored on a password-protected computer. The data will be stored for four years. Only the PI and the Co-PI will have access to the data. All the individuals who have access to the data have had CITI training. After four years, the data will be deleted from the computer.

The audio recordings will be deleted from the original recording device upon transfer to the computer and any identifiers (if there are any) will be removed. Respondents will be told to not use names of individuals in their responses.

Because the interview subjects will all be adults, only verbal consent will be obtained. Thus, no written consent form is necessary and will not need to be stored.

The last bullet is not applicable for this research.

12. **Consent Process**

Describe the process and procedures process you will use to obtain consent. Include a description of:

- Who will be responsible for consenting participants?
- Where will the consent process take place?
- How will consent be obtained?
- If participants who do not speak English will be enrolled, describe the process to ensure that the oral and/or written information provided to those participants will be in that language. Indicate the language that will be used by those obtaining consent. Translated consent forms should be submitted after the English is approved.

For the surveys, completion of the survey will constitute consent. For the interviews, consent will be obtained through verbal consent. Participants will be given a recruitment/consent letter. See the attached recruitment/consent document. The study will not recruit non-English speaking participants. The study will not recruit minors.

13. **Training**

Provide the date(s) the members of the research team have completed the CITI training for human participants. This training must be taken within the last 4 years. Additional information can be found at: Training.

Dr. Ray Buss, PI, CITI Certificate on file
Serena Christianson, Co-PI, CITI Training on file

Dear School of Life Sciences Student,

My name is Serena Christianson and I am a doctoral student in the Mary Lou Fulton Teachers College (MLFTC) at Arizona State University (ASU). I am working under the direction of Dr. Ray Buss, a faculty member in MLFTC. We are conducting a research study on career readiness and professional development programming for School of Life Sciences (SOLS) students. The purpose of this study is to understand better the effectiveness of the one-credit course in which you are participating this semester.

We are asking for your help, which will involve completing a pair of online surveys—one at the beginning of the course and the other at the end. We anticipate the surveys will take 9-12 minutes on each occasion and one additional survey that will take about 2 minutes on two occasions. We will also ask a few of you to participate in a 20- to 25-minute interview about your knowledge, experiences, and attitudes regarding career readiness in the life sciences. We also ask your permission to use your Autobiography and Goals paper, Career Filed Analysis paper, and your Strategies Academic/Career Planning paper to determine how course participation has influenced your understanding about careers. With your permission, these papers would be gathered after the course is completed and grades have been submitted. We will provide a separate consent form to obtain your permission to gather these three papers.

Your participation in this study is voluntary. If you choose not to participate or withdraw from the study at any time, there will be no penalty whatsoever. Moreover, your choice will not affect your standing in the course, the School of Life Sciences, or at ASU. You must be 18 years of age or older to participate.

The benefit to participation is the opportunity for you to provide feedback on how the course helped you develop career readiness skills. Responses will also inform future iterations of this work. Thus, there is potential to enhance the experiences of our students. There are no foreseeable risks or discomforts to your participation.

Your responses will be confidential. For the surveys, use the following process to create a unique identifier known only to you. Use the first three letters of your mother's first name and the last four digits of your phone number. For example, Sar 4567 would be the identifier if your mom's first name was Sarah and your phone number is (623) 555-4567. Results from this study may be used in reports, presentations, or publications but your name will not be used.

If you have any questions concerning the research study, please contact the research team – Ray Buss at ray.buss@asu.edu or (602) 543-6343 or Serena Christianson at serena.christianson@asu.edu or 480-965-5340. If you have any questions about your rights as a participant in this research, or if you feel you have been placed at risk, you can contact Ray Buss at (602) 543-6343 or the Chair of Human Subjects Institutional Review Board via the ASU Office of Research Integrity and Assurance at (480) 965-6788.

For the surveys, filling out the surveys will be considered your consent to participate. For those of you who are being interviewed, we will obtain your permission at that time. We would like to audio record the interview to explore your responses more closely. Please let us know if you do not want to be audio recorded. You can change your mind after we start just let us know. Please let us know if you will let us audio record your responses by verbally indicating your consent. The audio recordings will be deleted upon transcription.

Thank you,

Serena Christianson, Doctoral Student
Ray Buss, Associate Professor

Dear School of Life Sciences Student,

This is the additional consent form for the research study connected to BIO 394: Career Professional Development for Life Sciences. I agree to allow the researchers to use three papers I wrote for the course. The three papers are:

- Autobiography and Goals paper,
- Career Field Analysis paper, and
- Strategies Academic/Career Planning paper.

I understand these papers will be used to determine how course participation has influenced my understanding about careers. I understand these papers would be gathered after the course is completed and grades have been submitted and that my name will not be used in any way.

Please enter your name and the date below to indicate your permission. Then email the form to serena.christianson@asu.edu

_____   _____
Name   Date

ASU | Knowledge Enterprise
Development

EXEMPTION GRANTED

Ray Buss
Division of Educational Leadership and Innovation - West Campus
602/543-6343
RAY.BUSS@asu.edu

Dear Ray Buss:

On 9/13/2019 the ASU IRB reviewed the following protocol:

Type of Review:	Initial Study
Title:	School of Life Sciences Career Readiness and Professional Development Course – Surveys and Interviews
Investigator:	Ray Buss
IRB ID:	STUDY00010625
Funding:	None
Grant Title:	None
Grant ID:	None
Documents Reviewed:	• IRB Protocol, Category: IRB Protocol; • Recruitment and Consent Letter, Category: Consent Form; • Survey 2, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • Consent Form to Use Three Papers, Category: Consent Form; • Survey 1, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • Interview Questions, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions);

The IRB determined that the protocol is considered exempt pursuant to Federal Regulations 45CFR46 (1) Educational settings, (2) Tests, surveys, interviews, or observation on 9/13/2019.

In conducting this protocol you are required to follow the requirements listed in the INVESTIGATOR MANUAL (HRP-103).

Sincerely,

IRB Administrator

cc:
     Serena Christianson

Survey 1: Career State Inventory (permission granted for use from Robert Reardon of Florida State University)

1. List all occupations you are considering right now.
2. Which occupation is your first choice? If undecided, write "undecided."
3. How well satisfied are you with your responses to No. 1 above? Place a check next to the appropriate statement below:
    a. _____Very satisfied
    b. _____Satisfied
    c. _____Not sure
    d. _____Dissatisfied
    e. _____Very dissatisfied
4. Please select True (T) or False (F) for the statements below
    a. If I had to make an occupational choice right now, I'm afraid I would make a bad choice.
    b. Making up my mind about a career has been a long and difficult problem for me.
    c. I am confused about the whole problem of deciding on a career.

Interview Questions for class participants:

1. Why did you choose to take this course?
2. What were you looking to gain or learn from this course?
3. Before this course, for which jobs did you believe someone with a life science education could apply?
4. What are the three (3) most important things you learned from taking the course? (Note: I did not say "in the course" on purpose.)
5. What things have you learned about yourself because you took the course?
6. After taking this course, has your thinking about careers in life sciences changed? If so, how? If not, why not?
7. After taking this course, have you changed personally? If so, how? If not, why not?
8. Would you recommend this class to other SOLS students? Why/why not?
9. What modifications would you make to this course, if any?

Survey 2a: Selected Items from CDMSE: Post Survey

Item	After this course, how much confidence do you have that you could:	No confiden ce at all					Complete Confidenc e
1	Make a career decision and then not worry about whether it was right or wrong.	1	2	3	4	5	6
2	Find information about companies who employ people with life science majors/minors.	1	2	3	4	5	6
9	Change occupations if you are not satisfied with the one you enter.	1	2	3	4	5	6
11	Accurately assess your abilities.	1	2	3	4	5	6
15	Identify some reasonable career alternatives if you are unable to get your first choice.	1	2	3	4	5	6
18	Figure out what you are and are not ready to sacrifice to achieve your career goals.	1	2	3	4	5	6
19	Find and use the Career and Professional Development Services office on campus.	1	2	3	4	5	6
20	Determine what your ideal job would be.	1	2	3	4	5	6
25	Apply again to graduate/professional schools after being rejected the first time.	1	2	3	4	5	6
27	Find out the employment trends for an occupation over the next 10 years.	1	2	3	4	5	6

32	Choose a career that will fit your preferred lifestyle.	1	2	3	4	5	6
35	Identify employers, firms, institutions relevant to your career possibilities.	1	2	3	4	5	6
36	Resist attempts of parents or friends to push you into a career or major you believe is beyond your abilities.	1	2	3	4	5	6
39	Choose a major or career that will suit your abilities.	1	2	3	4	5	6
40	Decide whether or not you will need to attend graduate or professional school to achieve your career goals.	1	2	3	4	5	6
41	Choose a major or career that will fit your interests.	1	2	3	4	5	6
43	Get involved in a work experience relevant to your future goals.	1	2	3	4	5	6
44	Find information about graduate or professional schools.	1	2	3	4	5	6
46	Ask a faculty member about graduate schools and job opportunities in your major.	1	2	3	4	5	6
49	Determine whether you would rather work primarily with people or with information.	1	2	3	4	5	6

Additional items crafted in alignment with the research questions:

Knowledge of career exploration and development tasks:

- I possess the necessary knowledge to search for career options.
- I understand how to conduct a search with regard to a life science-related career.

- I know what must be done to carry out a search for career opportunities in the life sciences that utilize my life science education.
- I have the knowledge needed to conduct a search of varied opportunities in life science careers.
- What I know about exploring careers in the life sciences will allow me to conduct appropriate searches.

Self-efficacy for searching for alternative careers

- I am certain I can implement a search for life science-related careers.
- I am self-confident that I can engage in a search of careers that utilize skills developed from a life science curriculum.
- I can definitely conduct a search for life science-related careers.
- I am certain that I can successfully explore career pathways in the life sciences.
  I feel confident that I can conduct a search for life science-related careers.

Survey 2b: Selected Items from CDMSE: Retrospective Pre-Test Survey

Item	Prior to this course, how much confidence did you have that you could:	No confidence at all					Complete Confidence
1	Make a career decision and then not worry about whether it was right or wrong.	1	2	3	4	5	6
2	Find information about companies who employ people with life science majors/minors.	1	2	3	4	5	6
9	Change occupations if you are not satisfied with the one you enter.	1	2	3	4	5	6
11	Accurately assess your abilities.	1	2	3	4	5	6
15	Identify some reasonable career alternatives if you are unable to get your first choice.	1	2	3	4	5	6
18	Figure out what you are and are not ready to sacrifice to achieve your career goals.	1	2	3	4	5	6

19	Find and use the Career and Professional Development Services office on campus.	1	2	3	4	5	6
20	Determine what your ideal job would be.	1	2	3	4	5	6
25	Apply again to graduate/professional schools after being rejected the first time.	1	2	3	4	5	6
27	Find out the employment trends for an occupation over the next 10 years.	1	2	3	4	5	6
32	Choose a career that will fit your preferred lifestyle.	1	2	3	4	5	6
35	Identify employers, firms, institutions relevant to your career possibilities.	1	2	3	4	5	6
36	Resist attempts of parents or friends to push you into a career or major you believe is beyond your abilities.	1	2	3	4	5	6
39	Choose a major or career that will suit your abilities.	1	2	3	4	5	6
40	Decide whether or not you will need to attend graduate or professional school to achieve your career goals.	1	2	3	4	5	6
41	Choose a major or career that will fit your interests.	1	2	3	4	5	6
43	Get involved in a work experience relevant to your future goals.	1	2	3	4	5	6
44	Find information about graduate or professional schools.	1	2	3	4	5	6

46	Ask a faculty member about graduate schools and job opportunities in your major.	1	2	3	4	5	6
49	Determine whether you would rather work primarily with people or with information.	1	2	3	4	5	6

Additional items crafted in alignment with the research questions:

*Knowledge of career exploration and development tasks:*

- I possess the necessary knowledge to search for career options.
- I understand how to conduct a search with regard to a life science-related career.
- I know what must be done to carry out a search for career opportunities in the life sciences that utilize my life science education.
- I have the knowledge needed to conduct a search of varied opportunities in life science careers.
- What I know about exploring careers in the life sciences will allow me to conduct appropriate searches.

Self-efficacy for searching for alternative careers

- I am certain I can implement a search for life science-related careers.
- I am self-confident that I can engage in a search of careers that utilize skills developed from a life science curriculum.
- I can definitely conduct a search for life science-related careers.
- I am certain that I can successfully explore career pathways in the life sciences.
    I feel confident that I can conduct a search for life science-related careers.

APPENDIX G

CODING EXAMPLE

Example of coding trail for one of the study's themes

First coding cycle

- acknowledging other career courses
- considering career options
- desiring resources to help weigh career options
- …
- seeking balance between financial stability and personal wellbeing
- showing concern of what others think
- taking a job because they want to versus just because

Second coding cycle

- REASONS FOR TAKING THE COURSE
- …
- FEELING INTERNAL CONFLICT SURROUNDING CAREER CHOICE

Final theme

- Balancing tensions relating to career choice